

SCIENCE CONCEPTS SCIENCE ITEMS

The *Science Concepts and Science Items* book contains the released TIMSS science assessment items. These are the released items from the 1995 and 2003 assessments (as distinct from the secure items, which are kept confidential so that they may be used in subsequent cycles to monitor trends).

Guide to Using the Science Concepts and Science Items Materials

The materials contained in this book can be used in a number of ways as a tool to assist teachers in making a formative assessment of student knowledge and skills. Some of these ways include the following:

Teacher-designed formative assessments. A teacher might, for example, decide to examine how well his or her class can understand complex information. In such a case, the first step would be to review the questions in *Science Concepts and Science Items*, selecting the ones of interest. Ready-to-use versions of these items can be found in the *Science Items* book. The teacher can print these items or present them to students on an overhead. Student responses can be scored by referring to the appropriate page in *Science Concepts and Science Items*. The teacher can also compare the overall percentage of students responding correctly to the international benchmark for that item.

Feedback on teaching. To the extent that the items coincide with concepts taught, the teacher might follow the same process to gain rapid feedback on the success of the teaching episode.

Understanding misunderstandings. Again, a teacher might decide to examine the incorrect or partially correct responses of the class for insight into any general misunderstandings, with a view to re-teaching a particular topic or skill.

Identifying individual difficulties. In the same way, the teacher might use the items to identify particular difficulties experienced by individual students, as the basis for some remedial teaching or focused practice.

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Guide to the Content and Layout of This Book

This book contains the released items from both TIMSS 1995 and TIMSS 2003. Due to slight revisions in terminology and released information between cycles, the format for the items in each cycle differs slightly. Each item appears on a single page and is accompanied by a number of descriptors.

1999 Content Domains:

- Earth science
- Life science
- Physics
- Chemistry
- Environmental and resource issues
- Scientific enquiry and the nature of science

2003 Content Domains:

- Chemistry
- Earth science
- Environmental science
- Life science
- Physics

1999 Cognitive Domains:

- Understanding simple information
- Understanding complex information
- Theorizing, analyzing and solving problems
- · Using tools, routine procedures and science processes
- Investigating the natural world

2003 Cognitive Domains:

- Factual knowledge
- Conceptual understanding
- Reasoning and analysis

Take a look at *Layers of Earth*, the name given to the first item in this book. As specified in boxes at the top of the page, the content domain for this item is *earth science* and the cognitive domain is *understanding simple information*. Looking at *Litmus test*, the first item from TIMSS 2003 (page 75), the content domain (*chemistry*) and the cognitive domain (*conceptual understanding*) are also accompanied by the Main Topic (*acids and bases*).

International item numbers identify each item. This number appears just below the item box.

Correct answers are shown beneath each item. These correct answers take two forms:

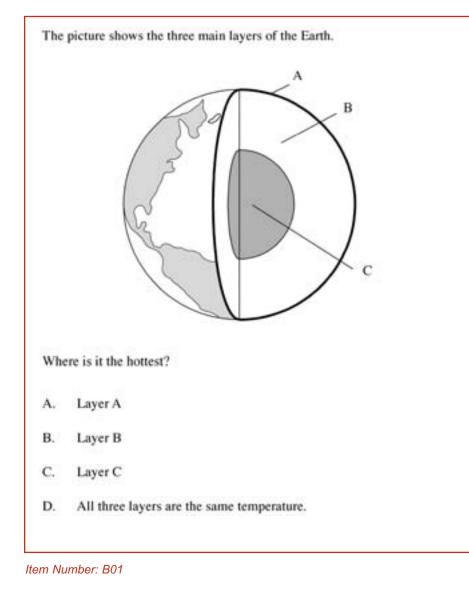
- Letter code. This form is used for the correct response on multiple-choice items. *Layers of Earth* provides an example of the letter code type—the correct answer is C.
- Scoring guide. This form is used to assist in scoring write-in responses. *Life on other planets* (J09) further along in the *Earth Science* domain (page 11), provides an example of the scoring guide approach, indicating the general nature of correct and incorrect responses. In some cases, partial credit may be awarded and these items will provide guidelines for fully correct, partially correct, and incorrect responses.

Sample student responses are provided for TIMSS 2003 extended response items. An example of an actual U.S. fourth-grade student's response is provided for each scoring category. See item S032057 on page 76.

International benchmarks are provided in a table next to each item. These consist of statistics on the percentage of students in each country who answered the question correctly. The countries are ordered in terms of this percentage. The international average is included as well, and this display also indicates which countries scored significantly higher, significantly lower, and not significantly different from this international average.

Content Domain	Cognitive Domain
Earth Science	Understanding Simple Information

Layers of Earth



С

Overall Percent Correct

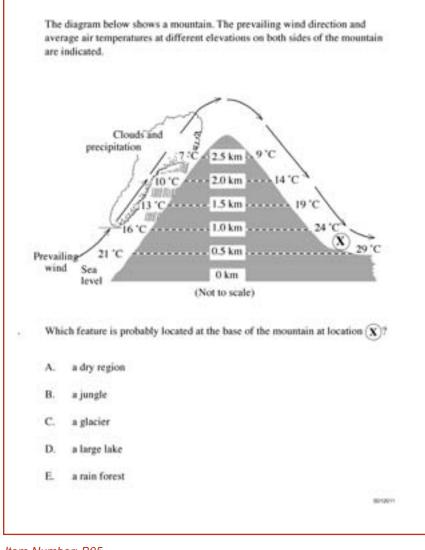
Slovenia	96	
Slovak Republic	95	
Canada	94	
Bulgaria	94	
Netherlands	93	
Finland	93	
England	93	
United States	92	
Hungary	92	
Italy	91	
Czech Republic	91	
Russian Federation	90	
Australia	90	
New Zealand	89	
Japan	89	
Belgium (Flemish)	89	
Hong Kong, SAR	88	
Korea, Rep. of	85	
Chinese Taipei	84	0
Singapore	84	0
Lithuania	83	0
Latvia (LSS)	83	0
Latvia (LSS) International Averag		
International Averag		0
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Country average vs. International average:	
Higher Not different Lower	

Correct Response:

Content Domain	Cognitive Domain
Earth Science	Using Tools, Routine Procedures and Science Processes

Elevation diagram of wind/temperature



Overall Percent Correct

Hungary69ASlovak Republic65ASlovenia62ASlovenia62AIsrael59AIsrael59ALatvia (LSS)59AGanada57AFinland56ABulgaria55ALithuania55AKorea, Rep. of55AOzech Republic55AJapan54ABelgium (Flemish)50OAustralia49OUnited States49OTurkey47OTurkey47OChinese Taipei44OMoldova44OCyprus43OHong Kong, SAR42TPhilippines41TMalaysia37TMalaysia37TIndonesia30TIndonesia30T			
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Tunisia 25 🔻	Jordan England Romania Chinese Taipei Macedonia, Rep. of Moldova Cyprus Hong Kong, SAR Philippines Chile Italy Morocco Malaysia Thailand South Africa Iran, Islamic Rep.	47 44 44 44 43 42 41 41 38 37 37 34 32 31	0 0 0 0 0 0
	Jordan England Romania Chinese Taipei Macedonia, Rep. of Moldova Cyprus Hong Kong, SAR Philippines Chile Italy Morocco Malaysia Thailand South Africa Iran, Islamic Rep. Singapore	47 44 44 43 42 41 41 38 37 37 34 32 31 30	0 0 0 0 0 0
	Jordan England Romania Chinese Taipei Macedonia, Rep. of Moldova Cyprus Hong Kong, SAR Philippines Chile Italy Morocco Malaysia Thailand South Africa Iran, Islamic Rep. Singapore Indonesia	47 44 44 43 42 41 41 38 37 37 34 32 31 30 30	0 0 0 0 0

Country average vs. International average:		
Higher Not different Lower		

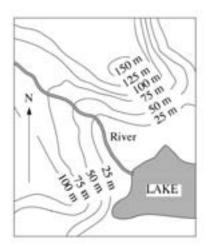
Item Number: B05

Correct Response: A

Content Domain	Cognitive Domain
Earth Science	Using Tools, Routine Procedures and Science Processes

Contour map showing river

On the diagram, hills and valleys are shown by means of contour lines. Each contour line indicates that all points on the line have the same elevation above sea level.



In which direction does the river flow?

- A. Northeast
- B. Southeast
- C. Northwest
- D. Southwest
- E. It is not possible to tell from the map.

Item Number: D03

Correct Response: B

Chinese Taipei 61 Hong Kong, SAR 61 Slovenia 59 Belgium (Flemish) 53 Australia 53 52 Japan 51 Malaysia England 51 Korea, Rep. of 50 Russian Federation 50 Netherlands 49 Finland 48 United States 48 Canada 46 0 Singapore 44 44 Hungary 43 0 Slovak Republic Bulgaria 41 0 New Zealand 41 0 Czech Republic 40 0 Lithuania 38 0 Latvia (LSS) 37 0 International Average 37 32 0 Moldova ▼ Macedonia, Rep. of 28 ▼ Thailand 26 ▼ Turkey 26 ▼ 26 Romania ▼ 25 Israel ▼ 23 Iran, Islamic Rep. ▼ 21 Italy ▼ Cyprus 21 South Africa 21 ▼ Jordan 19 ▼ ▼ Indonesia 18 • Morocco 17 ▼ Philippines 16 ▼ Tunisia 16 • Chile 14

Country average vs. International average:	
Higher	
Not different	0
Lower	▼

Content Domain	Cognitive Domain
Earth Science	Understanding Complex Information

Oxygen equipment on mountain tops

Why do mountain climbers use oxygen equipment at the top of the world's highest mountains?

- A. There is less oxygen in the air at great heights.
- B. There is little nitrogen in the air at great heights.
- C. There is a hole in the ozone layer.
- D. There is no air at the top of very high mountains.

Item Number: F05

Correct Response:

Α

Singapore	95	
Hong Kong, SAR	94	
Chinese Taipei	94	
Korea, Rep. of	93	
Czech Republic	92	
Canada	92	
Netherlands	91	
Slovak Republic	91	
Bulgaria	91	
Malaysia	90	
United States	90	
England	90	
Hungary	90	
Belgium (Flemish)	90	
Australia	90	
Finland	90	
New Zealand	87	
Slovenia	87	
Russian Federation	84	
Israel	80	0
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Lithuania	80	0
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International Average Iran, Islamic Rep.	80 e 79 79	0 0 0 0 0 0
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International Averag Iran, Islamic Rep. Italy Thailand	80 e 79 79 78 76	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile	80 e 79 79 78 76 75 75	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus	80 e 79 78 76 75 75 75 74 70	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania	80 79 78 76 75 75 74 70 70	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania Latvia (LSS) Indonesia	80 79 78 76 75 75 74 70 70 69 67	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania Latvia (LSS) Indonesia Turkey	80 79 78 76 75 75 74 70 70 69 67 65	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania Latvia (LSS) Indonesia Turkey Moldova Jordan	80 79 78 76 75 75 74 70 69 67 65 64 63	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
International Average Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania Latvia (LSS) Indonesia Turkey Moldova Jordan Tunisia	80 79 78 76 75 75 74 70 69 67 65 64 63 56	0 0 0 0 0 0 0 0 0 0 0
International Averag Iran, Islamic Rep. Italy Thailand Macedonia, Rep. of Chile Japan Cyprus Romania Latvia (LSS) Indonesia Turkey Moldova Jordan Tunisia Philippines	80 79 78 76 75 75 74 70 70 69 67 65 64 63 56 48	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Country average vs. International average:		
Higher Not different Lower		

Content Domain	Cognitive Domain
Earth Science	Understanding Simple Information

Why moon shines

The Moon produces no light, and yet it shines at night. Why is this?

- A. The Moon reflects the light from the Sun.
- B. The Moon rotates at very high speed.
- C. The Moon is covered with a thin layer of ice.
- D. The Moon has many craters.

Item Number: H03

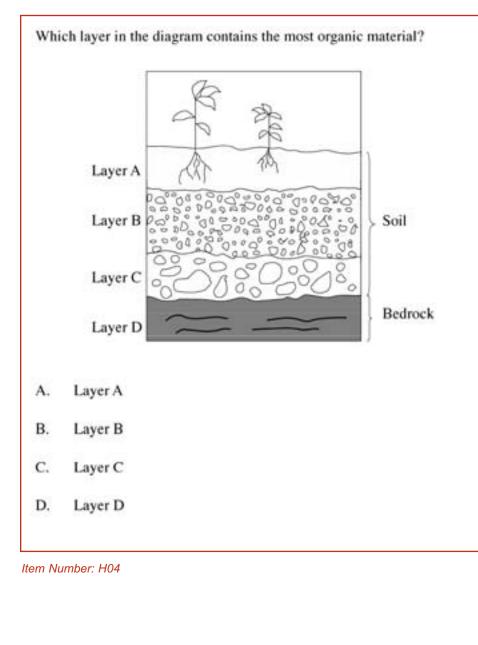
Correct Response:	Α
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Hong Kong, SAR	96	
Singapore	95	
Chinese Taipei	95	
Bulgaria	93	
Netherlands	91	
Japan	89	
England	88	
Malaysia	87	
Canada	87	
Belgium (Flemish)	86	
United States	86	
Finland	86	
Hungary	86	
Czech Republic	86	
New Zealand	84	0
Cyprus	84	0
Turkey	84	0
Australia	83	0
Latvia (LSS)	83	0
Slovak Republic	83	0
Jordan	83	0
Iran, Islamic Rep.	82	0
International Average	81	
Russian Federation	81	0
Korea, Rep. of	80	0
Macedonia, Rep. of	80	0
Slovenia	79	0
Thailand	78	0
Romania	78	0
Indonesia	76	▼
Italy	75	•
Moldova	75	•
Philippines	73	▼
Israel	72	•
Lithuania	72	•
Tunisia	71	* * * * * *
Morocco	64	▼
Chile	64	▼
South Africa	57	•

Country average vs. International average:		
Higher Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Earth Science	Understanding Complex Information

Diagram of soil layers



Overall Percent Correct

Macedonia, Rep. of	76	
Russian Federation	76	
Slovenia	75	
Czech Republic	71	
Lithuania	67	
Romania	63	
Belgium (Flemish)	63	
Hungary	60	
Latvia (LSS)	59	
Slovak Republic	57	
Italy	53	0
Netherlands	53	0
Korea, Rep. of	53	
Moldova	51	0
Australia	50	0
Japan	50	0
Canada	50	0
Bulgaria	50	0
Thailand	49	0
England	48	0
International Average	e 48	
Finland	e 48 48	0
Finland Cyprus	48 47	0
Finland Cyprus Chile	48	0
Finland Cyprus Chile New Zealand	48 47 47 46	0 0 0
Finland Cyprus Chile New Zealand Philippines	48 47 47 46 44	0 0 0 0
Finland Cyprus Chile New Zealand Philippines Singapore	48 47 47 46 44 43	0 0 0 0
Finland Cyprus Chile New Zealand Philippines Singapore Tunisia	48 47 47 46 44 43 42	0 0 0 0
Finland Cyprus Chile New Zealand Philippines Singapore Tunisia Indonesia	48 47 46 44 43 42 41	0 0 0 0
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Finland Cyprus Chile New Zealand Philippines Singapore Tunisia Indonesia United States Morocco	48 47 46 44 43 42 41 40 36	0 0 0 0
Finland Cyprus Chile New Zealand Philippines Singapore Tunisia Indonesia United States Morocco South Africa	48 47 46 44 43 42 41 40 36 35	0 0 0 0
Finland Cyprus Chile New Zealand Philippines Singapore Tunisia Indonesia United States Morocco South Africa Iran, Islamic Rep.	48 47 46 44 43 42 41 40 36 35 34	0 0 0 0
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Finland Cyprus Chile New Zealand Philippines Singapore Tunisia Indonesia United States Morocco South Africa Iran, Islamic Rep. Jordan Turkey Chinese Taipei Israel Malaysia	48 47 46 44 43 42 41 40 36 35 34 32 29 28 28 28 28 22	0 0 0 0

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

Α

8

Content Domain	Cognitive Domain
Earth Science	Understanding Simple Information

Earth's plates over millions of years

Which BEST describes the movement of the plates that make up Earth's surface over millions of years?

- A. They moved for millions of years but have now stopped.
- B. They stayed the same for millions of years but are now moving.
- C. They have been continually moving.
- D. They have never moved.

Item Number: J01

Correct Response: C

Hungary	93	
Canada	91	
Australia	89	
Slovak Republic	89	
Singapore	89	
Chinese Taipei	87	
Czech Republic	87	
England	86	
Hong Kong, SAR	85	
United States	84	
Korea, Rep. of	83	
Slovenia	82	
Finland	82	0
Netherlands	81	0
New Zealand	81	0
Belgium (Flemish)	81	0
Bulgaria	81	0
Latvia (LSS)	80	0
Lithuania	80	0
Russian Federation	80	0
Moldova	80	0
Japan	79	
Italy	77	0
Romania	75	0
Thailand	75	0
International Average	e 75	
Chile	73	0
Israel	73	0
Malaysia	68	•
Cyprus	68	0
Macedonia, Rep. of	67	•
Turkey	65	▼
Iran, Islamic Rep.	61	▼
Indonesia	60	▼
Jordan	56	•
Philippines	55	▼
Tunisia	52	
South Africa	32	▼
Morocco	29	▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Content Domain	Cognitive Domain
Earth Science	Understanding Complex Information

Factor explaining seasons on Earth

Which of the following is an important factor in explaining why seasons occur on Earth?

- A. Earth rotates on its axis.
- B. The Sun rotates on its axis.
- C. Earth's axis is tilted.
- D. The Sun's axis is tilted.

Item Number: J06

Correct Response: C

Japan	52	
Hong Kong, SAR	48	
England	44	
Italy	44	
Australia	41	
Chinese Taipei	40	
Canada	38	
New Zealand	38	
United States	37	
Finland	34	0
Bulgaria	34	0
Korea, Rep. of	30	0
Slovak Republic	30	0
Russian Federation	30	0
Slovenia	29	0
Czech Republic	28	0
Israel	28	0
Netherlands	27	0
International Averag	e 26	
Lithuania	26	0
Littiuailla	20	0
Malaysia	26 25	0
Malaysia	25	0 0 0
Malaysia Cyprus	25 24	0 0 0 0
Malaysia Cyprus Hungary	25 24 23	0 0 0
Malaysia Cyprus Hungary Belgium (Flemish)	25 24 23 22	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova	25 24 23 22 22	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand	25 24 23 22 22 21	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey	25 24 23 22 22 21 18	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore	25 24 23 22 22 21 18 18	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco	25 24 23 22 21 18 18 18	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan	25 24 23 22 21 18 18 18 18 18	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania	25 24 23 22 21 18 18 18 18 17 17	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa	25 24 23 22 21 18 18 18 18 17 17	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa Chile	25 24 23 22 21 18 18 18 17 17 15 15	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa Chile Iran, Islamic Rep.	25 24 23 22 21 18 18 18 17 17 15 15 13	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa Chile Iran, Islamic Rep. Latvia (LSS)	25 24 23 22 21 18 18 18 17 17 15 15 13 13	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa Chile Iran, Islamic Rep. Latvia (LSS) Tunisia	25 24 23 22 21 18 18 18 17 17 15 15 13 13 13	0 0 0 0
Malaysia Cyprus Hungary Belgium (Flemish) Moldova Thailand Turkey Singapore Morocco Jordan Romania South Africa Chile Iran, Islamic Rep. Latvia (LSS) Tunisia Philippines	25 24 23 22 21 18 18 18 17 15 15 13 13 13 13 13	0 0 0 0

Country average vs. International average:		
Higher Not different Lower	0	

Content Domain	Cognitive Domain
Earth Science	Theorizing, Analyzing and Solving Problems

Life on other planets

Diana and Mario were discussing what it might be like on other planets. Their science teacher gave them data about Earth and an imaginary planet Proto. The table shows these data.

	Earth	Proto
Distance from a star like the Sun	148 640 000 km	902 546 000 km
Atmospheric pressure at surface of planet	101-325 Pa	100 Pa
Atmospheric conditions • gas components	21% oxygen 0.03% carbon dioxide 78% nitrogen	5% oxygen 5% carbon dioxide 90% nitrogen
ozone layer	yes	no
cloud cover	yes	во

Write down one important reason why it would be difficult for humans to live on Proto if it existed. Explain your answer.

Item Number: J09

SCORING

Note: A correct response must clearly indicate the reason why a condition listed in the table makes it hard for humans to live on Proto. Responses referencing insufficient (too little, less, not enough, etc.) oxygen with or without explicitly mentioning breathing will be given credit due to the assumption of common knowledge. If more than one reason is given, assign credit corresponding to the first correct reason.

Correct Response

- States that there would be insufficient (too little, less, not enough, etc.) oxygen (to breath).
- States that the atmospheric pressure would be too low with an explanation based on low air/oxygen levels or effects of lower boiling point, etc.
- States that there is no ozone layer to protect people (against star's UV radiation).
- · States that no cloud cover means no (low) water.
- States that it is too cold (due to distance from the star).
- Other correct.

Incorrect Response

- Merely repeats information in table and/or stem with no explanation.
- States that it is too hot due to no ozone layer.
- States that there is little (no) gravity (confuses atmospheric pressure with gravity).
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Slovak Republic	89	
Singapore	86	
Australia	83	
Hungary	83	
Canada	82	
England	82	
Netherlands	81	
Latvia (LSS)	80	
New Zealand	80	
Finland	80	
Chinese Taipei	79	
Slovenia	78	
United States	78	
Belgium (Flemish)	77	
Korea, Rep. of	77	
Czech Republic	75	0
Russian Federation	73	
Italy	70	0
Hong Kong, SAR	70	0
Japan	69	0
Lithuania	67	0
Malaysia	67	0
International Average	e 66	
Bulgaria	65	0
Tunisia	64	0
Thailand	62	0
Israel	62	0
Jordan	59	0
Indonesia	59	0
Macedonia, Rep. of	58	0
Chile	57	
Cyprus	51	
Moldova	51	
Romania	48	
Turkey	47	
Iran, Islamic Rep.	45	
Philippines	26	
Morocco	25	* * * * * *
South Africa	21	

Country average vs. International average:		

Content Domain	Cognitive Domain
Earth Science	Understanding Complex Information

Atmospheric conditions in jets

Jet aircraft typically fly at altitudes of approximately 10,000 meters. Atmospheric conditions at this altitude are different from those at ground level. Write down one difference that exists and explain why it must be controlled for in order for people to survive inside jet aircraft.

Item Number: R04

SCORING

Note: A correct response must include an explanation identifying an atmospheric condition that is different at high altitudes and why it must be controlled for. Responses referencing low oxygen level (too little, less, not enough) with or without explicitly mentioning breathing will be given credit due to the assumption of prior knowledge.

Correct Response

- Refers to controlling for low oxygen level and/or little air ("thin atmosphere") in order to breath.
- Refers to controlling for low atmospheric pressure with explanation relating to the effect on humans.
- Refers to controlling for low atmospheric temperature.
- Other correct.

Incorrect Response

- Mentions pressure, temperature or oxygen with incorrect or no further explanation.
- · Mentions gravity.
- · Refers only to effects of wind, air currents, or turbulence, etc.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Slovak Republic	65	
Chinese Taipei	55	
Belgium (Flemish)	51	
Canada	50	
Australia	49	
Thailand	47	
Russian Federation	46	
Singapore	46	
Korea, Rep. of	45	
Lithuania	45	
New Zealand	45	
England	44	
Finland	42	0
Bulgaria	40	0
Latvia (LSS)	38	0
Slovenia	38	0
Hong Kong, SAR	35	0
Indonesia	35	0
Italy	34	0
International Average	e 33	
International Average	e	
Hungary	33	0
		0
Hungary	33	
Hungary Israel	33 32	0 0 0
Hungary Israel Moldova	33 32 31	0 0 0
Hungary Israel Moldova Czech Republic	33 32 31 29	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of	33 32 31 29 28	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan	33 32 31 29 28 28 28 27 25	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania	33 32 31 29 28 28 28 27	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey	33 32 31 29 28 28 28 27 25	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands	33 32 31 29 28 28 28 27 25 24	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia	 33 32 31 29 28 28 27 25 24 23 23 21 	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep.	 33 32 31 29 28 28 27 25 24 23 23 	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus	 33 32 31 29 28 28 27 25 24 23 23 21 	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus Tunisia United States Jordan	 33 32 31 29 28 27 25 24 23 23 21 17 	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus Tunisia United States	 33 32 31 29 28 27 25 24 23 23 21 17 17 	0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus Tunisia United States Jordan Chile Philippines	 33 32 31 29 28 27 25 24 23 23 21 17 17 17 	0 0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus Tunisia United States Jordan Chile	 33 32 31 29 28 27 25 24 23 21 17 17 10 6 5 	0 0 0 0 0
Hungary Israel Moldova Czech Republic Macedonia, Rep. of Japan Romania Turkey Netherlands Malaysia Iran, Islamic Rep. Cyprus Tunisia United States Jordan Chile Philippines	 33 32 31 29 28 27 25 24 23 23 21 17 17 17 10 6 	0 0 0 0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Earth Science	Theorizing, Analyzing and Solving Problems

Diagram of rain from sea

Draw a diagram to show how water from the sea can fall as rain on land.

Item Number: Z02

SCORING

Note: A fully correct response must show clear evidence of the following 4 steps:

- (i) Evaporation of water from the sea
- (ii) Condensation (as clouds)
- (iii) Transportation (from sea to land)
- (iv) Precipitation.

The steps do not have to be indicated on a labeled diagram for full credit, but the drawing and/or accompanying explanatory text must be clear with respect to the direction of water flow. Steps (ii) and (iii) may be clearly indicated as two steps (e.g. formation of clouds and transportation by wind) or as a single step showing a series of clouds extending over land and sea.

Correct Response

- •Response includes a diagram indicating all 4 steps (i, ii, iii and iv above) and direction of water flow.
- •No diagram is shown, but response includes a complete and correct textual description of the water cycle.

•Other fully correct.

Partial Response

- · As in correct response but evaporation is unclear or omitted.
- As in correct response but condensation is unclear or omitted.
- · As in correct response but transportation is unclear or omitted.
- · As in correct response but precipitation is unclear or omitted.
- Other partially correct.

Incorrect Response

- · Response clearly indicates evaporation and/or condensation only.
- Response clearly indicates precipitation only (may also show clouds).
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Belgium (Flemish)	77	
Singapore	76	
England	74	
Hungary	67	
Malaysia	66	
Australia	66	
Netherlands	65	
Russian Federation	64	
New Zealand	60	
Canada	58	
Slovenia	56	
Japan	54	
Finland	52	
Czech Republic	47	0
Korea, Rep. of	43	0
Chinese Taipei	43	0
Italy	42	0
Thailand	41	0
Jordan	41	0
Latvia (LSS)	41	0
International Average	40	
Cyprus	35	0
-) - : : : -	55	0
Slovak Republic	35	
Slovak Republic Chile Romania	35	
Slovak Republic Chile	35 27 26 26	
Slovak Republic Chile Romania	35 27 26 26 25	
Slovak Republic Chile Romania Macedonia, Rep. of	35 27 26 26 25 25	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia	35 27 26 26 25	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey	35 27 26 26 25 25	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania	35 27 26 26 25 25 20	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines	35 27 26 26 25 25 20 19	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia	35 27 26 25 25 20 19 17	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova	35 27 26 25 25 20 19 17 14	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova Israel	35 27 26 25 25 20 19 17 14 14	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova Israel United States South Africa Bulgaria	35 27 26 25 25 20 19 17 14 14 13	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova Israel United States South Africa	35 27 26 25 25 20 19 17 14 14 13 11	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova Israel United States South Africa Bulgaria	35 27 26 25 25 20 19 17 14 14 13 11	
Slovak Republic Chile Romania Macedonia, Rep. of Tunisia Turkey Lithuania Philippines Indonesia Moldova Israel United States South Africa Bulgaria Iran, Islamic Rep.	35 27 26 25 25 20 19 17 14 14 13 11 11 10	

Country average vs.		
International av	erage:	
Higher		
Not different	0	
Lower		

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Pulse/breathing rate after exercise

Immediately before and after running a 50 meter race, your pulse and breathing rates are taken. What changes would you expect to find?

- A. no change in pulse but a decrease in breathing rate
- B. an increase in pulse but no change in breathing rate
- C. an increase in pulse and breathing rate
- D. a decrease in pulse and breathing rate
- E. no change in either

Item Number: B04

Overall Percent Correct

Japan	98	
Hungary	97	
Singapore	96	
Netherlands	95	
Belgium (Flemish)	95	
England	95	
Slovenia	95	
Korea, Rep. of	95	
Lithuania	95	
Canada	94	
Chinese Taipei	94	
Finland	94	
Czech Republic	94	
Australia	94	
Hong Kong, SAR	93	
Tunisia	92	
Slovak Republic	92	
Bulgaria	92	
Latvia (LSS)	92	
United States	91	
New Zealand	90	
Malaysia	89	0
Russian Federation	89	0
Italy	89	0
Cyprus	88	0
International Average	e 87	
Thailand	87	0
Israel	86	0
Macedonia, Rep. of	86	0
Moldova	85	0
Romania	84	0
Chile	83	▼
Indonesia	83	▼
Jordan	83	▼
Turkey	79	▼
Iran, Islamic Rep.	79	▼
Philippines	59	0 • • • •
Morocco	58	▼
South Africa	36	▼

Country avera International av	•
Higher	▲
Not different	○
Lower	▼

Correct Response:

С

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Sensory messages to the brain

Sensory messages are taken to the brain by
A. arteries and veins
B. arteries and hormones
C. nerves and hormones
D. muscles and veins
Item Number: D05
Nom Humbon Boo

С

Overall Percent Correct

Czech Republic	89	
Netherlands	83	
Bulgaria	82	
Thailand	82	
Latvia (LSS)	82	
Korea, Rep. of	80	
Lithuania	80	
Belgium (Flemish)	79	
Slovenia	78	
Slovak Republic	78	
Russian Federation	78	
Hungary	78	
Tunisia	76	
Japan	75	
Iran, Islamic Rep.	74	
England	74	
Chinese Taipei	72	0
Moldova	72	0
Finland	71	0
Australia	71	0
Macedonia, Rep. of	71	0
United States	71	0
Israel	70	0
International Average	e 69	
Singapore	68	0
Canada	68	0
Hong Kong, SAR	67	0
Indonesia	66	0
Italy	64	0
Jordan	64	0
Romania	64	0
New Zealand	61	
Malaysia	60	
Cyprus	53	
Turkey	53	
Philippines	45	* * * * *
Morocco	42	
South Africa	36	
Chile	35	
Country overero ve		

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

15

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Seed development from plant part

Seeds develop from which part of a plant? A. Flower B. Leaf C. Root D. Stem		
B. Leaf C. Root D. Stem	Seeds develop from which part of a plant?	
C. Root D. Stem	A. Flower	
D. Stem	B. Leaf	
	C. Root	
tem Number: D06	D. Stem	
tem Number: D06		
rem Number: D06		
em Number: D06		
em Number: D06		
em Number: D06		
em Number: D06		
em Number: D06		
em Number: D06		
tem Number: D06		
tem Number: D06		
	tem Number: D06	

Α

Overall Percent Correct

Czech Republic Slovak Republic	94 93	
Latvia (LSS)	92	
Lithuania	89	
Hungary	87	
Russian Federation	86	
Romania	85	
Slovenia	84	
Japan	83	
Moldova	82	
Italy	82	
Singapore	82	
Finland	82	
Belgium (Flemish)	80	
Macedonia, Rep. of	80	
Indonesia	80	
Bulgaria	78	
Korea, Rep. of	77	
Netherlands	72	0
International Average	71	
Hong Kong, SAR	69	0
Thailand	69	0
Thailand Australia	69 68	0
Thailand Australia Iran, Islamic Rep.	69 68 68	0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia	69 68 68 67	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan	69 68 68 67 67	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand	69 68 68 67 67 65	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan	69 68 67 67 65 65	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England	69 68 67 67 65 65 63	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia	69 68 67 67 65 65	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada	69 68 67 67 65 65 63 63 63	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei	69 68 67 67 65 65 63 63 61 57	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus	69 68 67 67 65 65 63 63 61 57 57	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile	69 68 67 67 65 65 63 63 61 57	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus	69 68 67 67 65 65 63 63 61 57 57 57 57	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus United States Turkey Israel	69 68 67 67 65 65 63 63 61 57 57 57	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus United States Turkey Israel Philippines	69 68 67 67 65 63 63 63 61 57 57 57 57 52 39	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus United States Turkey Israel	69 68 67 67 65 63 63 63 61 57 57 57 56 52	0 0 0 0
Thailand Australia Iran, Islamic Rep. Malaysia Jordan New Zealand Tunisia England Chinese Taipei Canada Chile Cyprus United States Turkey Israel Philippines	69 68 67 67 65 63 63 63 61 57 57 57 57 52 39	0 0 0

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

16

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Characteristic of mammal

A small animal called the duckbilled platypus lives in Australia. Which characteristic of this animal shows that it is a mammal?

- A. It eats other animals.
- B. It feeds its young milk.
- C. It makes a nest and lays eggs.
- D. It has webbed feet.

Item Number: F01

Correct Response: B

Slovenia	89	
Japan	86	
Bulgaria	85	
Iran, Islamic Rep.	84	
Hong Kong, SAR	83	
Slovak Republic	81	
Chinese Taipei	80	
Latvia (LSS)	80	
Cyprus	80	
Czech Republic	79	
Malaysia	78	
Hungary	78	
Korea, Rep. of	77	
Singapore	77	
Russian Federation	76	0
Romania	73	0
Thailand	71	0
Finland	71	0
Belgium (Flemish)	70	0
Lithuania	70	0
Littiualiia	70	0
Macedonia, Rep. of	70	0
	70	
Macedonia, Rep. of	70	0
Macedonia, Rep. of International Average	70 70	0
Macedonia, Rep. of International Average Italy	70 70 70 70	0 0 0 0
Macedonia, Rep. of International Average Italy Chile	70 70 70 68	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova	70 70 68 68 67 66	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia	70 70 70 68 68 68 67	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada	70 70 68 68 67 66	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey	70 70 70 68 68 68 67 66 65	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States	70 70 68 68 67 66 65 65	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia	70 70 68 68 67 66 65 65 64	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan	70 70 68 68 67 66 65 65 64 63	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands Israel	70 70 68 68 67 66 65 65 64 63 63	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands	70 70 68 68 67 66 65 65 65 64 63 63 63 62	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands Israel	70 70 68 68 67 66 65 65 65 64 63 63 62 60	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands Israel New Zealand	70 70 68 67 66 65 65 64 63 63 63 62 60 54 52 46	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands Israel New Zealand England South Africa Morocco	70 70 68 67 66 65 65 65 64 63 63 63 62 60 54 52 46 45	0 0 0 0
Macedonia, Rep. of International Average Italy Chile Moldova Tunisia Canada Turkey United States Indonesia Jordan Australia Netherlands Israel New Zealand England South Africa	70 70 68 67 66 65 65 64 63 63 63 62 60 54 52 46	0

Country average International av	-
Higher Not different	▲ ○
Lower	V

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Interpretation of senses

Humans interpret seeing, hearing, tasting and smelling in the

A. brain

B. spinal cord

C. receptors

D. skin

Item Number: F03

Correct Response: A

Bulgaria	91	
Hong Kong, SAR	91	
Singapore	86	
Malaysia	85	
United States	85	
Netherlands	83	
Russian Federation	82	
England	81	
New Zealand	81	
Canada	81	
Chinese Taipei	80	
Moldova	78	
Turkey	78	
Hungary	76	
Australia	72	
Finland	69	0
Lithuania	67	0
Czech Republic	67	0
International Average	e 65	
Chile	65	0
		0 0
Chile	65	0
Chile Latvia (LSS)	65 65	0
Chile Latvia (LSS) Macedonia, Rep. of	65 65 65	0
Chile Latvia (LSS) Macedonia, Rep. of Romania	65 65 65 63	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia	65 65 63 61	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel	65 65 63 61 60	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines	65 65 63 61 60 58	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan	65 65 63 61 60 58 58	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of	65 65 63 61 60 58 58 55	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan	65 65 63 61 60 58 58 55 54	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep.	65 65 63 61 60 58 58 55 54 50	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep. Italy	65 65 63 61 60 58 58 55 54 50 44	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep. Italy Slovenia	65 65 63 61 60 58 58 55 54 50 44 43	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep. Italy Slovenia Morocco	65 65 63 61 60 58 58 55 54 50 44 43 43	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep. Italy Slovenia Morocco Belgium (Flemish)	65 65 63 61 60 58 58 55 54 50 44 43 43 40	0
Chile Latvia (LSS) Macedonia, Rep. of Romania Indonesia Israel Philippines Jordan Korea, Rep. of Japan Iran, Islamic Rep. Italy Slovenia Morocco Belgium (Flemish) South Africa	65 65 63 61 60 58 55 54 50 44 43 43 40 32	0

Country avera International av	•
Higher	
Not different	0
Lower	•

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

NOT a function of blood

Which of these is NOT a function of the blood?	Which of these	is NOT a	function	of the blood?
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- A. Digesting food
- B. Protecting against disease
- C. Carrying waste materials away from the cells
- D. Carrying oxygen to different parts of the body

Item Number: H01

Correct Response:

Α

Thailand	90	
Chinese Taipei	88	
Czech Republic	88	
Hungary	85	
Japan	84	
United States	83	
Canada	81	
England	81	
Slovak Republic	81	
Finland	80	
Australia	80	
Bulgaria	79	
Netherlands	79	
Korea, Rep. of	77	
Belgium (Flemish)	77	
Italy	77	
Hong Kong, SAR	76	
Russian Federation	75	0
Singapore	74	0
Slovenia	73	0
New Zealand	72	0
New Zealand International Average		0
		0
International Average	e 70	
International Average	70 69	0 0 0
International Average Lithuania Chile	e 70 69 69	0 0 0 0
International Average Lithuania Chile Romania	e 70 69 69 66	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of	 70 69 69 66 65 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel	 70 69 69 66 65 64 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan	 70 69 69 66 65 64 63 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS)	 70 69 69 66 65 64 63 58 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia	 70 69 69 66 65 64 63 58 57 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep.	 70 69 69 66 65 64 63 58 57 56 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova	 70 69 69 65 64 63 58 57 56 56 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova Indonesia	 70 69 69 66 65 64 63 58 57 56 56 53 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova Indonesia Turkey	 70 69 69 66 65 64 63 58 57 56 53 51 	0 0 0 0
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International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova Indonesia Turkey Philippines Tunisia	 70 69 69 66 65 64 63 58 57 56 56 53 51 50 44 	0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova Indonesia Turkey Philippines Tunisia Morocco	 70 69 69 66 65 64 63 58 57 56 56 53 51 50 44 43 	0 0 0 0
International Average Lithuania Chile Romania Macedonia, Rep. of Israel Jordan Latvia (LSS) Malaysia Iran, Islamic Rep. Moldova Indonesia Turkey Philippines Tunisia Morocco	 70 69 69 66 65 64 63 58 57 56 56 53 51 50 44 43 	0 0 0 0

Country avera International av	•
Higher	
Not different	0
Lower	•

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Role of vitamins

What are vitamins?

- A. Substances that break down food
- B. Bacteria that people get when they eat some foods
- C. Substances that people make from protein
- D. Substances that people need in small amounts in order for their bodies to function normally

Item Number: H02

Correct Response: D

Latvia (LSS)	95	
Russian Federation	95	
Hungary	95	
Netherlands	93	
Korea, Rep. of	92	
Slovenia	90	
Slovak Republic	89	
Finland	88	
Bulgaria	87	
Belgium (Flemish)	87	
Malaysia	86	
Lithuania	86	
Czech Republic	84	
Indonesia	84	
England	83	
Italy	83	
Australia	83	
Canada	82	0
Singapore	80	0
T 1 1	70	0
Thailand	79	0
Chile	79	0
	79	
Chile International Average United States	79	
Chile International Average	79 78	0
Chile International Average United States	79 78 78	0 0 0 0 0 0 0
Chile International Average United States New Zealand	79 78 78 78 76	0 0 0 0 0 0 0 0 0 0
Chile International Average United States New Zealand Israel	79 78 78 76 75	0 0 0 0 0
Chile International Average United States New Zealand Israel Romania	79 78 78 76 75 74	0 0 0 0 0
Chile International Average United States New Zealand Israel Romania Jordan	79 78 78 76 75 74 73	0 0 0 0 0
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of	79 78 78 76 75 74 73 71	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova	79 78 78 76 75 74 73 71 71	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei	79 78 78 76 75 74 73 71 71 71	0 0 0 0 0
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep.	79 78 78 76 75 74 73 71 71 71 71 70	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey	79 78 78 76 75 74 73 71 71 71 71 70 69	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey Hong Kong, SAR	79 78 78 76 75 74 73 71 71 71 71 70 69 69	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey Hong Kong, SAR Cyprus	79 78 78 76 75 74 73 71 71 71 71 70 69 69 68	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey Hong Kong, SAR Cyprus Philippines	79 78 78 76 75 74 73 71 71 71 71 71 70 69 69 68 68 68	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey Hong Kong, SAR Cyprus Philippines Japan	79 78 78 76 75 74 73 71 71 71 71 71 70 69 69 68 68 68 65	
Chile International Average United States New Zealand Israel Romania Jordan Macedonia, Rep. of Moldova Chinese Taipei Iran, Islamic Rep. Turkey Hong Kong, SAR Cyprus Philippines Japan Morocco	79 78 76 75 74 73 71 71 70 69 68 65 59	

Country avera International av	-
Higher Not different Lower	

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Feature shared by all insects

- A. External skeleton
- B. Two pairs of wings
- C. Jumping legs
- D. Stinging mechanism

Item Number: J02

Correct Response:

Α

Canada	81	
United States	78	
England	78	
New Zealand	76	
Netherlands	75	
Australia	74	
Japan	72	
Hungary	66	
Singapore	62	
Turkey	58	
Latvia (LSS)	58	0
Chinese Taipei	57	
Finland	55	0
Korea, Rep. of	54	0
Italy	53	0
Hong Kong, SAR	51	0
Russian Federation	50	0
Israel	50	0
International Average	e 49	
Slovenia	49	0
	1.5	-
Belgium (Flemish)	46	0
Belgium (Flemish)	46	0
Belgium (Flemish) Bulgaria	46 45	0 0 0
Belgium (Flemish) Bulgaria Malaysia	46 45 45	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic	46 45 45 43	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa	46 45 45 43 41	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia	46 45 45 43 41 39	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania	46 45 43 41 39 37	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus	46 45 43 41 39 37 36	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of	46 45 43 41 39 37 36 36	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand	46 45 43 41 39 37 36 36 36	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova	46 45 43 41 39 37 36 36 36 36 36	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania	46 45 43 41 39 37 36 36 36 36 36 32	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania Philippines Chile Jordan	46 45 43 41 39 37 36 36 36 36 32 32	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania Philippines Chile	46 45 43 41 39 37 36 36 36 36 36 32 32 32 32	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania Philippines Chile Jordan	46 45 43 41 39 37 36 36 36 36 36 32 32 32 32 29	0 0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania Philippines Chile Jordan Slovak Republic	46 45 43 41 39 37 36 36 36 36 32 32 32 29 29	0 0
Belgium (Flemish) Bulgaria Malaysia Czech Republic South Africa Indonesia Romania Cyprus Macedonia, Rep. of Thailand Moldova Lithuania Philippines Chile Jordan Slovak Republic Iran, Islamic Rep.	46 45 43 41 39 37 36 36 36 36 32 32 32 29 29 25	0 0 0

Country average vs. International average:		
Higher Not different	▲ ○	
Lower	•	

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Reason for protein in diet

The BEST reason for including protein in a healthy diet is because it is the main source of

- A. energy for the body
- B. fiber for digestion
- C. raw materials for cell growth and repair
- D. vitamins for fighting disease

Item Number: J07

Correct Response:

С

Chinese Taipei	62	
Finland	61	
Malaysia	60	
Belgium (Flemish)	54	
Hong Kong, SAR	53	
Slovenia	53	
Thailand	50	
Indonesia	49	
Czech Republic	47	
Singapore	45	
Hungary	44	
Slovak Republic	42	
Korea, Rep. of	41	
Russian Federation	38	0
Italy	36	0
Iran, Islamic Rep.	36	0
Cyprus	34	0
International Average	33	
England	33	0
Latvia (LSS)	29	0
	20	
Japan	29	0
		0 0
Japan	29	0 0 0
Japan Australia	29 27	0 0 0
Japan Australia Jordan	29 27 27	0 0 0
Japan Australia Jordan Bulgaria	29 27 27 26	0 0 0
Japan Australia Jordan Bulgaria Israel	29 27 27 26 24	0 0 0
Japan Australia Jordan Bulgaria Israel Chile	29 27 27 26 24 24	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco	29 27 26 24 24 23	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania	29 27 26 24 24 23 22	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia	29 27 26 24 24 23 22 22 22 22 22	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands	29 27 26 24 24 23 22 22 22	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova	29 27 26 24 24 23 22 22 22 22 22	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand	29 27 26 24 23 22 22 22 22 22 22 21	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova	29 27 26 24 23 22 22 22 22 22 21 20	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova United States	29 27 26 24 23 22 22 22 22 22 21 20 20	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova United States Turkey Romania Philippines	29 27 26 24 23 22 22 22 22 21 20 20 20 20	0 0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova United States Turkey Romania Philippines Macedonia, Rep. of	29 27 26 24 23 22 22 22 22 21 20 20 20 20 16	0 0
Japan Australia Jordan Bulgaria Israel Chile Morocco Lithuania Tunisia Netherlands Canada New Zealand Moldova United States Turkey Romania Philippines	29 27 26 24 23 22 22 22 22 21 20 20 20 16 16	0 0 0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Large leaves on seedlings

What is the primary function of the large leaves found on seedlings growing in a forest?

- A. To provide shade for the root systems
- B. To get rid of excess water that is entering through the roots
- C. To allow for leaf damage by insects
- D. To gather as much light as possible for photosynthesis

Item Number: L02

Correct Response:

D

Thailand	92	
Japan	89	
Korea, Rep. of	88	
Slovenia	84	
Hong Kong, SAR	83	
Finland	82	
Italy	82	
Singapore	81	
Hungary	80	
Slovak Republic	80	0
Lithuania	79	0
England	79	0
Russian Federation	79	
Malaysia	78	
Czech Republic	77	0
Turkey	73	0
Canada	73	0
Romania	73	0
Bulgaria	73	0
Cyprus	73	0
-) - · - · -		0
International Average		Ű
		0
International Average	e 72	
International Average Chinese Taipei	e 72 71	0
International Average Chinese Taipei Netherlands	e 72 71 70	0
International Average Chinese Taipei Netherlands Chile	e 72 71 70 69	0 0 0
International Average Chinese Taipei Netherlands Chile Belgium (Flemish)	e 72 71 70 69 69	0 0 0 0
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan	e 72 71 70 69 69 68	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia	e 72 71 70 69 69 68 68	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of	e 72 71 70 69 69 68 68 68 68	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep.	e 72 71 70 69 69 68 68 68 68 67 66	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel	e 72 71 70 69 69 68 68 68 68 67 66 66	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS)	e 72 71 70 69 69 68 68 68 67 66 66 65	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia	e 72 71 70 69 69 68 68 68 67 66 66 65 65	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia United States	e 72 71 70 69 69 68 68 68 67 66 65 65 65 63	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia United States Moldova	e 72 71 70 69 69 68 68 67 66 65 65 65 63 63 63	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia United States Moldova New Zealand	e 72 71 70 69 69 68 68 67 66 65 65 65 63 63 63 62	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia United States Moldova New Zealand Indonesia	e 72 71 70 69 69 68 68 67 66 65 65 65 63 63 62 62 62	
International Average Chinese Taipei Netherlands Chile Belgium (Flemish) Jordan Australia Macedonia, Rep. of Iran, Islamic Rep. Israel Latvia (LSS) Tunisia United States Moldova New Zealand Indonesia Philippines	e 72 71 70 69 68 68 67 66 65 65 65 63 63 63 62 62 55	

Country average vs. International average:		
Higher Not different Lower		

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Physical characteristic of prey

Which one of the following characteristics is most likely to be found in mammals that are preyed on by other mammals for food?

- A. Eyes on the sides of the head
- B. Teeth that are long and pointed
- C. Claws on the feet
- D. Ears that cannot move

Item Number: L03

Overall Percent Correct

Belgium (Flemish)	64	
Japan	61	
Korea, Rep. of	55	
England	54	
New Zealand	50	
Netherlands	50	
Finland	48	
Malaysia	46	
Chinese Taipei	46	
Australia	45	
United States	43	Ο
Canada	42	0
Slovenia	40	0
Czech Republic	40	Ο
International Average	e 37	
Lithuania	37	0
Italy	37	0
Bulgaria	35	0
Moldova	35	Ο
Slovak Republic	34	0
Singapore	34	0
Russian Federation	34	Ο
Hong Kong, SAR	34	0
Jordan	34	0
Cyprus	33	0
Turkey	32	0
Macedonia, Rep. of	30	0
Indonesia	29	
Iran, Islamic Rep.	29	•
Romania	29	0
South Africa	28	•
Israel	27	•
Chile	25	•
Tunisia	24	•
Thailand	23	•
Hungary	22	•
Philippines	22	
Morocco	16	▼

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

Α

24

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Wolves marking territory

When male wolves place their scent on trees, they most likely are doing this in order to

- A. attract female wolves
- B. attract prey
- C. mark their territory against other wolves
- D. mark the location of food supplies

Item Number: L05

Correct Response:	С
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Finland	92	
Korea, Rep. of	91	
Canada	89	
Latvia (LSS)	86	
Australia	84	
Russian Federation	84	
Japan	83	
Belgium (Flemish)	81	
Netherlands	80	
New Zealand	80	
Hungary	79	
United States	78	
England	75	
Czech Republic	74	
Lithuania	72	
Slovak Republic	71	
Bulgaria	71	
Italy	70	
Chile	66	
Thailand	65	0
Slovenia	63	0
Slovenia International Average		
International Average Hong Kong, SAR	60 54	0
International Average	e 60	0
International Average Hong Kong, SAR	60 54	0
International Average Hong Kong, SAR Chinese Taipei	e 60 54 50	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep.	60 54 50 49	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia	 60 54 50 49 46 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania	 60 54 50 49 46 45 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel	 60 54 50 49 46 45 44 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore	 60 54 50 49 46 45 44 44 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova	 60 54 50 49 46 45 44 44 44 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of	 60 54 50 49 46 45 44 44 34 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia	 60 54 50 49 46 45 44 44 34 33 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia Jordan	 60 54 50 49 46 45 44 44 34 33 33 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia Jordan Turkey	 60 54 50 49 46 45 44 44 34 33 33 32 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia Jordan Turkey Philippines	 60 54 50 49 46 45 44 44 34 33 32 31 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia Jordan Turkey Philippines Cyprus	 60 54 50 49 46 45 44 44 34 33 32 31 27 	0
International Average Hong Kong, SAR Chinese Taipei Iran, Islamic Rep. Malaysia Romania Israel Singapore Moldova Macedonia, Rep. of Indonesia Jordan Turkey Philippines Cyprus South Africa	 60 54 50 49 46 45 44 44 34 33 32 31 27 26 	

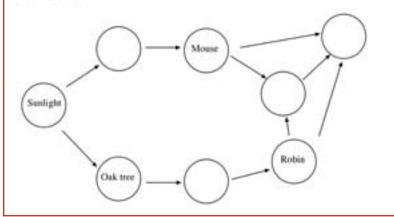
Country avera International av	•
Higher	
Not different	0
Lower	•

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Complete food web

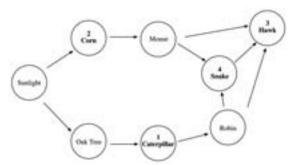
An incomplete food web has been drawn for you. Complete it by filling in each of the empty circles with the number of the correct animal or plant from the list. Remember that the arrows represent energy flow and go from the provider to the user.

- 1) Caterpillar
- 2) Corn
- 3) Hawk
- Snake



Item Number: L08

SCORING



Note: There are two possible food webs that are accepted as correct. An alternative, but less preferred, food web with the hawk (3) and snake (4) reversed is also scored as correct.

Correct Response

- Four placed correctly: 2,1,4,3 or names of animals/plants (corn, caterpillar, snake, hawk) as shown in the diagram above.
- Same as above but with hawk and snake reversed.

Incorrect Response

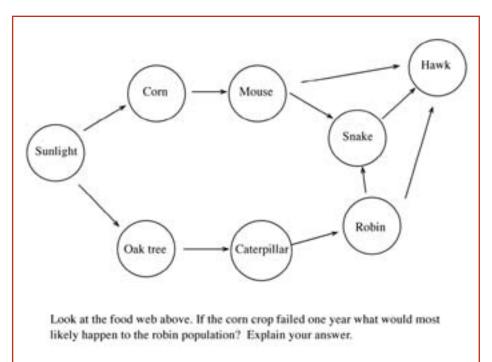
• Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei89ASingapore89AKorea, Rep. of85AMalaysia84AEngland75ABulgaria70AHungary70AJapan68ARomania65OHong Kong, SAR64ACanada63OBelgium (Flemish)62OAustralia60OAustralia60ONetherlands58OThailand57OMoldova56OUnited States56OJordan51OJordan51OLatvia (LSS)50ONew Zealand48OPhilippines39TIthuania37TCyprus37TItran, Islamic Rep.35TIran, Islamic Rep.35TKorocco16TSouth Africa12T			
Singapore89AKorea, Rep. of85AMalaysia84AEngland75ABulgaria70AHungary70AJapan68ARomania67AHong Kong, SAR64ACanada63OBelgium (Flemish)62OAustralia60ONetherlands58OThailand58OThailand58OThailand58OSlovak Republic56OJordan51OJordan51OJordan51OJordan54OSlovenia48OItaly48OPhilippines39TLithuania37TTurkey36TSrael35TIran, Islamic Rep.35TIran, Islamic Rep.35TIndianic36TIndianic37TIndiania36TSlovenia36TItaly36TItaly36TItaly36TItaliania36TItaliania36TItaly36TItaly36TItaly36TItaliania36TItaliania36T <td>Chinese Taipei</td> <td>89</td> <td></td>	Chinese Taipei	89	
Korea, Rep. of 85 A Malaysia 84 A England 75 A Bulgaria 70 A Hungary 70 A Japan 68 A Russian Federation 67 A Indonesia 66 A Romania 65 O Hong Kong, SAR 64 A Canada 63 O Belgium (Flemish) 62 O Australia 60 O Netherlands 58 O Thailand 58 O Finland 57 O Moldova 56 O United States 56 O Jordan 51 O Italy 48 O Slovenia 48 O Italy 48 O New Zealand 48 O Philippines 39 T		89	
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Czech Republic600Australia600Netherlands580Thailand580Finland570Moldova560United States560International Average55Slovak Republic540Jordan510Latvia (LSS)500Macedonia, Rep. of480Slovenia480Italy480New Zealand480Philippines39VLithuania37VCyprus36VIuraisa36VIsrael35VIran, Islamic Rep.35VMorocco16V	Canada	63	0
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Netherlands580Thailand580Finland570Moldova560United States560International Average57Slovak Republic540Jordan510Latvia (LSS)500Macedonia, Rep. of480Slovenia480Italy480New Zealand480Philippines39₹Lithuania37₹Cyprus36₹Turkey36₹Israel35₹Iran, Islamic Rep.35₹Morocco16₹	Czech Republic	60	0
Thailand58OFinland57OMoldova56OUnited States56OInternational Average57Slovak Republic54OJordan51OLatvia (LSS)50OMacedonia, Rep. of48OSlovenia48OItaly48ONew Zealand48OPhilippines39VLithuania37VTurkey36VIsrael35VIran, Islamic Rep.35VMorocco16V	Australia	60	0
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Moldova560United States560International Average55Slovak Republic540Jordan510Latvia (LSS)500Macedonia, Rep. of480Slovenia480Italy480New Zealand480Philippines39*Lithuania37*Cyprus36*Iunisia36*Israel35*Iran, Islamic Rep.35*Morocco16*	Thailand	58	0
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International Average55Slovak Republic54OJordan51OLatvia (LSS)50OMacedonia, Rep. of48OSlovenia48OItaly48OItaly48ONew Zealand48OPhilippines39VLithuania37VCyprus36VTurkey36VIsrael35VIran, Islamic Rep.35VMorocco16V	Moldova	56	0
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Latvia (LSS)50OMacedonia, Rep. of48OSlovenia48OItaly48ONew Zealand48OPhilippines39VLithuania37VCyprus37VTurkey36VIsrael35VIran, Islamic Rep.35VMorocco16V	Slovak Ropublic	54	0
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	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia	50 48 48	0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy	50 48 48 48	0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand	50 48 48 48 48	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines	50 48 48 48 48 39	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania	50 48 48 48 48 39 37	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus	50 48 48 48 48 39 37 37	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey	50 48 48 48 39 37 37 36	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey Tunisia	50 48 48 48 39 37 37 36 36	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey Tunisia Israel	50 48 48 48 39 37 37 36 36 35	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey Tunisia Israel Iran, Islamic Rep.	50 48 48 48 39 37 37 36 36 35 35	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey Tunisia Israel Iran, Islamic Rep. Chile	50 48 48 48 39 37 37 36 36 35 35 28	0 0 0 0 0
	Jordan Latvia (LSS) Macedonia, Rep. of Slovenia Italy New Zealand Philippines Lithuania Cyprus Turkey Tunisia Israel Iran, Islamic Rep. Chile Morocco	50 48 48 48 39 37 37 36 36 35 35 28 16	0 0 0 0 0

Country avera International a	-
Higher	▲
Not different	○
Lower	▼

Content Domain	Cognitive Domain
Life Science	Theorizing, Analyzing and Solving Problems

Food web: effect of crop failure



Item Number: N02

SCORING

Note: A correct response must include a feasible explanation directly relating the predicted change in robin population to the effect of corn crop failure on prey/predator relationships indicated in the food web. Responses do not have to use the specific terms decrease, increase, and same, as long as the explanation is clear with respect to the effect on the robin population. If more than one effect is given, assign credit corresponding to the first correct explanation.

Correct Response

- Robin population may decrease. Explanation based on predators (snakes/hawks) eating more robins if mice die.
- Robin population may increase. Explanation based on predators (snakes/hawks) dying due to lack of food (mice).
- Robin population would stay the same with a feasible explanation.
- Other acceptable explanation.

Incorrect Response

- Robin population would decrease. Incorrect explanation based on robins starving if snakes die (confuses prey/predator relationship).
- Robin population would decrease. Incorrect explanation based on the robin needing corn to survive.
- Robin population would stay the same. Incorrect explanation based on the robins not needing corn to survive or not being connected to corn in the food web. (Does not consider the effect of predators.)
- Mentions only that the whole food web will be upset and/or all the animals will die.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	72	
Chinese Taipei	55	
Korea, Rep. of	54	
England	46	
Belgium (Flemish)	45	
Australia	44	
Canada	38	
New Zealand	38	
Hong Kong, SAR	36	
Netherlands	36	0
United States	35	
Malaysia	31	0
Russian Federation	30	0
Japan	28	0
Hungary	28	0
Finland	26	0
International Average	e 26	
Czech Republic	26	0
Slovenia	23	0
Turkey	23	0
Italy	22	0
Slovak Republic	21	0
Macedonia, Rep. of	21	0
Latvia (LSS)	20	0
Bulgaria	20	0
Indonesia	19	▼
Romania	19	0
Philippines	17	•
Israel	15	▼
Lithuania	14	•
Thailand	14	•
Tunisia	13	•
Cyprus	13	•
Jordan	12	•
Chile	11	•
Iran, Islamic Rep.	9	•
Moldova	8	▼
South Africa	3	
Morocco	2	▼



Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Bacteria to convert milk to yogurt

Which of the following organisms are used to convert milk to yogurt?

A. Bacteria

B. Protozoa

C. Viruses

D. Algae

Item Number: N03

Correct Response:

Α

Japan	86	
Chinese Taipei	86	
Korea, Rep. of	75	
Hong Kong, SAR	73	
Russian Federation	73	
Czech Republic	71	
Jordan	71	
Iran, Islamic Rep.	67	
Cyprus	65	
Turkey	64	
Finland	64	
Bulgaria	62	0
Italy	62	0
Slovak Republic	61	0
Moldova	60	0
Latvia (LSS)	59	0
Netherlands	58	0
Lithuania	58	0
Thailand	57	0
Romania	56	0
International Average	e 5 4	
Slovenia	e 54 54	0
Slovenia Macedonia, Rep. of	e 54 54 54	0
Slovenia Macedonia, Rep. of Canada	54 54 54 52	0 0
Slovenia Macedonia, Rep. of Canada Tunisia	e 54 54 54 52 52	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary	e 54 54 52 52 52 47	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England	e 54 54 52 52 47 44	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia	54 54 52 52 52 47 44 44	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand	54 54 52 52 47 44 44 43	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States	 54 54 52 52 47 44 43 43 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco	 54 54 52 52 47 44 43 43 42 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel	 54 54 52 52 47 44 43 43 42 40 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia	 54 54 52 52 47 44 43 42 40 37 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore	 54 54 52 52 47 44 43 42 40 37 36 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore South Africa	 54 54 52 52 47 44 43 43 42 40 37 36 35 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore South Africa Malaysia	 54 54 52 52 47 44 43 43 42 40 37 36 35 34 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore South Africa Malaysia Philippines	 54 54 52 52 47 44 43 43 42 40 37 36 35 34 27 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore South Africa Malaysia Philippines Chile	 54 54 52 52 47 44 43 43 42 40 37 36 35 34 27 26 	0 0 0
Slovenia Macedonia, Rep. of Canada Tunisia Hungary England Australia New Zealand United States Morocco Israel Indonesia Singapore South Africa Malaysia Philippines	 54 54 52 52 47 44 43 43 42 40 37 36 35 34 27 	0 0

Country average vs. International average:	
Higher Not different Lower	

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Bone meal for plant growth

Some plants grow better if bone meal (ground-up bones) is spread around their roots. What does bone meal supply to plants that makes them grow better?

- A. Energy
- B. Minerals
- C. Vitamins
- D. Carbon dioxide
- E. Water

Item Number: N05

Correct Response: B

Latvia (LSS)	82	
Thailand	81	
Singapore	80	
Lithuania	79	
Hungary	78	
Malaysia	75	
Russian Federation	74	
Finland	73	
Chinese Taipei	72	
Czech Republic	69	
Japan	67	
Slovenia	65	
Canada	65	
Italy	60	0
United States	60	0
Moldova	59	0
England	59	0
Hong Kong, SAR	58	0
Korea, Rep. of	58	0
New Zealand	58	0
Tunisia	57	0
Bulgaria	57	0
Australia	57	0
International Average	e 56	
Iran, Islamic Rep.	52	0
Belgium (Flemish)	51	0
Romania	49	0
Slovak Republic	45	
Turkey	44	
Macedonia, Rep. of	44	
Netherlands	43	
Cyprus	42	▼
Chile	41	▼
Jordan	39	
Indonesia	34	
Philippines	31	▼
Israel	30	▼
South Africa	27	▼
Morocco	19	▼

Country avera International a	-
Higher	▲
Not different	○
Lower	▼

Content Domain	Cognitive Domain
Life Science	Understanding Simple Information

Definition of tissue

Tissues are found in living things. What is the definition of a tissue?

A. A group of cells with similar structure and function

B. A group of cells with different structure and function

C. A group of organelles contained inside a cell

D. A group of substances that make up the walls of a cell

Item Number: N06

Correct Response:

Α

Bulgaria	67	
Russian Federation	61	
Chinese Taipei	60	
Slovenia	57	
Lithuania	56	
Cyprus	56	
Korea, Rep. of	54	
Czech Republic	52	0
Slovak Republic	52	
Macedonia, Rep. of	50	
Jordan	49	
Belgium (Flemish)	47	0
Romania	47	0
United States	46	0
Netherlands	46	0
Moldova	46	0
Hungary	44	0
Canada	42	0
Israel	41	0
England	41	0
		<u> </u>
International Average		0
5		0
International Average	e 41	0 0
International Average Singapore	e 41 40	0 0 0
International Average Singapore Italy	41 40 38	0 0 0 0
International Average Singapore Italy Australia	e 41 40 38 37	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR	41 40 38 37 37	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan	40 40 38 37 37 37 37	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS)	e 41 40 38 37 37 37 36	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand	 41 40 38 37 37 37 36 33 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep.	 41 40 38 37 37 36 33 30 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland	 41 40 38 37 37 36 33 30 30 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines	 41 40 38 37 37 36 33 30 30 29 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco	 41 40 38 37 37 36 33 30 29 27 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco Turkey	 41 40 38 37 37 36 33 30 29 27 26 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco Turkey Malaysia	 41 40 38 37 37 36 33 30 30 29 27 26 25 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco Turkey Malaysia Thailand	 41 40 38 37 37 36 33 30 20 27 26 25 24 	0 0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco Turkey Malaysia Thailand Chile	 41 40 38 37 37 36 33 30 20 27 26 25 24 23 	0 0 0 0
International Average Singapore Italy Australia Hong Kong, SAR Japan Latvia (LSS) New Zealand Iran, Islamic Rep. Finland Philippines Morocco Turkey Malaysia Thailand Chile Indonesia	 41 40 38 37 37 36 33 30 20 27 26 25 24 23 22 	0 0 0 0 0

Country avera International a	-
Higher	▲
Not different	○
Lower	▼

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Mammal/lizards living in cold regions

Which statement best explains why mammals are found in very cold regions of the world but lizards are not?

- A. Both mammals and lizards are cold-blooded, but mammals have fur to keep them warm.
- B. Both mammals and lizards are warm-blooded, but lizards get too cold when they shed their skin.
- C. Since mammals, but not lizards, are warm blooded, their body temperature will adjust to match the external temperature.
- D. Since mammals, but not lizards, are warm-blooded, they will maintain their body temperature using heat from metabolic processes.

Item Number: N08

Overall Percent Correct

Russian Federation	62	
Bulgaria	59	
Korea, Rep. of	58	
Japan	56	
Netherlands	53	
Canada	52	
Hong Kong, SAR	51	
Chinese Taipei	49	
Slovak Republic	49	0
Thailand	49	
United States	47	
Singapore	47	0
Australia	46	0
Latvia (LSS)	45	0
Lithuania	44	0
Italy	44	0
Finland	43	0
Czech Republic	41	0
International Average	e 40	
England	40	0
Eligialiu	40	
New Zealand	40 40	0
5		0
New Zealand	40	0 0 0
New Zealand Belgium (Flemish)	40 39 39 39	0 0 0 0
New Zealand Belgium (Flemish) Hungary	40 39 39 39 39	0 0 0 0 0
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus	40 39 39 39 38 35	0 0 0 0 0
New Zealand Belgium (Flemish) Hungary Malaysia Romania	40 39 39 39 39	0 0 0 0 0 0
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus	40 39 39 39 38 35	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines	40 39 39 39 38 35 35	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel	40 39 39 39 38 35 35 35 34	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova	40 39 39 39 38 35 35 35 34 32	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan	40 39 39 38 35 35 35 34 32 30	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile	40 39 39 38 35 35 35 34 32 30 30	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan	40 39 39 38 35 35 34 32 30 30 29	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan Iran, Islamic Rep.	40 39 39 38 35 35 34 32 30 30 29 28	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan Iran, Islamic Rep. Indonesia	40 39 39 38 35 35 34 32 30 30 29 28 27	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan Iran, Islamic Rep. Indonesia Macedonia, Rep. of	40 39 39 38 35 35 34 32 30 30 29 28 27 27	
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan Iran, Islamic Rep. Indonesia Macedonia, Rep. of Tunisia	40 39 39 38 35 35 34 30 30 29 28 27 27 24	0 0 0 0 0 0
New Zealand Belgium (Flemish) Hungary Malaysia Romania Cyprus Philippines Israel Moldova Slovenia Chile Jordan Iran, Islamic Rep. Indonesia Macedonia, Rep. of Tunisia Turkey	40 39 39 38 35 35 34 30 30 29 28 27 27 24 23	

Country avera International av	-
Higher Not different Lower	

Correct Response:

D

Content Domain	Cognitive Domain
Life Science	Theorizing, Analyzing and Solving Problems

Tree growth

Ethan hammered a nail into the trunk of a young tree. Explain why the nail was still at the same height from the ground twenty years later even though the tree had grown to a height of 22 meters.

Item Number: P03

SCORING

Note: A correct response is based on trees increasing in height as a result of growth at the tips of stems/branches (apical meristem) and trunk growth only resulting in increased diameter. Responses should be scored as correct if either of these two factors are included.

Correct Response

- Mentions that trees grow in height at the tips of stems/branches. (May also mention trunk growth increasing in diameter.)
- Mentions ONLY that the trunk grows in width or diameter but not height (without mentioning growth of the stem or branches).
- Other correct.

Incorrect Response

- Mentions only that the trunk does not grow (is dead).
- Mentions that the nail stops or prevents growth.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Belgium (Flemish)	65	
Finland	64	
Canada	59	
Australia	57	
Japan	57	
Netherlands	56	
New Zealand	56	
Thailand	55	
Slovak Republic	55	
England	55	
Chinese Taipei	53	
Moldova	53	
Hungary	50	0
Singapore	49	0
Czech Republic	48	0
Russian Federation	48	0
Cyprus	47	0
Slovenia	45	0
United States	45	0
Turkey	44	0
Italy	43	0
Latvia (LSS)	42	0
International Average	e 41	
Hong Kong, SAR	40	0
Israel	38	0
Iran, Islamic Rep.	37	0
Lithuania	36	0
Romania	36	0
Malaysia	33	▼
Korea, Rep. of	33	▼
Chile	30	
Bulgaria	29	▼
Jordan	24	▼
Indonesia	23	▼
Tunisia	22	0 V V V V V V V V V
Macedonia, Rep. of	21	▼
Philippines	9	▼
South Africa	8	
Morocco	2	▼

Country average International av	
Higher	
Not different	0
Lower	V

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Hibernating animals

Animals hibernate to survive cold weather and poor food supplies. Which of the following occurs in animals when they hibernate?

- A. Their blood stops circulating.
- B. Their body temperature increases.
- C. Their body fat remains constant.
- D. Their rate of metabolism decreases.

Item Number: P04

Lithuania 77

Overall Percent Correct

Lithuania	77	
Hungary	75	
Czech Republic	75	
Slovak Republic	74	
Bulgaria	72	
Thailand	69	
Finland	67	
Russian Federation	66	
Latvia (LSS)	64	
Indonesia	63	
Slovenia	54	0
Moldova	54	0
Netherlands	54	0
Singapore	53	0
Australia	51	0
Chinese Taipei	50	0
Cyprus	50	0
Iran, Islamic Rep.	50	0
Italy	50	0
Canada	50	0
Malaysia	49	0
International Averag	e 48	
International Average Belgium (Flemish)	e 48 48	0
International Average Belgium (Flemish) United States	e 48 48 47	0 0
International Average Belgium (Flemish) United States Hong Kong, SAR	e 48 48 47 47	0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania	e 48 48 47 47 46	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel	e 48 48 47 47 46 44	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand	e 48 48 47 47 46 44 33	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England	e 48 48 47 47 46 44 33 33	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan	e 48 48 47 47 46 44 33 33 31	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of	e 48 48 47 47 46 44 33 33 31 30	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile	e 48 48 47 47 46 44 33 33 31 30 30	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines	e 48 48 47 47 46 44 33 33 31 30 30 29	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan	e 48 48 47 47 46 44 33 31 30 30 29 28	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan Turkey	e 48 48 47 46 44 33 31 30 30 29 28 25	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan Turkey Tunisia	e 48 47 47 46 44 33 31 30 29 28 25 23	0 0 0 0
International Averag Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan Turkey Tunisia Korea, Rep. of	e 48 48 47 47 46 44 33 33 31 30 29 28 25 23 22	0 0 0 0
International Average Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan Turkey Tunisia Korea, Rep. of South Africa	e 48 48 47 47 46 44 33 33 31 30 29 28 25 23 22 20	0 0 0 0
International Averag Belgium (Flemish) United States Hong Kong, SAR Romania Israel New Zealand England Jordan Macedonia, Rep. of Chile Philippines Japan Turkey Tunisia Korea, Rep. of	e 48 48 47 47 46 44 33 33 31 30 29 28 25 23 22	0 0 0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Correct Response:

D

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Digestion in stomach

What digestive substance is found in the stomach? What does it do?

Item Number: P06

SCORING

Note: To be correct, a response must name a specific digestive substance found in the stomach (enzyme, hydrochloric acid, or gastric juices) with or without a full description of its function. A general response related to "acid" will be accepted as correct, but an incorrect acid will be scored as incorrect.

Correct Response

- Names enzyme, hydrochloric acid or gastric juices with an explanation based on breaking down food (particles) or protein.
- · Names enzyme, hydrochloric acid or gastric juices without a complete explanation.
- Names acid with or without a complete explanation (does not explicitly name hydrochloric acid).
- Other correct.

Incorrect Response

- Names an incorrect acid not involved in digestion in stomach (lactic acid, amino acid, sulfuric acid, etc.).
- Names a substance (or body part) not found in the stomach but involved in digestion (saliva, bile salts, bacteria, intestines, etc.).
- Mentions digesting (breaking down) food but no specific substance or body part is named.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Slovak Republic	75	
Czech Republic	64	
Hong Kong, SAR	64	
Slovenia	62	
Romania	62	
Moldova	60	
Hungary	59	
Latvia (LSS)	57	
Singapore	56	
Bulgaria	55	
Netherlands	54	0
Chinese Taipei	54	
Russian Federation	54	
Japan	53	
England	51	
Australia	49	0
Lithuania	49	0
New Zealand	49	0
United States	46	0
Belgium (Flemish)	46	0
Canada	43	0
Korea, Rep. of	42	0
Thailand	41	0
International Averag	e 41	
Macedonia, Rep. of	39	0
Jordan	37	0
Italy	35	0
Finland	34	0
Malaysia	29	▼
Iran, Islamic Rep.	26	▼
Chile	24	▼
Indonesia	22	▼
Israel	19	▼
Cyprus	14	▼
Turkey	13	▼
Tunisia	6	
Philippines	6	▼
South Africa	4	0 V V V V V V V V V
Morocco	1	▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Cognitive Domain
Life Science	Understanding Complex Information

Two outcomes of introducing new species

A new species of fish was released into a lake. State two unwanted outcomes that could arise from the introduction of this new species.

1.

2.

Item Number: R03D

SCORING

Note: Each of the two outcomes are scored separately. The same score may be used twice, since they are based on general outcome categories. However, if the two outcomes are essentially the same, the second outcome should be scored as incorrect. If only one outcome is given, the second should be scored as incorrect.

Correct Response

- Mentions competition with native species (e.g. overpopulation, eating the limited food supply).
- · Mentions new species introducing diseases (bacteria, parasites, etc.).
- Mentions effects of predation (new species killing off existing species or vice-versa).
- Mentions that the new species cannot survive in the lake (extinction due to inhospitable habitat).
- · Mentions upsetting food web or ecological balance.
- Mentions mating with existing species.
- Other correct.

Incorrect Response

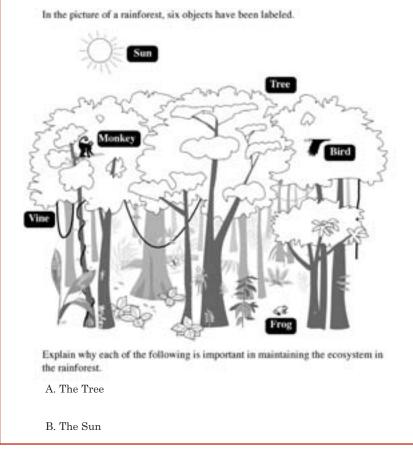
- Response too general.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Australia	74	
New Zealand	60	
Slovak Republic	58	
Canada	57	
Singapore	57	
Thailand	57	
England	56	
Finland	56	
Latvia (LSS)	53	
Chinese Taipei	52	
Belgium (Flemish)	50	
Moldova	48	0
Netherlands	47	0
Israel	47	0
Russian Federation	46	0
Lithuania	46	0
Hungary	44	0
Slovenia	43	0
Bulgaria	43	0
United States	42	0
International Average		
International Average		0
	e 40	0
Italy	40 40	0 0 0
ltaly Japan	40 40 39	0 0 0 0
Italy Japan Romania	40 40 39 36	0 0 0 0 0
Italy Japan Romania Tunisia	 40 40 39 36 35 35 34 	0 0 0 0 0
ltaly Japan Romania Tunisia Cyprus	 40 40 39 36 35 35 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia	 40 40 39 36 35 35 34 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of	 40 40 39 36 35 35 34 33 32 30 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia	 40 40 39 36 35 35 34 33 32 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of	 40 40 39 36 35 35 34 33 32 30 29 28 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR	 40 40 39 36 35 35 34 33 32 30 29 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile	 40 40 39 36 35 35 34 33 32 30 29 28 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile Indonesia	 40 40 39 36 35 35 34 33 32 30 29 28 23 22 22 22 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile Indonesia Iran, Islamic Rep.	 40 40 39 36 35 35 34 33 32 30 29 28 23 22 22 21 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile Indonesia Iran, Islamic Rep. Turkey	 40 40 39 36 35 35 34 33 32 30 29 28 23 22 22 22 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile Indonesia Iran, Islamic Rep. Turkey Jordan	 40 40 39 36 35 35 34 33 32 30 29 28 23 22 22 21 	0 0 0 0 0
Italy Japan Romania Tunisia Cyprus Czech Republic Korea, Rep. of Malaysia Macedonia, Rep. of Hong Kong, SAR Chile Indonesia Iran, Islamic Rep. Turkey Jordan Morocco	 40 40 39 36 35 34 33 32 30 29 28 23 22 22 21 19 	0 0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Life Science	Theorizing, Analyzing and Solving Problems

Importance of trees/sun in rain forest



Item Number: X02A

SCORING

A: Scoring for Trees

Note: If student response refers to oxygen/carbon dioxide cycle, score as correct even if other reasons are given. If more than one reason is given, assign credit corresponding to the first correct reason.

Correct Response

- Trees produce oxygen and/or use carbon dioxide.
- Trees provide food or energy.
- Trees provide a place to hide/shelter.
- Trees provide shade or protection from the Sun.
- Other correct.

Incorrect Response

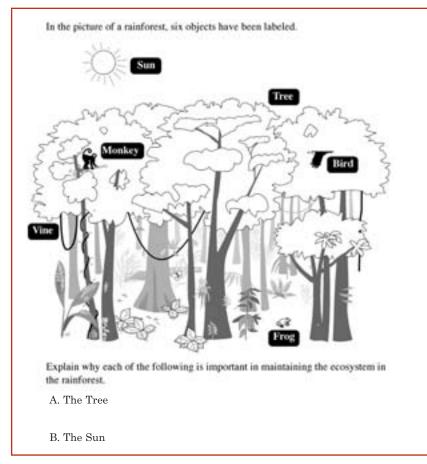
- Response too vague.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	93	
Australia	91	
Canada	90	
England	88	
Chinese Taipei	87	
Korea, Rep. of	87	
Thailand	87	
Belgium (Flemish)	86	
United States	85	
New Zealand	83	
Finland	83	
Japan	83	
Hong Kong, SAR	82	
Slovak Republic	80	
Hungary	79	
Netherlands	79	0
Cyprus	79	
Malaysia	79	
Latvia (LSS)	79	
Slovenia	78	0
Tunisia	77	
Czech Republic	76	0
International Average	e 72	
Indonesia	72	0
Italy	71	0
Jordan	69	0
Russian Federation	64	
Lithuania	63	
Turkey	61	▼
Bulgaria	60	▼
Romania	60	
Israel	59	
Philippines	59	
Moldova	56	
Macedonia, Rep. of	49	▼
Chile	48	▼
Morocco	44	
Iran, Islamic Rep.	42	0 * * * * * * * *
South Africa	30	▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Content Domain	Cognitive Domain
Life Science	Theorizing, Analyzing and Solving Problems

Importance of trees/sun in rain forest



Item Number: X02B

SCORING

B: Scoring for Sun

Note: If response refers explicitly to photosynthesis, score as correct even if other reasons are given. If more than one reason is given, assign credit corresponding to the first correct reason.

Correct Response

- Sun is needed for photosynthesis (by plants).
- Sun is needed in order for chlorophyll in plants to produce food. (Does not explicitly mention photosynthesis).
- Sun provides energy and/or is needed for plant growth. (No mention of photosynthesis or chlorophyll).
- Sun provides heat (warmth) or maintains the temperature. (No mention of photosynthesis or chlorophyll).
- Sun provides light and/or enables animals to see.

• Other correct.

Incorrect Response

- Response too vague.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	91	
Canada	88	
Australia	88	
Korea, Rep. of	86	
Japan	85	
Thailand	84	
England	84	
Chinese Taipei	82	
New Zealand	82	
Finland	81	
Belgium (Flemish)	81	
United States	81	
Hong Kong, SAR	79	
Latvia (LSS)	79	
Malaysia	78	
Slovenia	77	
Netherlands	76	
Tunisia	69	0
Czech Republic	69	0
Jordan	68	0
		<u> </u>
International Average		
International Average Slovak Republic		0
	e 68	
Slovak Republic	e 68 67	0 0 0
Slovak Republic Cyprus	e 68 67 66	0 0
Slovak Republic Cyprus Indonesia	 68 67 66 65 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary	 68 67 66 65 64 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy	 68 67 66 65 64 62 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation	 68 67 66 65 64 62 60 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines	 68 67 66 65 64 62 60 59 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania	 68 67 66 65 64 62 60 59 57 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey	 68 67 66 65 64 62 60 59 57 56 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania	 68 67 66 65 64 62 60 59 57 56 56 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel	 68 67 66 65 64 62 60 59 57 56 55 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel Moldova	 68 67 66 65 64 62 60 59 57 56 55 55 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel Moldova Iran, Islamic Rep.	 68 67 66 65 64 62 60 59 57 56 55 55 48 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel Moldova Iran, Islamic Rep. Bulgaria	 68 67 66 65 64 62 60 59 57 56 55 48 48 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel Moldova Iran, Islamic Rep. Bulgaria Chile	 68 67 66 65 64 62 60 59 57 56 55 48 48 46 	0 0 0 0
Slovak Republic Cyprus Indonesia Hungary Italy Russian Federation Philippines Romania Turkey Lithuania Israel Moldova Iran, Islamic Rep. Bulgaria Chile Macedonia, Rep. of	 68 67 66 65 64 62 60 59 57 56 55 48 48 46 44 	0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Physics	Understanding Simple Information

Energy released from car engine

Most of the chemical energy released when gasoline burns in a car engine is not used to move the car, but is changed into

A. electricity

B. heat

C. magnetism

D. sound

Item Number: B02

Correct Response: B

Hungary	76	
Korea, Rep. of	74	
Russian Federation	72	
Bulgaria	71	
Slovenia	67	
England	67	
Finland	66	
Czech Republic	66	
Israel	65	
Japan	64	
Canada	63	
Netherlands	63	0
Cyprus	63	
Moldova	62	0
Slovak Republic	61	0
Singapore	60	0
Turkey	60	0
Romania	59	0
United States	59	0
Australia	59	0
Latvia (LSS)	59	0
New Zealand	58	0
International Average	58	
Jordan	56	0
Thailand	56	0
Iran, Islamic Rep.	54	0
Italy	53	0
Lithuania	52	▼
Chinese Taipei	52	▼
Philippines	51	▼
Malaysia	50	▼
Belgium (Flemish)	49	▼
Hong Kong, SAR	49	▼
Macedonia, Rep. of	48	▼
Tunisia	46	▼
Indonesia	42	 * *<
Morocco	40	▼
South Africa	40	
Chile	34	-
Chile	54	•

Country average vs. International average:		
Higher Not different		
Lower	V	

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Greatest density from mass/volume table

Object	Mass of Object	Volume of Object
w	11.0 grams	24 cubic centimeters
х	11.0 grams	12 cubic centimeters
Y	5.5 grams	4 cubic centimeters
Z	5.5 grams	11 cubic centimeters

Α.	w

- B. X
- C. Y
- D. Z

Item Number: B03

Correct Response: C

Chinese Taipei	52	
Hong Kong, SAR	50	
Korea, Rep. of	47	
Finland	46	
Belgium (Flemish)	46	
Israel	44	
Singapore	44	
Japan	42	
Netherlands	38	
Hungary	36	
Russian Federation	35	0
Bulgaria	35	0
Slovak Republic	32	0
Slovenia	32	0
Canada	32	0
Malaysia	31	0
Latvia (LSS)	30	0
Lithuania	30	0
Czech Republic	29	0
International Average	28	
International Average		
Australia	25	0
		0
Australia	25	0 0
Australia Romania	25 25	0 0
Australia Romania Macedonia, Rep. of	25 25 24	0 0
Australia Romania Macedonia, Rep. of Moldova	25 25 24 23	0 0
Australia Romania Macedonia, Rep. of Moldova United States	25 25 24 23 23 23 23 21	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy	25 25 24 23 23 23	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey	25 25 24 23 23 23 23 21	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus	25 25 24 23 23 23 23 21 21	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand	25 25 24 23 23 23 21 21 21 20	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines	25 25 24 23 23 23 21 21 20 19	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep.	25 25 24 23 23 21 21 21 20 19 19	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan	25 25 24 23 23 23 21 21 20 19 19 18	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep.	25 25 24 23 23 21 21 21 20 19 19 18 17	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep. South Africa New Zealand Chile	25 25 24 23 23 21 21 20 19 19 18 17 17 17 17	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep. South Africa New Zealand Chile Tunisia	25 25 24 23 23 21 21 20 19 19 18 17 17	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep. South Africa New Zealand Chile	25 25 24 23 23 21 21 20 19 19 19 18 17 17 17 17 11 10 8	0 0
Australia Romania Macedonia, Rep. of Moldova United States Italy Turkey Cyprus Thailand Philippines England Jordan Iran, Islamic Rep. South Africa New Zealand Chile Tunisia	25 25 24 23 23 21 21 20 19 19 19 18 17 17 17 17 11 10	0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Physics	Understanding Simple Information

Color reflecting most light

The walls of a building are to be painted to reflect as much light as possible. What color should they be painted?

A. White

B. Red

C. Black

D. Pink

Item Number: B06

Correct Response: A

Belgium (Flemish)	94	
Hungary	94	
Slovak Republic	92	
Netherlands	92	
Singapore	91	
Slovenia	91	
Czech Republic	90	
Russian Federation	90	
Australia	89	
England	89	
Chinese Taipei	89	
Lithuania	88	
Malaysia	87	
Japan	87	
Bulgaria	86	
Romania	86	0
Latvia (LSS)	86	
Hong Kong, SAR	85	
Finland	85	0
Israel	85	
Canada	83	0
United States	83	0
International Average	82	
Italy	82	0
New Zealand	81	0
Philippines	80	0
Korea, Rep. of	78	
Indonesia	78	
Macedonia, Rep. of	77	
Cyprus	76	
Moldova	75	
Turkey	75	
Chile	75	
Iran, Islamic Rep.	73	
Thailand	73	
Tunisia	73	
Jordan	70	
South Africa	69	
Morocco	56	
	50	•

Country average vs. International average:			
Higher	▲		
Not different	○		
Lower	▼		

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Light rays through magnifying glass

Г

Which diag magnifying		hat happens when light passes throug
	А	
	В	
	С	
	D	
	Е	$ \rightarrow $

Overall Percent Correct

Japan	88	
Chinese Taipei	73	
Bulgaria	70	
Russian Federation	67	
Korea, Rep. of	61	
Singapore	54	
Malaysia	52	
Lithuania	51	
Finland	50	
Czech Republic	49	0
Slovak Republic	49	0
Moldova	48	0
Australia	48	0
Hungary	47	0
Netherlands	47	0
Canada	46	
Hong Kong, SAR	43	0
Romania	43	0
International Averag	e 42	
Slovenia	41	0
Belgium (Flemish)	41	0
Belgium (Flemish) New Zealand	41 40	0
5		0
New Zealand Thailand Iran, Islamic Rep.	40 40 39	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS)	40 40	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile	40 40 39 38 37	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan	40 40 39 38 37 37	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile	40 40 39 38 37 37 36	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan	40 40 39 38 37 37 36 34	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States	40 40 39 38 37 37 36 34 31	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy	40 40 39 38 37 37 36 34	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England	40 40 39 38 37 37 36 34 31 31 29	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus	40 40 39 38 37 37 36 34 31 31 29 28	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia	40 40 39 38 37 37 36 34 31 31 29 28 24	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia Turkey	40 40 39 38 37 37 36 34 31 31 29 28 24 23	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia Turkey Tunisia	40 40 39 38 37 37 36 34 31 31 29 28 24 23 21	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia Turkey Tunisia Macedonia, Rep. of	40 40 39 38 37 37 36 34 31 31 29 28 24 23 21 20	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia Turkey Tunisia Macedonia, Rep. of Philippines	40 40 39 38 37 37 36 34 31 31 29 28 24 23 21 20 19	0 0 0
New Zealand Thailand Iran, Islamic Rep. Latvia (LSS) Chile Jordan United States Italy Morocco Israel England Cyprus Indonesia Turkey Tunisia Macedonia, Rep. of	40 40 39 38 37 37 36 34 31 31 29 28 24 23 21 20	0 0 0

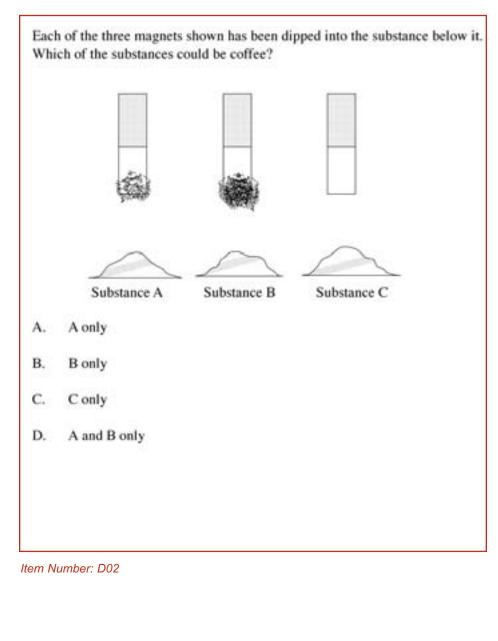
Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Correct Response:

В

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Magnetic substances



Overall Percent Correct

Hungary	92		
Czech Republic	91		
Bulgaria	91		
Korea, Rep. of	90		
Singapore	89		
England	89		
Slovak Republic	88		
Russian Federation	88		
Japan	85		
Slovenia	84		
Australia	83		
Lithuania	82		
Finland	82		
Canada	81		
Romania	79		
Macedonia, Rep. of	78		
Belgium (Flemish)	78		
Chinese Taipei	77		
Malaysia	75	0	
Jordan	75	0	
Netherlands	74	0	
Hong Kong, SAR	74	0	
New Zealand	73	0	
Italy	73	0	
United States	72	0	
International Average	e 72		
Moldova	71	0	
Turkey	70	0	
Cyprus	69	0	
Israel	67	0	
Thailand	58	▼	
Latvia (LSS)	58	▼	
Chile	53	▼	
Tunisia	53	▼	
Iran, Islamic Rep.	52	▼	
Indonesia	47	* * * * *	
South Africa	36	▼	
Morocco	29	▼	
Philippines	27		
Country average vs.			

International average:		
Higher Not different Lower		

Correct Response:

С

42

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Sequence of energy changes

Chemio	cal Energy — Heat Energy — Mechanical Energy (with wasted heat)
The	sequence of energy changes shown in the diagram explains which even
A.	A flashlight is on.
В.	A candle burns.
С,	Gasoline burns to power a car.
D.	Electric current runs a refrigerator.

Item Number: D04

Correct Response: C

Singapore	77	
Hungary	74	
Chinese Taipei	72	
England	71	
Slovak Republic	67	
Cyprus	67	
Russian Federation	67	
Australia	67	
Israel	66	
Hong Kong, SAR	66	
Italy	66	
Belgium (Flemish)	65	
Netherlands	65	
Iran, Islamic Rep.	65	
Thailand	64	
United States	64	
Bulgaria	64	0
Japan	63	
New Zealand	61	0
Canada	61	0
Korea, Rep. of	60	0
Slovenia	59	0
International Average	59	
Jordan	58	0
Romania	56	0
Tunisia	55	▼
Czech Republic	55	0
Latvia (LSS)	54	0
Moldova	53	0
Indonesia	53	▼
Malaysia	52	▼
Lithuania	51	▼
Macedonia, Rep. of	51	▼
Chile	50	▼
Morocco	48	▼
Finland	45	
Philippines	39	▼
Turkey	36	▼
South Africa	20	▼

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Why light-colored clothes are cooler

On a warm sunny day, you will feel cooler wearing lightcolored clothes because they

- A. reflect more radiation
- B. prevent sweating
- C. are not as heavy as dark clothes
- D. let more air in

Item Number: F02

Correct Response: A

Hungary	88	
Netherlands	88	
Chinese Taipei	87	
Belgium (Flemish)	86	
Czech Republic	86	
Slovak Republic	85	
Korea, Rep. of	85	
Hong Kong, SAR	84	
Singapore	83	
Russian Federation	83	
Slovenia	81	
Japan	79	
Malaysia	79	
Australia	77	
Latvia (LSS)	77	
Lithuania	75	
England	74	
Israel	72	
Bulgaria	71	0
Finland	71	
Canada	69	0
Macedonia, Rep. of	69	0
International Average	e 65	
United States	61	0
Italy	61	0
Romania	58	0
Iran, Islamic Rep.	58	▼
New Zealand	55	▼
Moldova	55	▼
Indonesia	52	▼
Cyprus	52	
Jordan	47	▼
Philippines	43	
Thailand	39	▼
Morocco	38	▼
Chile	37	▼
Turkey	34	▼
Tunisia	31	0 * * * * * * * *
South Africa	18	▼

Country average vs. International average:		
Higher Not different Lower		

Content Domain	Cognitive Domain
Physics	Understanding Simple Information

Energy stored in food

People get energy from the food they eat. Where does the energy stored in food come from?

- A. Fertilizer
- B. The Sun
- C. Vitamins
- D. The soil

Item Number: H05

Correct Response: B

Singapore	55	
Iran, Islamic Rep.	53	
Japan	45	
Malaysia	44	
England	42	
Korea, Rep. of	41	
Hong Kong, SAR	39	
Finland	38	
Philippines	38	
Jordan	34	
Australia	33	
Indonesia	32	
Russian Federation	29	0
United States	26	0
Chinese Taipei	25	0
New Zealand	25	0
International Averag	e 24	
Canada	23	0
Bulgaria	22	0
Thailand	21	0
Hungary	19	▼
Netherlands	19	•
Czech Republic	18	▼
Macedonia, Rep. of	18	•
Italy	18	•
Slovak Republic	17	•
Cyprus	16	•
South Africa	15	▼
Latvia (LSS)	15	•
Slovenia	14	▼
Turkey	14	▼
Moldova	14	▼
Morocco	12	▼
Chile	11	▼
Romania	11	
Lithuania	11	▼
Israel	11	▼
Belgium (Flemish)	9	▼
Tunisia	6	▼

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Evaporation rate by surface area

A student put 100 mL of water in each the sun for one day. Which container w evaporation?	of the open containers and let them stand in ould probably lose the most water due to
A.	B.
C.	D.

Item Number: J04

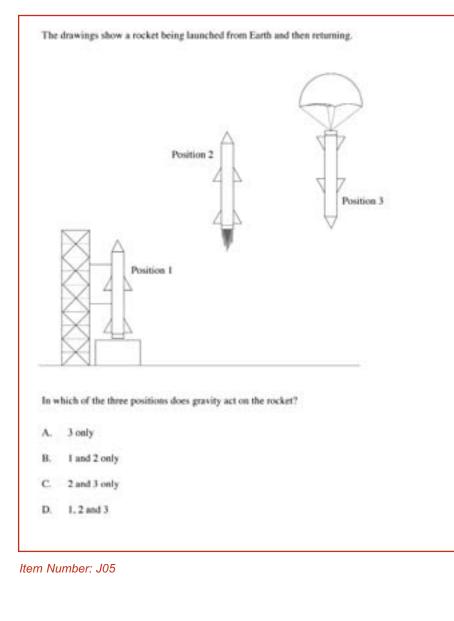
Correct Response: C

Singapore	98	
Hungary	95	
Korea, Rep. of	95	
Russian Federation	95	
Czech Republic	94	
Japan	94	
Slovak Republic	94	
Hong Kong, SAR	93	
Moldova	93	
Bulgaria	93	
Malaysia	93	
Chinese Taipei	93	
England	92	
Canada	91	
Australia	90	
Latvia (LSS)	90	
Lithuania	90	0
Israel	89	
Netherlands	89	0
Romania	88	0
Cyprus	88	0
New Zealand	88	0
Jordan	87	0
Finland	86	0
Thailand	85	0
International Average	e 84	
Belgium (Flemish)	84	0
United States	84	0
Slovenia	83	0
Macedonia, Rep. of	83	0
Indonesia	75	
Tunisia	75	
Turkey	74	▼
Chile	72	▼
Italy	70	▼
Iran, Islamic Rep.	69	* * * * * *
Philippines	60	▼
South Africa	53	▼
Morocco	45	

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Physics	Understanding Simple Information

Gravity acting on rocket



D

Overall Percent Correct

Slovak Republic	68	
Czech Republic	65	
Hungary	65	
Finland	53	
Singapore	49	
Chinese Taipei	48	
Lithuania	48	
Slovenia	46	
United States	46	
Russian Federation	46	0
Australia	45	
Canada	45	Ο
England	43	Ο
Moldova	42	0
Japan	40	0
New Zealand	39	0
Netherlands	39	0
International Average	36	
Jordan	36	0
Bulgaria	35	0
Thailand	30	0
Iran, Islamic Rep.	30	0
Cyprus	30	Ο
Romania	29	Ο
Korea, Rep. of	29	•
Belgium (Flemish)	29	•
Philippines	27	•
Israel	26	•
Italy	25	•
Hong Kong, SAR	24	•
Latvia (LSS)	24	•
Chile	23	▼
Turkey	22	▼
Malaysia	21	▼
Macedonia, Rep. of	19	 * *<
Tunisia	19	▼
Morocco	17	▼
South Africa	15	▼

Country avera International av	-
Higher	
Not different	0
Lower	V

Correct Response:

47

Content Domain	Cognitive Domain
Physics	Understanding Simple Information

Sunscreen to protect against radiation

Sunscreen is used to protect the skin from exposure to which type of solar radiation?

A. Visible

B. X-rays

C. Infrared

D. Ultraviolet

E. Microwaves

Item Number: J08

Correct Response: D

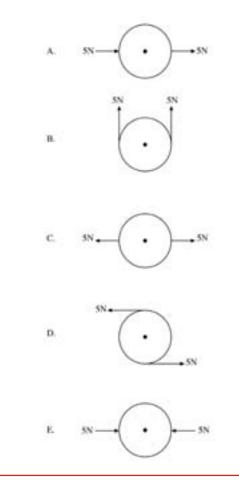
Chinese Taipei	94	
Singapore	91	
Hungary	87	
Thailand	86	
Australia	85	
Hong Kong, SAR	84	
Slovenia	84	
New Zealand	80	
Japan	79	
Slovak Republic	79	
Korea, Rep. of	77	
Finland	77	
Chile	76	
Czech Republic	75	
Netherlands	75	
Canada	75	
Indonesia	72	
Lithuania	70	
United States	69	
Italy	68	0
Russian Federation	65	0
Belgium (Flemish)	64	0
England	64	0
Bulgaria	62	0
International Averag	e 62	
Philippines	57	0
Latvia (LSS)	54	0
Malaysia	54	▼
Romania	48	▼
Moldova	45	▼
Jordan	43	▼
Israel	39	▼
Macedonia, Rep. of	36	▼
Tunisia	33	▼
Turkey	32	▼
Cyprus	26	▼
South Africa	18	▼
Morocco	18	
Iran, Islamic Rep.	17	▼

Country avera International av	•
Higher	
Not different	0
Lower	•

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Rotating forces on wheel

A uniform wheel is free to rotate on its axle at its center. It is acted on by two forces in the same plane. Each force has the same size, equal to 5N (Newtons). In which case will the wheel rotate?



Item Number: L01

Correct Response: D

Japan	76	
Hungary	74	
Lithuania	72	
Latvia (LSS)	72	
Czech Republic	69	0
Netherlands	69	0
Finland	69	
Slovenia	69	0
Russian Federation	68	0
Thailand	67	0
Bulgaria	67	0
Italy	66	0
Canada	66	0
Slovak Republic	66	0
Belgium (Flemish)	64	0
Korea, Rep. of	63	0
Romania	63	0
United States	62	0
Moldova	62	0
International Average	e 62	
Hong Kong SAR	62	0
Hong Kong, SAR England	62 61	0
England	61	0
England Chile		
England Chile Australia	61 60	0 0
England Chile	61 60 60	0 0 0
England Chile Australia Singapore	61 60 60 60	0 0 0 0
England Chile Australia Singapore Jordan	61 60 60 60	0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia	61 60 60 60 60 59	0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia	61 60 60 60 60 59 58	0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei	61 60 60 60 59 58 58	0 0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus	61 60 60 60 59 58 58 58	0 0 0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei	61 60 60 60 59 58 58 58 58 58 58	
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey	61 60 60 60 59 58 58 58 58 58 57 57	0 0 0 0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey Israel Morocco	61 60 60 59 58 58 58 58 57 57 57	
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey Israel Morocco Iran, Islamic Rep.	61 60 60 59 58 58 58 57 57 57 55	0 0 0 0 0 0 0 0 0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey Israel Morocco	61 60 60 59 58 58 58 57 57 57 57 55 54	
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey Israel Morocco Iran, Islamic Rep. Macedonia, Rep. of Indonesia	61 60 60 59 58 58 58 57 57 57 57 55 54 54	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
England Chile Australia Singapore Jordan New Zealand Tunisia Malaysia Chinese Taipei Cyprus Turkey Israel Morocco Iran, Islamic Rep. Macedonia, Rep. of	61 60 60 59 58 58 58 57 57 57 55 54 54 52	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Country avera International a	-
Higher Not different Lower	

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Efficiency of machines

Machine A and Machine B are each used to pump water from a river. The table shows what volume of water each machine removed in one hour and how much gasoline each of them used.

	Volume of Water Removed in 1 Hour (liters)	Gasoline Used in 1 Hour (liters)
Machine A	1000	1.25
Machine B	500	0.5

a) Which machine is more efficient in converting the energy in gasoline to work?

Answer:

b) Explain your answer.

Item Number: L04

SCORING

Note: A correct response must identify B and include an explanation based on the concept of energy efficiency (ratio of energy output to energy input) that compares the volume of water pumped for an equivalent volume of gasoline used for the two machines. Responses based ONLY on comparing the amount of gasoline used OR the amount of water pumped by the machines without considering the ratio of water/gasoline are scored as incorrect. No credit is lost for missing/incorrect units or for minor computational errors, provided the correct conclusion and explanation are given.

Correct Response

• B. With correct explanation based on the concept of energy efficiency (B uses less gasoline than A for an equivalent volume of water pumped).

Incorrect Response

- B. It uses less gasoline (no comparison of efficiency based on volume of water pumped).
- B. Other incorrect/inadequate or no explanation.
- A. It removes more water in 1 hour (no comparison of efficiency based on gas used).
- A. Other incorrect/inadequate or no explanation.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Netherlands	58	
Korea, Rep. of	52	
Belgium (Flemish)	51	
Slovak Republic	50	
Singapore	49	
Australia	49	
Japan	46	
Chinese Taipei	44	
Canada	43	
New Zealand	42	
England	42	
Finland	40	0
Lithuania	38	0
Hungary	38	0
Israel	35	0
Slovenia	33	0
Russian Federation	33	0
Hong Kong, SAR	32	0
International Average	e 31	
Czech Republic	30	0
CZCCII IICPUDIIC	50	0
United States	30	0
		-
United States	30	0 0 0
United States Thailand	30 28	0 0 0 0
United States Thailand Bulgaria	30 28 28	0 0 0 0 0
United States Thailand Bulgaria Cyprus	30 28 28 27	0 0 0 0 0 0
United States Thailand Bulgaria Cyprus Latvia (LSS)	30 28 28 27 26	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy	30 28 28 27 26 23	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania	30 28 27 26 23 22	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep.	30 28 27 26 23 22 21	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of	30 28 27 26 23 22 21 20	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia	30 28 27 26 23 22 21 20 20	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia	30 28 27 26 23 22 21 20 20 20	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova	30 28 27 26 23 22 21 20 20 20 20 19	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova Jordan	30 28 27 26 23 22 21 20 20 20 19 19	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova Jordan Tunisia	30 28 27 26 23 22 21 20 20 20 20 19 19 19	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova Jordan Tunisia Turkey	30 28 27 26 23 22 21 20 20 20 19 19 19 19	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova Jordan Tunisia Turkey Chile	30 28 27 26 23 22 21 20 20 20 19 19 19 19 17 8	
United States Thailand Bulgaria Cyprus Latvia (LSS) Italy Romania Iran, Islamic Rep. Macedonia, Rep. of Malaysia Indonesia Moldova Jordan Tunisia Turkey Chile Morocco	30 28 27 26 23 22 21 20 20 20 19 19 19 19 17 8 7	0 0 0 0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Complete circuits

Bolb 1	Bulb 2
0	0
¢.	¢
afaminam foil	plastic spoon
Bulb 3	Bath 4
\square	(m)
ų į	ų į
6	
brass key	
Which of the bulbs will light?	
A. I only	
B. 2 and 3 only	
C. 1 and 3 only	
D. 1, 3 and 4 only	
E. 1, 2 and 3 only	

Overall Percent Correct

Hong Kong, SAR	84	
Russian Federation	82	
Belgium (Flemish)	81	
Chinese Taipei	80	
Singapore	79	
Israel	79	
Korea, Rep. of	78	
Netherlands	78	
Hungary	74	
Australia	73	
Malaysia	72	
Czech Republic	72	0
Slovak Republic	71	0
Jordan	70	0
Cyprus	69	0
Finland	68	0
Japan	68	0
Thailand	65	0
Slovenia	65	0
England	65	0
5		
Tunisia	65	0
Tunisia United States	65 64	0 0
United States	64	
	64	
United States International Averag	64 e 64	0
United States International Average New Zealand	64 e 64 64	0
United States International Average New Zealand Lithuania Canada	64 e 64 64 63	0 0 0 0
United States International Average New Zealand Lithuania	64 e 64 63 60	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania	64 e 64 63 60 57	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy	64 e 64 63 60 57 57	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania	64 e 64 63 60 57 57 57 56	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS)	64 e 64 63 60 57 57 56 56	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco	64 e 64 63 60 57 57 56 56 56 56	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile	64 64 63 60 57 57 56 56 56 56 52 50	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova	64 64 63 60 57 57 56 56 56 56 52 50 48	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova Macedonia, Rep. of	64 64 63 60 57 57 56 56 56 56 52 50 48 48	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova Macedonia, Rep. of Turkey	64 64 63 60 57 57 56 56 56 56 52 50 48 48 48	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova Macedonia, Rep. of Turkey Iran, Islamic Rep.	64 64 63 60 57 57 56 56 56 56 52 50 48 48 48 46 43	0 0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova Macedonia, Rep. of Turkey Iran, Islamic Rep. Philippines	64 64 63 60 57 57 56 56 56 56 56 52 50 48 48 48 46 43 42	0 0 0 0
United States International Average New Zealand Lithuania Canada Bulgaria Romania Italy Morocco Latvia (LSS) Indonesia Chile Moldova Macedonia, Rep. of Turkey Iran, Islamic Rep.	64 64 63 60 57 57 56 56 56 56 52 50 48 48 48 46 43	0 0 0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower V		

Correct Response:

С

51

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Balancing 10 and 5 liter buckets

A. 10 likers 3 litters
B. i0 liters 10 liters
C.
D. 10 liters 5 liters

Item Number: N09

Correct Response:

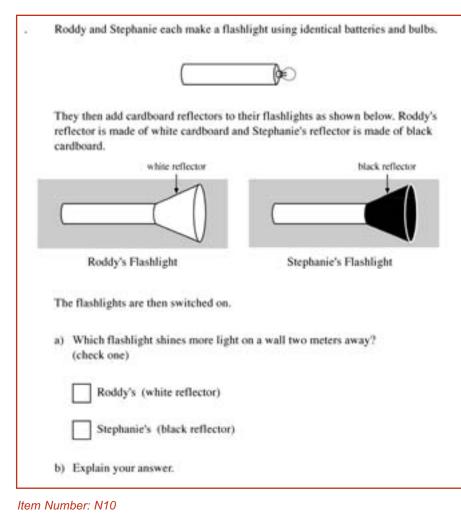
D

Japan	88	
Russian Federation	87	
Korea, Rep. of	87	
Finland	86	
Slovenia	84	
Chinese Taipei	84	
Netherlands	83	
Latvia (LSS)	82	
Czech Republic	82	
Hungary	81	
Australia	80	
Slovak Republic	80	
Thailand	78	
Lithuania	78	0
Canada	78	
Singapore	77	0
Belgium (Flemish)	77	0
New Zealand	77	0
Bulgaria	76	0
Malaysia	76	0
United States	73	0
Hong Kong, SAR	72	0
International Average	e 71	
Romania	70	0
England	70	0
Italy	69	0
Turkey	69	0
Indonesia	66	
Chile	63	
Moldova	62	
Macedonia, Rep. of	62	
Philippines	58	
Israel	56	▼
Tunisia	52	▼
Cyprus	50	▼
Iran, Islamic Rep.	47	
Morocco	34	▼
South Africa	33	▼

Country average vs. International average:		
Higher Not different		
Lower	▼	

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Flashlights with white/black reflectors



SCORING

Note: A correct response must identify Roddy's and include an explanation based on the relative reflectivity of the white and black cardboard. Credit is given both for responses explicitly mentioning the higher reflectance of the white cardboard and/or the higher absorptance of the black cardboard as well as responses communicating this concept using less scientific terminology.

Correct Response

- Roddy's. With correct explanation based on the higher reflectivity of the white cardboard (or lower reflectivity/higher absorption of the black cardboard). [Explicitly refers to absorption and/or reflectivity.]
- Roddy's. Explanation based on the concept of higher reflectivity but using other terminology. [Does not explicitly refer to absorption/reflection properties.]
- Other correct.

Incorrect Response

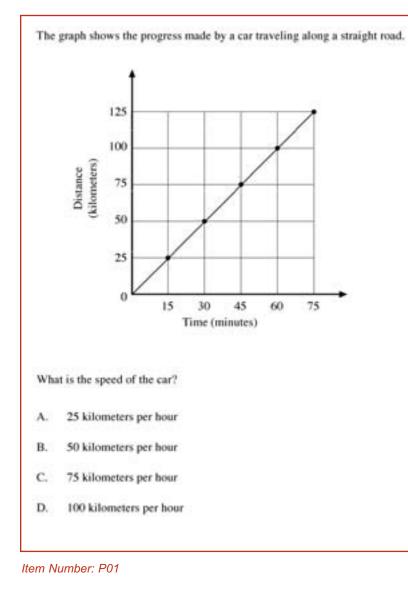
- Roddy's with an inadequate/incorrect or no explanation.
- Stephanie's. With or without explanation.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	59	
Singapore	58	
Russian Federation	57	
Malaysia	55	
England	54	
Hungary	52	
Netherlands	52	0
Belgium (Flemish)	51	
Japan	50	
Czech Republic	48	
Canada	47	
Lithuania	47	0
Australia	47	0
Slovenia	47	0
Bulgaria	45	0
United States	45	0
Finland	44	0
Korea, Rep. of	43	0
Jordan	43	0
Slovak Republic	42	0
New Zealand	41	0
Latvia (LSS)	41	0
Indonesia	40	0
Thailand	40	0
International Average	e 39	
Hong Kong, SAR	38	0
Macedonia, Rep. of	37	0
Tunisia	35	0
Italy	34	0
Turkey	32	
Cyprus	26	▼
Romania	25	
Israel	24	▼
Moldova	22	▼
Iran, Islamic Rep.	21	
Chile	17	
Morocco	16	0 V V V V V V V V
Philippines	12	▼
South Africa	11	▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Determination of speed from graph



Overall Percent Correct

Hong Kong, SAR	82	
Chinese Taipei	78	
Belgium (Flemish)	78	
Singapore	77	
Netherlands	75	
Malaysia	71	
Finland	71	
Australia	69	
Slovak Republic	69	
Canada	68	
Czech Republic	66	
Thailand	65	
Latvia (LSS)	62	0
Lithuania	62	0
Japan	61	0
New Zealand	60	0
Hungary	59	0
Slovenia	57	0
England	56	0
International Average	e 54	
Russian Federation	51	0
-		0 0
Russian Federation	51	
Russian Federation United States	51 50	0
Russian Federation United States Israel	51 50 49	0
Russian Federation United States Israel Tunisia	51 50 49 49	0 0 0 0
Russian Federation United States Israel Tunisia Moldova	51 50 49 49 47	0 0 0 0 0
Russian Federation United States Israel Tunisia Moldova Italy	51 50 49 49 47 47	
Russian Federation United States Israel Tunisia Moldova Italy South Africa	51 50 49 49 47 47 47	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria	51 50 49 49 47 47 47 47	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of	51 50 49 47 47 47 47 47 47 44	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania	51 50 49 47 47 47 47 47 44 42	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of	51 50 49 47 47 47 47 44 42 41	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus	51 50 49 47 47 47 47 44 42 41 41	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile	51 50 49 47 47 47 47 47 44 42 41 41 37	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile Turkey	51 50 49 47 47 47 47 47 44 41 41 37 36	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile Turkey Morocco	51 50 49 47 47 47 47 47 42 41 41 37 36 34	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile Turkey Morocco Jordan	51 50 49 47 47 47 47 47 42 41 41 37 36 34 32	
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile Turkey Morocco Jordan Iran, Islamic Rep.	51 50 49 47 47 47 47 47 42 41 37 36 34 32 30	0 0 0 0 0
Russian Federation United States Israel Tunisia Moldova Italy South Africa Bulgaria Macedonia, Rep. of Romania Korea, Rep. of Cyprus Chile Turkey Morocco Jordan Iran, Islamic Rep. Indonesia	51 50 49 47 47 47 47 47 42 41 41 37 36 34 32 30 30	0 0 0 0 0 0

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Correct Response:

D

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Amount of light on wall and ceiling

James turns on a flashlight in his bedroom and shines it on his wall one meter away to produce a small circle of light. He then shines the flashlight on his ceiling two meters away to produce a larger circle of light.

a) Does more light reach the ceiling than the wall? (Check one)

Yes
Yes

N	0
1.N	U

b) Explain your answer.

Item Number: P02

SCORING

Note: A correct response is based on the same amount of light reaching both the ceiling and the wall but being more spread out (less bright) on the ceiling. Correct responses must identify NO and include an explanation that states that the light is the same or that indicates that the light is just more spread out (less bright) on the ceiling without explicitly stating same. If the explanation merely repeats information that is in the stem, it is scored as incorrect even if NO is checked. If a response indicates that there is less light on the ceiling, the explanation must include a correct reason based on more air absorption/ scattering at a greater distance to be correct. Responses that indicate less light at a greater distance without further explanation should be scored as incorrect.

Correct Response

- No. Explains that the same amount of light reaches the wall and ceiling. (May also refer to light being more spread out on the ceiling or less concentrated/focused/bright).
- No. Explains (or shows in a diagram) that light is (only) more spread out (less bright) at a greater distance. (Does not explicitly state that the light is the same.)
- No. Explains that less light reaches the ceiling because of more air absorption/scattering at a greater distance.
- No. Other correct explanation.

Incorrect Response

- No. States that less light reaches the ceiling with inadequate explanation related to distance from source. (Does not include explanation of less light due to air absorption or scattering as in third correct response).
- No. Other incorrect/inadequate or no explanation. (Includes explanations that merely paraphrase the stem).
- Yes. Explanation based on light being bigger or more spread out.
- Yes. Other incorrect/inadequate or no explanation.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	52	
Hong Kong, SAR	40	
Korea, Rep. of	36	
Israel	36	
Australia	35	
Canada	35	
Singapore	34	
Cyprus	34	
Slovak Republic	32	0
Finland	32	0
Hungary	32	
United States	31	
Macedonia, Rep. of	31	0
Latvia (LSS)	30	0
New Zealand	29	0
England	29	0
Belgium (Flemish)	28	0
Netherlands	26	0
Slovenia	25	0
International Average	e 24	
Lithuania	24	0
		0 0
Lithuania	24	
Lithuania Czech Republic	24 23	0
Lithuania Czech Republic Thailand	24 23 22	0
Lithuania Czech Republic Thailand Iran, Islamic Rep.	24 23 22 22	0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria	24 23 22 22 20	0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova	24 23 22 22 20 20	0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation	24 23 22 22 20 20 20	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy	24 23 22 20 20 20 20 19	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan	24 23 22 20 20 20 20 19 19	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey	24 23 22 20 20 20 20 19 19 18	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia	24 23 22 20 20 20 19 19 18 14	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania	24 23 22 20 20 20 20 19 19 18 14 13	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia	24 23 22 20 20 20 19 19 18 14 13 13	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia Chile	24 23 22 20 20 20 19 19 18 14 13 13 12	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia Chile Jordan	24 23 22 20 20 20 19 19 18 14 13 13 12 11	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia Chile Jordan Malaysia South Africa	24 23 22 20 20 20 19 19 18 14 13 13 12 11 8 3	0 0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia Chile Jordan Malaysia	24 23 22 20 20 20 19 19 18 14 13 13 12 11 8	0 0 0 0 0
Lithuania Czech Republic Thailand Iran, Islamic Rep. Bulgaria Moldova Russian Federation Italy Japan Turkey Indonesia Romania Tunisia Chile Jordan Malaysia South Africa Philippines	24 23 22 20 20 20 19 19 18 14 13 13 12 11 8 3 3	0 0 0 0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Cognitive Domain
Physics	Understanding Complex Information

Appearance of red dress in green light

As a play begins, white stage lights shine on an actress wearing a red dress. Suddenly, the lights go off and a green light is shone on the actress. The dress looks black. Why does the dress look black?

- A. The dress reflects the green part of light.
- B. The dress absorbs the red part of light.
- C. The dress absorbs the green part of light.
- D. The dress reflects the black part of light.

Item Number: R02

Singapore 63

Overall Percent Correct

Singapore	63	
Hungary	57	
Japan	55	
Malaysia	53	
Korea, Rep. of	51	
Australia	49	
Netherlands	48	0
Slovenia	48	
United States	47	
Canada	45	
England	44	0
Chinese Taipei	44	0
Czech Republic	43	0
New Zealand	40	0
Russian Federation	39	0
Indonesia	38	0
Slovak Republic	38	0
International Average	e 37	
Belgium (Flemish)	36	0
Latvia (LSS)	35	0
Lithuania	35	0
Cyprus	35	0
		0 0
Cyprus	35 35 35	0 0 0
Cyprus Thailand	35 35	0 0 0
Cyprus Thailand Bulgaria	35 35 35	0 0 0 0
Cyprus Thailand Bulgaria Finland	35 35 35 35	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy	35 35 35 35 35	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel	35 35 35 35 35 35 33	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR	35 35 35 35 35 33 33 32	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile	35 35 35 35 35 33 32 29	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan	35 35 35 35 35 33 32 29 28	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova	35 35 35 35 33 32 29 28 28 28	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia	35 35 35 35 33 32 29 28 28 28 28	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia Macedonia, Rep. of	35 35 35 35 33 32 29 28 28 28 28 28 28 27	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia Macedonia, Rep. of Iran, Islamic Rep.	35 35 35 35 33 32 29 28 28 28 28 28 28 27 26	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia Macedonia, Rep. of Iran, Islamic Rep. Romania	35 35 35 35 33 29 28 28 28 28 28 28 28 27 26 24	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia Macedonia, Rep. of Iran, Islamic Rep. Romania Philippines	35 35 35 35 33 29 28 28 28 28 28 28 27 26 24 23	0 0 0 0 0
Cyprus Thailand Bulgaria Finland Italy Israel Hong Kong, SAR Chile Jordan Moldova Tunisia Macedonia, Rep. of Iran, Islamic Rep. Romania Philippines Turkey	35 35 35 33 32 29 28 28 28 28 28 27 26 24 23 22	0 0 0 0

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

С

56

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Conversion of electrical/light energy

Electrical energy is used to power a lamp. How does the amount of electrical energy used compare to amount of light energy produced?

a) The amount of electrical energy used is: (Check one)

more than the amount of light energy produced.

less than the amount of light energy produced.

the same as the amount of light energy produced.

b) Give a reason to support your answer.

Item Number: X01

SCORING

Note: A correct response must identify more and include a correct explanation based on electrical energy being converted to heat or a more general description of energy losses or low efficiency. Responses that include explanations based on heat, energy losses or low efficiency but with an incorrect application to the problem by checking less are scored as incorrect.

Correct Response

- MORE. With an explanation based on (much) energy being converted to heat.
- MORE. With other correct explanation of energy (power) loss or low efficiency. [Must clearly indicate that "some" energy goes elsewhere].
- MORE. Other correct explanation.

Incorrect Response

- MORE. Incorrect/inadequate or no explanation.
- SAME. Explanation is based on the concept of conservation of energy without considering energy losses.
- LESS. Explanation based on heat, energy losses or low efficiency but with an incorrect application.
- · LESS. Any other incorrect or no explanation.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

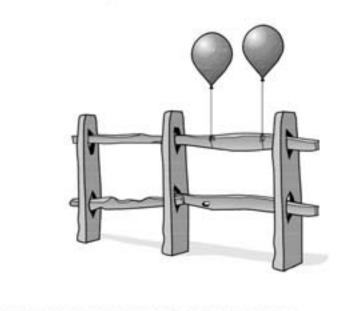
Singapore	21	
England	16	
Russian Federation	16	
Hungary	14	
Slovenia	13	
Chinese Taipei	12	
Hong Kong, SAR	12	
Belgium (Flemish)	11	
Macedonia, Rep. of	11	0
Iran, Islamic Rep.	10	0
Slovak Republic	10	Ο
Netherlands	10	0
Japan	10	Ο
Australia	9	0
Korea, Rep. of	8	0
Canada	8	0
Czech Republic	8	0
International Averag	e 8	
Bulgaria	7	0
New Zealand	7	0
Tunisia	6	0
Turkey	6	0
Finland	6	0
Latvia (LSS)	6	0
Lithuania	5	0
Italy	5	0
Israel	5	•
Romania	4	•
Cyprus	4	▼
United States	4	•
Jordan	4	•
Moldova	4	▼
Malaysia	3	•
Thailand	3	•
Morocco	3	
Indonesia	2	▼
South Africa	2	▼
Chile	1	▼
Philippines	0	▼

Country average vs. International average:		
Higher Not different Lower		

Content Domain	Cognitive Domain
Physics	Theorizing, Analyzing and Solving Problems

Heat expansion of balloons

Balloons filled with helium gas are taken outside on a hot, sunny day and tied to a fence as shown in the diagram.



Over a period of a few hours, the balloons increase in size. Explain why.

Item Number: Z03

SCORING

Note: A correct response is based on an increase in gas volume (or internal gas pressure) as a result of increased temperature. Credit is given for both higher-level responses relating to the increased kinetic energy of helium atoms as a function of temperature as well as more general responses relating to increased internal gas pressure and/or gas volume. An increase in temperature does not have to be explicitly mentioned in order to receive credit. Responses referring ONLY to the balloon expanding or to the effect of temperature on the balloon without further explanation of the gas behavior are scored as incorrect.

Correct Response

- Mentions explicitly that (as the gas in the balloon heats up), the helium (gas) atoms (particles, molecules) move faster (collide more frequently) causing the pressure inside the balloon to increase and/or the volume to increase (expand).
- Mentions that the pressure of the gas inside the balloon increases and/or the volume of the gas increases (expands). (No mention of gas atoms/molecules).
- Other correct.

Incorrect Response

- Mentions only that the sun heats the helium (gas) and/or causes the balloon to expand. [No reference to the pressure/volume changes in the gas.]
- Mentions pressure and/or volume with inadequate explanation.
- Mentions only the effect of heat (from Sun) on the balloon material (rubber, latex).
- · Refers to (individual) atoms or molecules expanding (or growing).
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Korea, Rep. of	50	
Finland	49	
Netherlands	46	
Singapore	46	
Lithuania	41	
Japan	37	
Australia	36	
Russian Federation	35	
Hungary	34	
New Zealand	33	
Thailand	33	
Chinese Taipei	33	
Czech Republic	33	0
Jordan	32	0
England	32	0
United States	31	0
Slovak Republic	30	0
Slovenia	30	0
Canada	28	0
Belgium (Flemish)	26	0
-) - ()		
International Averag		
		0
International Averag	e 26	0 0
International Averag Bulgaria	e 26 25	0 0
International Averag Bulgaria Latvia (LSS)	e 26 25 24	0 0 0
International Averag Bulgaria Latvia (LSS) Italy	e 26 25 24 24	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of	e 26 25 24 24 24 24	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia	e 26 25 24 24 24 24 21	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR	e 26 25 24 24 24 24 21 19	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania	e 26 25 24 24 24 24 21 19 17	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova	e 26 25 24 24 24 21 19 17 17	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia	e 26 25 24 24 24 21 19 17 17 16	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey	e 26 25 24 24 24 21 19 17 17 16 15	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel	e 26 25 24 24 24 21 19 17 17 16 15 15	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel Morocco	e 26 25 24 24 24 21 19 17 17 16 15 15 14	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel Morocco Iran, Islamic Rep.	e 26 25 24 24 24 21 19 17 17 16 15 15 14 14	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel Morocco Iran, Islamic Rep. Chile	e 26 25 24 24 24 21 19 17 17 16 15 15 14 14 6	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel Morocco Iran, Islamic Rep. Chile Cyprus	e 26 25 24 24 24 21 19 17 17 16 15 15 14 14 6 6	0 0 0
International Averag Bulgaria Latvia (LSS) Italy Macedonia, Rep. of Malaysia Hong Kong, SAR Romania Moldova Tunisia Turkey Israel Morocco Iran, Islamic Rep. Chile Cyprus Indonesia	e 26 25 24 24 24 21 19 17 17 16 15 15 14 14 6 6 5	0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Cognitive Domain
Chemistry	Understanding Simple Information

Best reason for painting iron surfaces

Paint applied to an iron surface prevents the iron from rusting. Which ONE of the following provides the best reason?

- A. It prevents nitrogen from coming in contact with the iron.
- B. It reacts chemically with the iron.
- C. It prevents carbon dioxide from coming in contact with the iron.
- D. It makes the surface of the iron smoother.
- E. It prevents oxygen and moisture from coming in contact with the iron.

Item Number: F06

Overall Percent Correct

Chinese Taipei	91	
Finland	83	
Russian Federation	81	
Hungary	81	
Singapore	81	
Netherlands	80	
Hong Kong, SAR	79	
Jordan	78	
England	76	
Bulgaria	76	
Iran, Islamic Rep.	76	
Lithuania	74	
Slovak Republic	73	
Korea, Rep. of	73	
Canada	72	0
Australia	72	0
Czech Republic	72	0
Romania	71	0
Thailand	70	0
Slovenia	70	0
Japan	70	0
Belgium (Flemish)	70	0
Latvia (LSS)	69	0
International Average	67	
New Zealand	66	0
United States	66	0
Israel	66	0
Malaysia	66	0
Italy	65	0
Macedonia, Rep. of	65	0
Chile	64	0
Cyprus	62	
Turkey	58	
Philippines	48	
Moldova	47	
Indonesia	47	
Tunisia	44	0 • • • •
South Africa	26	▼
Morocco	24	▼

Country average vs. International average:		
Higher Not different Lower		

Correct Response:

: | E

▲ 0 ▼

Country average vs. International average:

Higher Not different

Lower

Content Domain	Cognitive Domain		
Chemistry	Understanding Simple Information		
urning wood absorbs/releases	energy	Overall Percen	it Cor
If you are burning wood, the rea	action will	Chinese Taipei	82
ii you are burning wood, the rea		Hungary	77
		Finland	75
A. release energy		Macedonia, Rep. of	74
		Hong Kong, SAR	70
B. absorb energy		England	68
D. abborb energy		Singapore	68
~		Iran, Islamic Rep.	66
C. neither absorb nor release er	nergy	Canada	66
		Korea, Rep. of	65
D. sometimes release and some	imes absorb energy	Russian Federation	65
		Malaysia	65
depending on the kind of woo	d d	United States	64
		Netherlands	64
		Bulgaria	63
		Belgium (Flemish)	61
		Lithuania	61
		Japan	59
		Israel	58
		Australia	58
		Turkey	58
		New Zealand	58
		Slovenia	57
		International Averag	e 55
		Italy	54
		Cyprus	54
		Slovak Republic	54
		Moldova	53
		Jordan	51
		Czech Republic	47
		Romania	46
		Thailand	43
		Latvia (LSS)	40
		Indonesia	36
		Chile	33
		Philippines	30
		Tunisia	25
em Number: H06		South Africa	20

Correct Response: Α

Content Domain	Cognitive Domain
Chemistry	Understanding Complex Information

Compounds, molecules and atoms

The words *organs, tissues*, and *cells* can be used in the following sentence:

Lungs are *organs* composed of *tissues* which are made up of *cells*.

Use the words *molecules*, *atoms*, and *compounds* to complete the following sentence:

Sugars are _____ composed of _____ which are made up of

Item Number: J03

SCORING

Correct Response

• Compounds - Molecules - Atoms

Incorrect Response

- Compounds Atoms Molecules
- Molecules Atoms Compounds

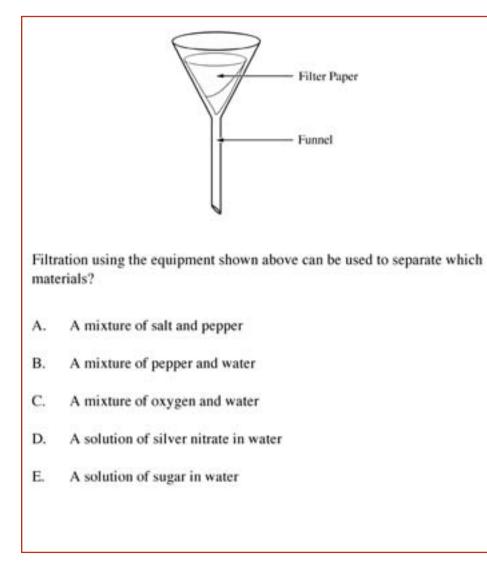
• Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	69	
Bulgaria	67	
Slovak Republic	65	
Japan	63	
Russian Federation	61	
Korea, Rep. of	60	
Czech Republic	60	
Chinese Taipei	57	
Macedonia, Rep. of	56	
Italy	55	
Lithuania	54	0
Slovenia	54	0
Malaysia	53	
Australia	53	0
Latvia (LSS)	52	0
Canada	51	0
United States	51	0
England	49	0
Moldova	48	0
Iran, Islamic Rep.	46	0
Hungary	46	0
International Average	e 46	
international Average	- 40	
Finland	44	0
		0 0
Finland	44	0 0
Finland Israel	44 43	0 0 0
Finland Israel Netherlands	44 43 42	0 0 0
Finland Israel Netherlands Belgium (Flemish)	44 43 42 41	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand	44 43 42 41 41	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines	44 43 42 41 41 41	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile	44 43 42 41 41 41 39	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR	44 43 42 41 41 41 39 38	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan	44 43 42 41 41 41 39 38 36	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania	44 43 42 41 41 39 38 36 33	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania Indonesia	44 43 42 41 41 39 38 36 33 30	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania Indonesia Thailand	44 43 42 41 41 41 39 38 36 33 30 30	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania Indonesia Thailand Cyprus	44 43 42 41 41 39 38 36 33 30 30 29	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania Indonesia Thailand Cyprus Tunisia	44 43 42 41 41 39 38 36 33 30 30 29 27	0 0 0
Finland Israel Netherlands Belgium (Flemish) New Zealand Philippines Chile Hong Kong, SAR Jordan Romania Indonesia Thailand Cyprus Tunisia Turkey	44 43 41 41 39 38 36 33 30 30 29 27 23	0 0 0

Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Content Domain	Cognitive Domain
Chemistry	Using Tools, Routine Procedures and Science Processes

Filtration of mixtures



Item Number: L06

Correct Response: B

Czech Republic	64	
Slovak Republic	62	
Lithuania	54	
Finland	54	
Latvia (LSS)	53	
Hungary	52	
Korea, Rep. of	51	
Russian Federation	50	
Canada	50	
Singapore	50	
Slovenia	48	
Netherlands	48	0
Chinese Taipei	46	
Romania	42	0
Japan	42	0
Malaysia	42	0
Australia	41	0
New Zealand	39	0
International Averag	e 39	
United States	39	0
officed states	55	0
Cyprus	39	0
		0
Cyprus	39	0 0 0
Cyprus Hong Kong, SAR	39 38	0 0 0
Cyprus Hong Kong, SAR Bulgaria	39 38 37	0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova	39 38 37 34	0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova England	39 38 37 34 34	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia	39 38 37 34 34 34	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish)	39 38 37 34 34 34 34 33	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel	39 38 37 34 34 34 34 33 32	0 0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy	 39 38 37 34 34 34 34 33 32 30 	0 0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand	39 38 37 34 34 34 33 32 30 30	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of	 39 38 37 34 34 34 33 32 30 30 29 	0 0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey	 39 38 37 34 34 34 33 32 30 30 29 28 	0 0 0 0 0 0
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of	 39 38 37 34 34 34 32 30 30 29 28 27 	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of South Africa Jordan Chile	 39 38 37 34 34 33 32 30 30 29 28 27 27 24 21 	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of South Africa Jordan Chile Iran, Islamic Rep.	 39 38 37 34 34 33 32 30 30 29 28 27 27 24 21 19 	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of South Africa Jordan Chile	 39 38 37 34 34 33 32 30 30 29 28 27 27 24 21 19 15 	
Cyprus Hong Kong, SAR Bulgaria Moldova England Tunisia Belgium (Flemish) Israel Italy Thailand Philippines Turkey Macedonia, Rep. of South Africa Jordan Chile Iran, Islamic Rep.	 39 38 37 34 34 33 32 30 30 29 28 27 27 24 21 19 	0 0 0 0 0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Chemistry	Understanding Simple Information

Example of chemical reaction

Chinese Taipei	87	
Japan	76	
Hong Kong, SAR	72	
England	66	
Singapore	64	
Netherlands	64	
Russian Federation	60	
Korea, Rep. of	59	
Iran, Islamic Rep.	58	
Malaysia	57	
Finland	56	0
Hungary	56	0
Canada	55	0
Bulgaria	54	0
Jordan	54	0
Slovenia	54	0
Australia	53	0
Romania	52	0
United States	52	0
International Average	e 49	
Belgium (Flemish)	49	0
Thailand	49	0
Italy	48	0
Latvia (LSS)	47	0
Czech Republic	47	0
Slovak Republic	47	0
New Zealand	42	0
Macedonia, Rep. of	40	
Cyprus	40	▼
Chile	37	▼
Lithuania	~ -	
Litilaama	37	
Indonesia	37 35	•
		• •
Indonesia Moldova	35	• • •
Indonesia	35 34	* * * *
Indonesia Moldova Turkey Israel	35 34 32	* * * *
Indonesia Moldova Turkey	35 34 32 31	* * * * *
Indonesia Moldova Turkey Israel Philippines	35 34 32 31 30	* * * * *
Indonesia Moldova Turkey Israel Philippines Morocco	35 34 32 31 30 30	* * * * * * * * * * * * * * * * * * *
Indonesia Moldova Turkey Israel Philippines Morocco Tunisia	35 34 32 31 30 30 23	* * * * *
	Japan Hong Kong, SAR England Singapore Netherlands Russian Federation Korea, Rep. of Iran, Islamic Rep. Malaysia Finland Hungary Canada Bulgaria Jordan Slovenia Australia Romania United States International Averag Belgium (Flemish) Thailand Italy Latvia (LSS) Czech Republic Slovak Republic Slovak Republic New Zealand Macedonia, Rep. of Cyprus	Japan 76 Hong Kong, SAR 72 England 66 Singapore 64 Netherlands 64 Russian Federation 60 Korea, Rep. of 59 Iran, Islamic Rep. 58 Malaysia 57 Finland 56 Hungary 56 Canada 55 Bulgaria 54 Jordan 54 Australia 53 Romania 52 United States 52 International Average 49 Italy 48 Latvia (LSS) 47 Slovak Republic 47 Slovak Republic 42 Macedonia, Rep. of 40

Overall Percent Correct

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Which is an example of a chemical reaction?

- A. Water boiling
- B. Sugar dissolving
- C. Nails rusting
- D. Wax melting

Item Number: N07

Correct Response: С

Content Domain	Cognitive Domain
Chemistry	Theorizing, Analyzing and Solving Problems

Small pieces of wood burn faster

A large log of wood will burn more slowly than the same log chopped into smaller pieces. Explain why.

Item Number: R05

SCORING

Note: A correct response is based on the concept of increased surface area in the smaller pieces resulting in faster burning (reaction with oxygen). Credit is given both for higher-level responses indicating increased availability of oxygen/air or surface area in the chopped wood pieces as well as less sophisticated responses describing only that more wood is exposed to the flame and can, therefore, burn simultaneously.

Correct Response

- Mentions that there is more wood (surface area) in contact with oxygen or air in the smaller pieces. [Explicitly mentions availability to oxygen/air.]
- Mentions effect of increased surface area in the chopped wood pieces. [Explicitly mentions surface area, surface, or area. No mention of oxygen/air.]
- Mentions that when chopped, more parts of the wood are exposed to flame (ignite, catch fire) and all the small pieces can burn simultaneously. [No explicit mention of oxygen/air or surface area.]
- Other correct.

Incorrect Response

- Refers only to relative rates of burning (burning through). [Does not refer explicitly to surface area, oxygen/air, or simultaneous burning.]
- Refers only to the relative rate of ignition (catching on fire, heating up). [Does not refer explicitly to surface area, oxygen/air, or simultaneous burning.]
- Mentions only the need for oxygen/air. [Incorrect/inadequate or no connection to increased availability in chopped wood.]
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Slovak Republic	53	
Moldova	53	
Chinese Taipei	50	
Finland	39	
Russian Federation	33	0
Hungary	32	
Latvia (LSS)	32	0
Slovenia	31	0
Macedonia, Rep. of	31	0
Netherlands	30	0
New Zealand	30	0
England	30	0
Bulgaria	29	0
Australia	29	0
Czech Republic	29	0
Belgium (Flemish)	28	0
Korea, Rep. of	28	0
Singapore	27	0
Iran, Islamic Rep.	25	0
International Average	e 24	
Canada	23	0
Canada Indonesia		0 0
	23	0 0
Indonesia	23 23	0 0 0
Indonesia Malaysia	23 23 21	0 0 0
Indonesia Malaysia Romania	23 23 21 21	0 0 0
Indonesia Malaysia Romania Lithuania	23 23 21 21 20	0 0 0
Indonesia Malaysia Romania Lithuania Jordan	23 23 21 21 20 18	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States	23 23 21 21 20 18 18	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel	23 23 21 21 20 18 18 18 17	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey	23 23 21 20 18 18 17 15	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR	23 23 21 20 18 18 17 15 14	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy	23 21 21 20 18 18 17 15 14 13	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus	23 21 21 20 18 18 17 15 14 13 13	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand	23 21 21 20 18 18 17 15 14 13 13 13	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand Philippines Chile Tunisia	23 21 21 20 18 18 17 15 14 13 13 13 10	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand Philippines Chile	23 21 21 20 18 18 17 15 14 13 13 13 10 9	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand Philippines Chile Tunisia	23 21 21 20 18 17 15 14 13 13 13 10 9 9	0 0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand Philippines Chile Tunisia South Africa	23 21 21 20 18 18 17 15 14 13 13 13 10 9 9 7	0 0
Indonesia Malaysia Romania Lithuania Jordan United States Israel Turkey Hong Kong, SAR Italy Cyprus Thailand Philippines Chile Tunisia South Africa Japan	23 21 21 20 18 18 17 15 14 13 13 10 9 9 7 5	0 0 0

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Content Domain	Cognitive Domain
Chemistry	Theorizing, Analyzing and Solving Problems

Galvanization of steel

A steel manufacturer uses a chemical process called 'galvanization' to protect the surface of steel beams that are used to construct high-rise buildings. It takes a crew of steel workers 8 hours to 'galvanize' a large batch of steel.

a) Why MUST the surface of the steel be protected?

b) A new 'galvanization' process is developed that shortens the procedure to 4 hours. Describe two consequences of the steel manufacturer switching to the shorter 'galvanization' process.

1.

2.

Item Number: Z01A

SCORING

A: Scoring for why steel is galvanized

Note: A correct response must explicitly reference rusting, corrosion, oxidation, or comparable term.

Correct Response

• Explicitly refers to rusting, corrosion, or oxidation.

Incorrect Response

- Mentions only the general structural properties of steel (hardness, strength, durability, etc.). [No mention of rusting, corrosion, oxidation, or equivalent].
- Mentions protection from weather, water, air, etc. [No mention of rusting, oxidation, corrosion, or equivalent.]
- Mentions only protecting the surface (repeats information in stem).
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	77	
Singapore	66	
Korea, Rep. of	63	
England	57	
Finland	56	
Australia	56	
Canada	56	
Hong Kong, SAR	56	
Hungary	54	
Belgium (Flemish)	54	
Slovak Republic	48	
New Zealand	48	
United States	46	
Malaysia	46	
Jordan	44	0
Thailand	43	0
Slovenia	40	0
Czech Republic	38	0
Japan	38	0
International Average	e 37	
international Average	e 37	
Bulgaria	e 37 35	0
		0
Bulgaria	35	0
Bulgaria Romania	35 32	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands	35 32 32	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy	35 32 32 31	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands	35 32 32 31 31	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS)	35 32 32 31 31 29	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation	35 32 31 31 29 28	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia	35 32 31 31 29 28 28	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep.	35 32 31 31 29 28 28 28 27	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia	35 32 31 31 29 28 28 27 24 23 21	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel	35 32 31 31 29 28 28 27 24 23	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey	35 32 31 31 29 28 28 27 24 23 21	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey Cyprus	35 32 31 31 29 28 28 27 24 23 21 20	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey Cyprus Chile Lithuania Moldova	35 32 31 31 29 28 27 24 23 21 20 16	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey Cyprus Chile Lithuania	35 32 31 31 29 28 28 27 24 23 21 20 16 16	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey Cyprus Chile Lithuania Moldova	35 32 31 31 29 28 28 27 24 23 21 20 16 16 11	0 0 0
Bulgaria Romania Macedonia, Rep. of Italy Netherlands Latvia (LSS) Russian Federation Indonesia Iran, Islamic Rep. Tunisia Israel Turkey Cyprus Chile Lithuania Moldova Philippines	35 32 31 31 29 28 28 27 24 23 21 20 16 16 11 10	0



Content Domain	Cognitive Domain
Chemistry	Theorizing, Analyzing and Solving Problems

Galvanization of steel

A steel manufacturer uses a chemical process called 'galvanization' to protect the surface of steel beams that are used to construct high-rise buildings. It takes a crew of steel workers 8 hours to 'galvanize' a large batch of steel.

a) Why MUST the surface of the steel be protected?

b) A new 'galvanization' process is developed that shortens the procedure to 4 hours. Describe two consequences of the steel manufacturers switching to the shorter 'galvanization' process.

1.

2.

Item Number: Z01D

SCORING

B: Scoring for new process

Correct Response

- Mentions that there is more profit (or lower cost) for the manufacturing company.
- Mentions greater efficiency/productivity or that more steel/buildings can be produced (faster).
- · Mentions unemployment or lower pay for workers.
- · Mentions any other worker-related consequence.
- Mentions that the new method might be inferior to the old (shorter process saves time at the expense of quality; unproven method compared to old reliable one).
- Other correct.

Incorrect Response

• Mentions only that the new process is shorter or takes 4 hours (less time). [Merely reports information given in stem.]

Korea, Rep. of	45	
Netherlands	42	
Singapore	41	
Canada	37	
Japan	36	
Thailand	35	
Finland	34	
Belgium (Flemish)	32	
New Zealand	31	
Slovak Republic	30	
Australia	27	
England	26	0
United States	26	
Hungary	25	0
Hong Kong, SAR	22	0
Chinese Taipei	21	0
Slovenia	21	0
Malaysia	20	0
International Averag	e 20	
Bulgaria	18	0
Latvia (LSS)	17	0
	17 16	0 0
Latvia (LSS)		0 0 0
Latvia (LSS) Czech Republic	16	0 0 0 V
Latvia (LSS) Czech Republic Jordan	16 15	0 0 V V
Latvia (LSS) Czech Republic Jordan Israel	16 15 13	0 0 V V
Latvia (LSS) Czech Republic Jordan Israel Tunisia	16 15 13 13	0 0 V V
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy	16 15 13 13 12	0 0 V V V
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus	16 15 13 13 12 11	0 0 V V V V
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of	16 15 13 13 12 11 11	0 0 * * *
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania	16 15 13 13 12 11 11 11	0 0 7 7 7 7 7 7 7
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey	16 15 13 13 12 11 11 11 11	0 0 * * * * *
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia	16 15 13 12 11 11 11 10 9	0 0 7 7 7 7 7 7 7 7 7 7
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova	16 15 13 12 11 11 11 10 9 8	0 0 7 7 7 7 7 7 7 7 7 7
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova Chile	16 15 13 12 11 11 10 9 8 7 7 5	
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova Chile Romania	16 15 13 12 11 11 10 9 8 7 7 5 3	
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova Chile Romania Russian Federation	16 15 13 12 11 11 11 10 9 8 7 7 5 3 3 3	0 0 * * * * * * * * * *
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova Chile Romania Russian Federation South Africa	16 15 13 12 11 11 10 9 8 7 7 5 3	
Latvia (LSS) Czech Republic Jordan Israel Tunisia Italy Cyprus Macedonia, Rep. of Lithuania Turkey Indonesia Moldova Chile Romania Russian Federation South Africa Philippines	16 15 13 12 11 11 11 10 9 8 7 7 5 3 3 3	

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Cal	ntant	main
60	пеп	IIIdIII

Cognitive Domain

Environmental and Resource Issues **Understanding Complex** Information

Area where soil is washed away

Rain and running water can wash away soil. From which area is soil most likely to be washed away?

- A. A sloping area with bushes
- B. A flat area with grasses
- C. A flat area that is barren
- D. A sloping area that is barren

Item Number: F04

Correct Response:

D

Chinese Taipei	92	
Singapore	88	
Slovak Republic	85	
Hong Kong, SAR	85	
Netherlands	83	
Korea, Rep. of	83	
Malaysia	81	
Russian Federation	80	
Japan	79	
England	78	
Australia	78	
Canada	76	
Cyprus	76	
Latvia (LSS)	75	
Slovenia	75	
Tunisia	74	
Czech Republic	73	0
Indonesia	73	
United States	73	0
New Zealand	71	0
Hungary	70	0
Thailand	69	0
Belgium (Flemish)	68	0
Finland	68	0
International Average		
Lithuania	66	0
Jordan	65	0
Romania	65	0
Israel	63	0
Italy	59	
Macedonia, Rep. of	55	
Bulgaria	52	▼
Chile	52	
Moldova	50	
Turkey	49	
Iran, Islamic Rep.	44	0 V V V V V V V V
Morocco	42	▼
Philippines	39	
South Africa	26	

Country average vs. International average:		
Higher Not different Lower		

Content Dom	ain
	alli

Cognitive Domain

Environmental and Resource Issues

Understanding Complex Information

Effectiveness of insecticides

Insecticides are used to control insect populations so that they do not destroy crops. Over time, some insecticides become less effective at killing insects, and new insecticides must be developed. What is the most likely reason insecticides become less effective over time?

- A. Surviving insects have learned to include insecticides as a food source.
- B. Surviving insects pass their resistance to insecticides to their Soffspring.
- C. Insecticides build up in the soil.
- D. Insecticides are concentrated at the bottom of the food chain.

Item Number: L07

Correct Response: B

Chinese Taipei	76	
Hong Kong, SAR	74	
Hungary	70	
Singapore	69	
Japan	68	
Australia	66	
United States	62	
Netherlands	61	
Canada	60	
Russian Federation	60	0
Finland	57	0
Slovenia	57	0
Czech Republic	57	0
England	56	0
New Zealand	56	0
Belgium (Flemish)	53	0
Lithuania	51	0
Israel	51	0
Bulgaria	50	0
Italy	50	0
italy	50	
Thailand	49	0
,	49	0
Thailand International Average Romania	49	0
Thailand International Average	49 48 48 47	0
Thailand International Average Romania Korea, Rep. of Slovak Republic	49 48 48	0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of	49 48 48 47	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic	49 48 48 47 45	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey	49 48 48 47 45 43	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova	49 48 48 47 45 43 42	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS)	49 48 48 47 45 43 42 38	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile	49 48 48 47 45 43 42 38 38 38 38 38 37	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS)	49 48 48 47 45 43 42 38 38 38 38	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of	49 48 48 47 45 43 42 38 38 38 38 38 37	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines	49 48 48 47 45 43 42 38 38 38 38 38 37 33	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines Jordan	49 48 48 47 45 43 42 38 38 38 38 38 37 33 32	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines Jordan Cyprus	 49 48 47 45 43 42 38 38 37 33 32 31 27 25 	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines Jordan Cyprus Indonesia	 49 48 47 45 43 42 38 38 37 33 32 31 27 	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines Jordan Cyprus Indonesia South Africa	 49 48 47 45 43 42 38 38 37 33 32 31 27 25 	0 0 0 0 0 0 0 0 0 0 0
Thailand International Average Romania Korea, Rep. of Slovak Republic Turkey Moldova Iran, Islamic Rep. Chile Latvia (LSS) Macedonia, Rep. of Philippines Jordan Cyprus Indonesia South Africa Malaysia	 49 48 47 45 43 42 38 38 38 37 33 32 31 27 25 24 	0 0 0 0 0 0 0

Country average vs. International average:	
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Not different	○
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Content Domain	Cognitive Domain
Environmental	Understanding Complex
and Resource Issues	Information

Two reasons for famine

What are two reasons why famine (a great shortage of food) occurs?

1.

2.

Item Number: P05D

SCORING

Note: Each of the two reasons must be scored separately. The same score can be used twice. However, if the reasons described are essentially the same, or an extension of the same idea, or if only one reason is given, the second reason should be scored as incorrect.

Correct Response

- Mentions agriculturally-related factors (soil depletion, overgrazing, erosion, poor farming techniques).
- Mentions natural disasters or weather-related factors (floods, earthquakes, rain distribution, drought, temperature, sun, etc.).
- Mentions crop disease, insect infestation or other pests.
- Mentions overpopulation or consumption.
- Mentions specific social/economic/political factors.
- Mentions pollution or other contamination.
- · Other correct.

Incorrect Response

- Mentions ONLY a lack or need of food (or other responses related to a general definition of famine).
- Response too vague.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	73	
Slovenia	72	
Slovak Republic	70	
Hong Kong, SAR	66	
Chinese Taipei	66	
Moldova	59	
Finland	55	
Australia	55	
Belgium (Flemish)	54	0
Canada	53	
Thailand	52	
New Zealand	48	0
Latvia (LSS)	47	0
Jordan	46	0
Czech Republic	44	0
Cyprus	43	0
International Avera	ige 42	
Turkey	42	0
Bulgaria	41	0
Italy	41	0
England	41	0
Malaysia	40	0
Netherlands	39	0
Korea, Rep. of	39	0
Japan	39	0
Russian Federation	38	0
Chile	37	0
United States	36	0
Indonesia	34	▼
Israel	33	▼
Iran, Islamic Rep.	33	▼
Romania	32	▼
Hungary	31	▼
Tunisia	29	
Lithuania	26	▼
Morocco	25	
Philippines	16	
Macedonia, Rep. of	14	
South Africa	8	

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Cognitive Domain
Environmentel	Linderstanding Simple

Environmental and Resource Issues Understanding Simple Information

Result of global warming

A. Rising ocean level
B. More severe earthquakes
C. Larger volcanic eruptions
D. Thinning ozone layer

What is predicted to be a result of global warming?

Item Number: R06

Correct Response: A

Japan	67	
Hong Kong, SAR	59	
Chinese Taipei	58	
Lithuania	57	
Singapore	56	
Australia	52	
Bulgaria	49	
Italy	48	
Korea, Rep. of	47	
Hungary	44	
New Zealand	43	
Cyprus	42	
Slovak Republic	42	0
Russian Federation	38	0
South Africa	37	0
Latvia (LSS)	35	0
International Average	e 33	
England	33	0
Belgium (Flemish)	33	0
Netherlands	33	0
Czech Republic	32	0
Canada	31	0
Finland	31	0
United States	30	0
Moldova	29	0
Slovenia	28	0
Macedonia, Rep. of	25	
Israel	23	
Romania	22	
Morocco	22	
Jordan	20	
Malaysia	18	
Chile	16	
Philippines	16	
Turkey	15	
Thailand	13	▼
Tunisia	11	▼
Indonesia	10	 * *<
Iran, Islamic Rep.	9	
L		

Country average vs. International average:		
Higher Not different Lower		

Content	Domain

Cognitive Domain

Scientific Inquiry and the Nature of Science

Investigating the Natural World

Evaporation of vinegar and oil

Two open bottles, one filled with vinegar and the other with olive oil, were left on a window sill in the Sun. Several days later it was observed that the bottles were no longer full. What can be concluded from this observation?

- A. Vinegar evaporates faster than olive oil.
- B. Olive oil evaporates faster than vinegar.
- C. Both vinegar and olive oil evaporate.
- D. Only liquids containing water evaporate.
- E. Direct sunlight is needed for evaporation.

Item Number: N04

Overall Percent Correct

England	78	
Singapore	78	
Netherlands	76	
United States	76	
Australia	70	
Israel	67	
New Zealand	67	
Hungary	64	
Canada	64	
Korea, Rep. of	59	
Japan	50	0
Italy	49	0
Jordan	49	0
Belgium (Flemish)	49	0
Hong Kong, SAR	49	0
Czech Republic	49	0
International Average	48	
Malaysia	46	0
Bulgaria	45	0
Finland	45	0
Macedonia, Rep. of	44	0
Chinese Taipei	44	0
Indonesia	42	0
Iran, Islamic Rep.	42	0
Turkey	41	▼
Latvia (LSS)	41	0
Slovak Republic	40	0
Lithuania	39	0
Slovenia	39	•
Morocco	38	\bullet
Philippines	38	•
Chile	38	
Cyprus	36	
Romania	30	
South Africa	29	\bullet
Russian Federation	29	•
Thailand	28	▼
Tunisia	27	* * * * * * * *
Moldova	19	▼

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Correct Response:

С

71

0		D	
CO	ntent	Dom	lain

Scientific Inquiry and the Nature of Science **Cognitive Domain**

Understanding Simple Information

Replication of measurements

The primary reason scientists repeat the measurements they take during experiments is so that they can

- A. check that the equipment is working
- B. list all the results in a table
- C. estimate experimental error
- D. change the experimental conditions

Item Number: P07

Correct Response:

С

Korea, Rep. of	87	
Chinese Taipei	73	
Japan	61	
Thailand	60	
Israel	57	
Hong Kong, SAR	56	
Lithuania	52	
Turkey	51	
Slovak Republic	50	
Latvia (LSS)	46	0
Singapore	46	0
Czech Republic	46	0
Finland	45	0
Romania	44	0
Bulgaria	43	0
Slovenia	43	0
Russian Federation	41	0
International Averag	e 40	
United States	39	0
Moldova	39	0
Tunisia	35	0
England	35	0
England Jordan	35 34	0 0
5		0
Jordan	34	0
Jordan Canada	34 34	0
Jordan Canada Chile	34 34 33	0
Jordan Canada Chile Australia	34 34 33 33	0
Jordan Canada Chile Australia Macedonia, Rep. of	34 34 33 33 32	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary	34 34 33 33 32 31	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish)	34 34 33 33 32 31 31	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands	34 34 33 33 32 31 31 30	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand	34 34 33 32 31 31 30 29	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia	34 34 33 32 31 31 30 29 29	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia Philippines	34 34 33 32 31 31 30 29 29 29	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia Philippines Iran, Islamic Rep.	34 34 33 32 31 31 30 29 29 29 29 29	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia Philippines Iran, Islamic Rep. Cyprus	34 34 33 32 31 31 30 29 29 29 29 29 29 29 28	0
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia Philippines Iran, Islamic Rep. Cyprus Malaysia Italy	34 34 33 32 31 31 30 29 29 29 29 29 29 29 28 26	
Jordan Canada Chile Australia Macedonia, Rep. of Hungary Belgium (Flemish) Netherlands New Zealand Indonesia Philippines Iran, Islamic Rep. Cyprus Malaysia	34 34 33 32 31 31 30 29 29 29 29 29 29 29 29 28 26 24	0

Country average vs. International average:		
Higher	▲	
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Lower	▼	

Content Domain	Cognitive Domain
Scientific Inquiry and the Nature of Science	Investigating the Natural World

Bacteria/mold experiment

Alexander Fleming noticed that bacteria growing on a plate of agar did not grow next to a mold that was growing on the same plate. He wrote in his laboratory report: "The mold may be producing a substance that kills bacteria." This statement is best described as

- A. an observation
- B. a hypothesis
- C. a generalization
- D. a conclusion

Item Number: R01

Correct Response: B

Overall	Percent	Correct
Overan	I GIUGIII	ouneur

Chinese Taipei	80	
Japan	70	
Italy	67	
Israel	63	
Bulgaria	58	
Thailand	55	
Canada	52	
United States	47	
Hungary	42	0
Chile	42	
Netherlands	42	0
Morocco	41	0
Lithuania	41	0
Australia	39	0
Belgium (Flemish)	36	0
Tunisia	36	0
Cyprus	36	0
International Average	e 35	
New Zealand	32	0
New Zealand Slovenia		0
	32	0
Slovenia	32 32	0
Slovenia Hong Kong, SAR	32 32 32	0
Slovenia Hong Kong, SAR Slovak Republic	32 32 32 30	0
Slovenia Hong Kong, SAR Slovak Republic South Africa	32 32 32 30 29	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore	32 32 32 30 29 28	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of	32 32 30 29 28 25	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep.	32 32 30 29 28 25 25	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan	32 32 30 29 28 25 25 25 22	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of	32 32 30 29 28 25 25 22 22 22	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England	32 32 30 29 28 25 25 22 22 22 19	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England Malaysia	32 32 30 29 28 25 25 22 22 19 18	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England Malaysia Philippines	32 32 30 29 28 25 25 22 22 19 18 18	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England Malaysia Philippines Latvia (LSS)	32 32 30 29 28 25 25 22 22 19 18 18 18	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England Malaysia Philippines Latvia (LSS) Romania	32 32 30 29 28 25 25 22 22 19 18 18 18 16 14	0
Slovenia Hong Kong, SAR Slovak Republic South Africa Singapore Korea, Rep. of Iran, Islamic Rep. Jordan Macedonia, Rep. of England Malaysia Philippines Latvia (LSS) Romania Indonesia	32 32 30 29 28 25 25 22 22 19 18 18 16 14 11	0

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Not different	0
Lower	

Content Domain	Cognitive Domain
Scientific Inquiry and the Nature of Science	Investigating the Natural World

Heart rate experiment design

Suppose you want to investigate how long it takes for the heart rate to return to normal after exercising. What materials would you use and what procedures would you follow?

Item Number: X03

SCORING

Note: A fully correct procedure may or may not include a separate materials list in order to receive full credit. If a materials list is not included, then time measurements must be explicitly referenced within the procedure (e.g. 'time how long it takes'). Partial credit is given for responses where one of the criteria for a correct response is not completely satisfied.

Correct Response

• Describes a procedure in which: i) Somebody (or self) measures "normal" pulse or heart rate at rest (using a timer or watch). ii) Subject does an exercise (physical activity). iii) The time interval is measured from completion of exercise until pulse rate returns to "normal".

• Other fully correct.

Partial Response

- · As in correct response, but no mention of beginning ('normal') pulse measurement.
- As in correct response, but no mention of measuring the time interval after exercise until pulse returns to normal.
- · Other partially correct with one criterion not completely satisfied.

Incorrect Response

- No procedure given; only mentions materials.
- Describes a minimal procedure not satisfying two or more of the criteria stated in correct response.
- Refers only to how to measure the heart (pulse) rate.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	32	
England	31	
Australia	30	
Korea, Rep. of	30	
New Zealand	28	
Canada	26	
Chinese Taipei	24	
Belgium (Flemish)	23	
United States	21	
Hong Kong, SAR	20	
Netherlands	20	0
Japan	19	
Czech Republic	19	
Finland	17	
International Averag	e 12	
Hungary	11	0
Israel	9	•
Slovak Republic	8	▼
Slovenia	8	▼
Macedonia, Rep. of	7	•
Latvia (LSS)	7	•
Italy	6	▼
Cyprus	6	▼
Lithuania	6	•
Russian Federation	6	•
Jordan	5	▼
Indonesia	5	▼
Turkey	4	•
Thailand	4	•
Moldova	4	▼
Romania	3	▼
Bulgaria	3	▼
Chile	2	▼
Malaysia	2	▼
Morocco	2	•
Tunisia	2	▼
Philippines	2	
Iran, Islamic Rep.	2	▼
South Africa	1	▼

Country avera International av	-
Higher Not different Lower	

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Acids and Bases	Conceptual Understanding

Litmus test

A solution of hydrochloric acid (HCl) in water will turn blue litmus paper red. A solution of the base sodium hydroxide (NaOH) in water will turn red litmus paper blue. If the acid and base solutions above are mixed in the right proportion, the resulting solution will cause neither red nor blue litmus paper to change color.

Explain why the litmus paper does not change color in the mixed solution.

Item Number: S032057

SCORING

Note: To receive credit, responses must refer to neutralization or a chemical reaction that results in products that do not react with litmus paper.

Correct Response

- Explanation refers explicitly to the formation of **water** (and salt) from the neutralization reaction. Examples: Hydrochloric acid and sodium hydroxide will mix together to form water and salt.
 - which is neutral.

The hydrogen ions combine with the hydroxide ions to form water, so the litmus paper does not change color.

• Explanation refers explicitly to **neutralization** (or equivalent), but the specific reaction is not mentioned.

Examples: When you mix acid and alkali, the mixture becomes neutral and has a pH of 7. The HCI neutralizes the NaOH, and the NaOH neutralizes the HCI.

- The mixed solution is neutral, so litmus paper does not react.
- Acid + base = neutral solution
- There is a neutralization reaction.
- Explanation refers to a chemical reaction taking place (implicitly or explicitly) to form products that do not react with litmus paper (or similar). [Neutralization is not explicitly mentioned.] *Examples: The acid and base react, and the new chemicals do not react with litmus paper.*
 - The chemicals that change the litmus paper must have a chemical reaction to each other. Therefore they will not change the color of the paper anymore.

They form a new solution that has different properties and doesn't react with litmus.

• Other correct.

Incorrect Response

- Mentions **only** that acid and base are "balanced", "opposites", "cancel each other", or similar. Examples: The acid and base are opposites and counteract so they cancel each other out. The acid tries to turn it red and the base just turns it blue again at the same time. Because they're balanced out and equal.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	73	
Hong Kong, SAR	66	
Japan	64	
Singapore	56	
Malaysia	50	
Hungary	46	
England	39	
Korea, Republic of	39	
Sweden	34	
Egypt	31	
Scotland	25	0
Estonia	25	0
Norway	25	0
Russian Federation	23	0
Slovak Republic	22	0
Bulgaria	21	0
International average	21	
Moldova, Rep. of	21	0
Jordan	20	0
Armenia	20	0
Palestinian Nat'l Auth.	20	0
Romania	18	0
United States	17	
Israel	16	
Lithuania	15	$\bullet \bullet $
Cyprus	15	
Macedonia, Republic of	14	
Slovenia	14	
New Zealand	13	
Bahrain	13	
Latvia	13	
Australia	13	
Italy	12	
Iran, Islamic Republic of	12	
Serbia and Montenegro	12	
Lebanon	9	
Chile	7	
Netherlands	7	
Belgium (Flemish)	5	
Ghana	4	
Morocco	4	
Philippines	3	* * * *
South Africa	3 3 2	-
Indonesia Saudi Arabia	ל ר	-
Saudi Arabia	2	-
Tunisia	2 2	-
Botswana	Z	•

Country avera	•
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Not different	0
Lower	

Litmus test (continued)

Item Number: S032057

Student Responses

Correct Response:

A solution of hydrochloric acid (HCl) in water will turn blue litmus paper red. A solution of the base sodium hydroxide (NaOH) in water will turn red litmus paper blue. If the acid and base solutions above are mixed in the right proportion, the resulting solution will cause neither red nor blue litmus paper to change color.

Explain why the litmus paper does not change color in the mixed solution.

The chemicals have combined a new solution

Incorrect Response:

A solution of hydrochloric acid (HCl) in water will turn blue litmus paper red. A solution of the base sodium hydroxide (NaOH) in water will turn red litmus paper blue. If the acid and base solutions above are mixed in the right proportion, the resulting solution will cause neither red nor blue litmus paper to change color.

Explain why the litmus paper does not change color in the mixed solution.

Because both acids are formed as one mean that no color will show up

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Conceptual Understanding

Fanning a wood fire

Fanning can make a wood fire burn hotter because the fanning

- makes the wood hot enough to burn A
- B adds more oxygen needed for burning
- (C) increases the amount of wood there is to burn
- (D) provides the energy needed to keep the fire going

Item Number: S012003

Correct Response:

В

Japan	94	
Sweden	93	
Hungary	91	
Hong Kong, SAR	90	
Chinese Taipei	88	
Netherlands	87	
Estonia	86	
Norway	85	
New Zealand	84	
Australia	84	
England	83	
Italy	83	
Scotland	82	
Russian Federation	82	
Belgium (Flemish)	82	
Singapore	82 81	
United States	80	
Bulgaria Latvia	80	
	79 79	
Malaysia	78	
Slovak Republic	78	
Korea, Republic of	76	A
Israel	76	
Slovenia	76	
		-
Romania	73	0
Lithuania	72	0 0
Lithuania International average	72 70	0
Lithuania International average Moldova, Rep. of	72	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of	72 70	0
Lithuania International average Moldova, Rep. of	72 70 67	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of	72 70 67 66	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro	72 70 67 66 64	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan	72 70 67 66 64 64	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus	72 70 67 66 64 64 64 62	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of	72 70 67 66 64 64 62 61	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile	72 67 66 64 64 62 61 60	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia	72 67 66 64 64 62 61 60 58	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia	72 67 66 64 64 62 61 60 58 57	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain	72 67 66 64 64 62 61 60 58 57 56	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth.	72 67 66 64 64 62 61 60 58 57 56 55	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt	72 67 66 64 64 62 61 60 58 57 56 55 53	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco	72 67 66 64 62 61 60 58 57 56 55 53 50	
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia	72 67 64 64 62 61 60 58 57 56 55 53 50 49	
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia Lebanon	72 67 64 64 62 61 60 58 57 56 55 53 50 49 46	
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia Lebanon Saudi Arabia	72 67 66 64 62 61 60 58 57 56 55 53 50 49 46 43	
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia Lebanon Saudi Arabia Ghana	72 67 64 64 62 61 60 58 57 56 55 53 50 49 46 43 38	0
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia Lebanon Saudi Arabia Ghana Philippines	72 67 64 64 62 61 60 58 57 56 55 53 50 49 46 43 38 35	
Lithuania International average Moldova, Rep. of Iran, Islamic Republic of Serbia and Montenegro Jordan Cyprus Macedonia, Republic of Chile Armenia Indonesia Bahrain Palestinian Nat'l Auth. Egypt Morocco Tunisia Lebanon Saudi Arabia Ghana Philippines Botswana	72 67 66 64 62 61 60 58 57 56 55 53 50 49 46 43 38 35 34	

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Main Topic	Cognitive Dom	ain
CHEMISTRY	Chemical Change	Conceptual Underst	tanding
Reactions releasing energy		Overall Percen	t Correc
Some chemical reactions absorb energy chemical reactions in burning coal an release energy?	gy, while others release energy. Of the d exploding fireworks, which will	Chinese Taipei Hong Kong, SAR Singapore Scotland	77
chemical reactions in burning coal an		Hong Kong, SAR Singapore	74 A 68 A

(D) Neither burning coal nor exploding fireworks

Item Number: S022188

Correct Response:

С

Chinese Taipei	77	
Hong Kong, SAR	74	
Singapore	68	
Scotland	65	
United States	65	
Estonia	64	
England	62	
Tunisia	61	
Palestinian Nat'l Auth.	59	
Israel	59	
Iran, Islamic Republic of	59	
Malaysia	58	
Slovak Republic	58	
Australia	57	
Cyprus	57	
New Zealand	56	0
Chile	56	
Philippines	55	
Jordan	54	0
Hungary	53	0
Latvia	53	0
Russian Federation	52	0
International average	52	
Sweden	51	0
		-
Slovenia	50	0
Slovenia Egypt	50 50	0 0
Egypt	50	0
Egypt Norway	50 49	0 0 0
Egypt Norway Lithuania	50 49 49	0 0 0
Egypt Norway Lithuania Romania	50 49 49 47	0 0 0
Egypt Norway Lithuania Romania Ghana	50 49 49 47 47	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish)	50 49 49 47 47 47	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon	50 49 49 47 47 47 47	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy	50 49 47 47 47 47 47 47	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of	50 49 47 47 47 47 47 47 47 46	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia	50 49 47 47 47 47 47 47 46 46	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia	50 49 47 47 47 47 47 47 46 46 45	0 0 0
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain	50 49 47 47 47 47 47 47 46 46 45 44	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of	50 49 47 47 47 47 47 47 46 46 45 44 44	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands	50 49 47 47 47 47 47 46 46 45 44 44 42	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana	50 49 47 47 47 47 47 46 46 45 44 42 42	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan Indonesia	50 49 47 47 47 47 47 46 46 45 44 44 42 42 41	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan	50 49 47 47 47 47 47 46 46 45 44 42 42 41 40	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan Indonesia	50 49 47 47 47 47 47 46 46 45 44 42 42 41 40 39	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan Indonesia Serbia and Montenegro Korea, Republic of	50 49 47 47 47 47 47 46 46 45 44 42 42 41 40 39 38	
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan Indonesia Serbia and Montenegro Korea, Republic of South Africa	50 49 47 47 47 47 47 46 46 45 44 42 42 41 40 39 38 36	0 0 • • •
Egypt Norway Lithuania Romania Ghana Belgium (Flemish) Lebanon Italy Macedonia, Republic of Armenia Saudi Arabia Bahrain Moldova, Rep. of Netherlands Botswana Japan Indonesia Serbia and Montenegro Korea, Republic of South Africa Bulgaria	50 49 47 47 47 47 47 46 46 45 44 42 42 41 40 39 38 36 36	

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Conceptual Understanding

Chemical change involving elements

Which is a chemical change?

- (A) Element 1 is polished to form a smooth surface.
- (B) Element 2 is heated and evaporates.
- © Element 3 develops a white, powdery surface after standing in air.
- (D) Element 4 is separated from a mixture by filtration.

Item Number: S022198

Correct Response:

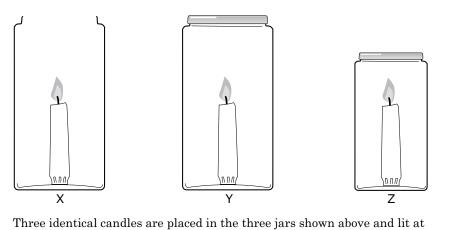
С

Chinese Taipei	73	
Singapore	60	
Hong Kong, SAR	52	
Malaysia	51	
Hungary	48	
Jordan	47	
Iran, Islamic Republic of	47	
England	46	
Japan	45	
Korea, Republic of	44	
Netherlands	43	
Palestinian Nat'l Auth.	41	
Armenia	40	
Russian Federation	39	
Bulgaria	39	0
Australia	39	
Belgium (Flemish)	38	0
Slovenia	36	0
New Zealand	34	0
Italy	34	0
International average	34	
Scotland	33	0
United States	33	0
Moldova, Rep. of	33	0
Estonia	32	0
Cyprus	32	0
Israel	30	▼
Tunisia	30	▼
Lebanon	30	▼
Serbia and Montenegro	30	▼
Macedonia, Republic of	30	▼
Norway	29	* * * *
South Africa	28	▼
Philippines	28	▼
Egypt	28	
Botswana	27	▼ ▼ ▼
Latvia	27	▼
Bahrain	25	▼
Romania	24	▼
Indonesia	24	▼
Saudi Arabia	22	▼
Sweden	22	* * * *
Slovak Republic	21	▼
Ghana	19	•
Lithuania	19	
Morocco	15	•
Chile	15	•
	-	

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Reasoning and Analysis

Candles burning in 3 jars



Three identical candles are placed in the three jars shown above and lit at the same time. Jars Y and Z are then sealed with lids, and Jar X is left open.

Which candle flame will go out first (X, Y, or Z)?

Explain your answer.

Item Number: S022191

SCORING

Note: For full credit, responses must identify **Z** and include an explanation that explicitly mentions the need for **oxygen** (for combustion or burning). Responses may also mention that the supply runs out faster in the smaller sealed jar, but it is not required for full credit. Responses referring to the need for air (explicitly or using non-scientific language) are given partial credit. Responses mentioning **only** smoke (fumes, carbon dioxide, etc.) build-up or **heat** should be scored as incorrect.

Correct Response

• Z. Explanation refers to the need for oxygen (for burning).

Examples: Z. The flame in the smaller jar will go out first since it has the least oxygen in it. Z. Oxygen is needed for the candle to burn.

- Z. It has less oxygen.
- Other fully correct.

Netherlands	82	
Estonia	79	
Sweden	78	
Singapore	78	
Lithuania	75	
	72	
Hungary	72	
Norway		
Belgium (Flemish)	71	
Russian Federation	69	
Japan	69	
England	66	
Italy	64	
Hong Kong, SAR	62	
Slovenia	62	
Chinese Taipei	60	
Israel	58	
Latvia	57	
Australia	57	
Slovak Republic	55	
Scotland	54	
New Zealand	53	
Korea, Republic of	52	
United States	48	0
Serbia and Montenegro	48 48	0
		0
International average	47	0
International average Malaysia	47 45	0
International average Malaysia Macedonia, Republic of	47 45 44	0
International average Malaysia Macedonia, Republic of Lebanon	47 45 44 44	0
International average Malaysia Macedonia, Republic of Lebanon Bulgaria	47 45 44 44 43	0 0 0
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus	47 45 44 43 43	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania	47 45 44 43 43 43 42	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia	47 45 44 43 43	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania	47 45 44 43 43 43 42	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia	47 45 44 43 43 43 42 41	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan	47 45 44 43 43 43 42 41 38	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt	47 45 44 43 43 43 42 41 38 34	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile	47 45 44 43 43 42 41 38 34 32	0 0 0
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain	47 45 44 43 43 42 41 38 34 32 31	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia	47 45 44 43 43 42 41 38 34 32 31 30	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of	47 45 44 43 43 43 42 41 38 34 32 31 30 29	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco	47 45 44 43 43 42 41 38 34 32 31 30 29 28	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia	47 45 44 43 43 42 41 38 34 32 31 30 29 28 27	
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of	47 45 44 43 43 42 41 38 34 32 31 30 29 28 27 23 20	
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of Indonesia	47 45 44 43 42 41 38 34 32 31 30 29 28 27 23 20 12	
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of Indonesia South Africa	47 45 44 43 42 41 38 34 32 31 30 29 28 27 23 20 12 9	
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of Indonesia South Africa Philippines	47 45 44 43 42 41 38 34 32 31 30 29 28 27 23 20 12 9 5	
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of Indonesia South Africa Philippines Botswana	47 45 44 43 42 41 38 34 32 31 30 29 28 27 23 20 12 9 5 3	0 0 0 V
International average Malaysia Macedonia, Republic of Lebanon Bulgaria Cyprus Romania Tunisia Jordan Egypt Chile Bahrain Armenia Moldova, Rep. of Morocco Palestinian Nat'l Auth. Saudi Arabia Iran, Islamic Republic of Indonesia South Africa Philippines	47 45 44 43 42 41 38 34 32 31 30 29 28 27 23 20 12 9 5	

Country average International av	
Higher	
Not different	0
Lower	V

Item Number: S022191

SCORING (continued)

Partially Correct Response

- Z. Explanation refers to lack of air (gas) explicitly or using non-scientific language (e.g. suffocation, smothering, choking, etc.). (No explicit mention of oxygen.) Examples: Z. The flame in the smallest jar will be suffocated first.
 - Z. It does not have enough air to breath.
 - Since Z is the smallest jar, it will have less air in order to burn.
 - Z. It gets smothered as the carbon dioxide increases.
- Indicates both Y AND Z (Y, Z; Y or Z; Y/Z etc.). Explanation based on the need for oxygen or air.
 Examples: Y and Z. The flame needs oxygen for it to burn, and both of these jars will run out of it.
 - Y, Z. The closed jars do not get any air.
 - Y or Z. They do not get any oxygen.
- · Other partially correct.

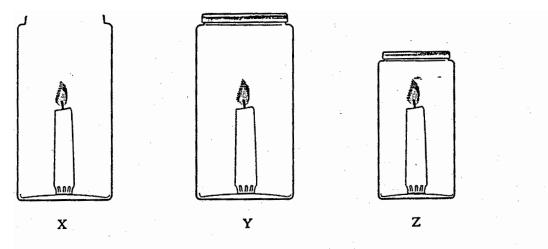
Incorrect Response

- Z with no explanation or an incorrect explanation.
 - Examples: Z. This jar will have the smallest flame since it is in the smallest jar.
 - Z. The smoke cannot escape, so the flame dies.
 - Z. The carbon dioxide level builds up too much.
 - Z. The candle wants to let off heat, so it bursts.
- X. Explanation based on the candle being blown out (or similar).
 - Examples: X. A person walking past the candle might cause it to blow out. X. If the jar is not closed, it goes out from the wind.
- X OR Y with no explanation or any other incorrect explanation.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Item Number: S022191

Student Responses

Correct Response:



Three identical candles are placed in the three jars shown above and lit at the same time. Jars Y and Z are then sealed with lids, and jar X is left open.

Which candle will go out first (X, Y, or Z)? _____

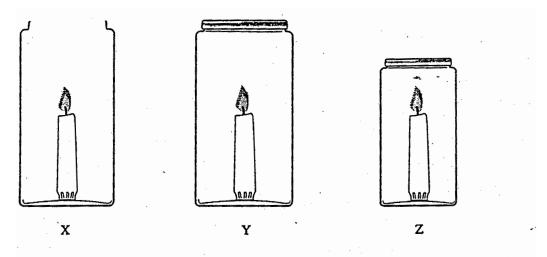
Explain your answer.

Z because fire needs oxygen to stay lit with the lid being scaled no oxygen can get in these is a little bit of air in their for it to stay lit. Since Z is the smaller than 4, Z wouldge out first.

Item Number: S022191

Student Responses (continued)

Partial Response:



Three identical candles are placed in the three jars shown above and lit at the same time. Jars Y and Z are then sealed with lids, and jar X is left open.

Which candle will go out first (X, Y, or Z)? _____

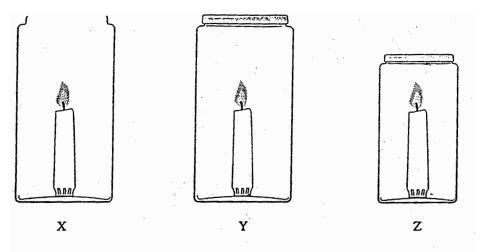
Explain your answer.

Fine needs Air to burn without it, it will go out. Since it is the smallest jar it has less air. Once the air is burned up the the fire will go out.

Item Number: S022191

Student Responses (continued)

Incorrect Response:



Three identical candles are placed in the three jars shown above and lit at the same time. Jars Y and Z are then sealed with lids, and jar X is left open.

Which candle will go out first (X, Y. or Z)? Explain your answer. because they are both closed and the oxygen 13 trapped so then they will both go out.

Content Domain	Main Topic	Cognitive Domain		
CHEMISTRY	Classification and Composition of Matter	Conceptual Understanding		
OT a mixture		Overall Percent	Corr	e
		Chinese Taipei	64	
Which of the following is NOT a mathematical sector of the following is not a mathematical sector of the sector of	ixture?	Sweden	58	4
		Estonia	57	
(A) Smoke		Jordan	56	
(B) Sugar		Netherlands	56	
0		Korea, Republic of	56	
© Milk		Singapore	55	
D Paint		Slovak Republic	53	
		Hungary	51	
		Slovenia	51	
		Australia	50	
		Palestinian Nat'l Auth.	50	
		New Zealand	49	
		Norway	49	
		Russian Federation	48	
		Belgium (Flemish)	48	
		Japan	48	
		Israel	47	
		United States	46	
		Lithuania	45	
		England	45	
		Italy	43	
		Scotland	40	
		International average	40	
		Serbia and Montenegro	40	
		Moldova, Rep. of	40	
		Bahrain	39	
		Bulgaria	37	
		Saudi Arabia	36	,
		Latvia	35	
			25	

Item Number: S022187

Correct Response:

В

Country average vs. International average: Higher

▼

▼

▼

▼ ▼

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▼

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35

34

34

33

33

30

30

30

29

28 27

26

25

18

16

16

15

Lebanon Hong Kong, SAR

Malaysia

Armenia

Romania

Indonesia

Tunisia

Cyprus

Chile

Egypt

Ghana

Morocco

Philippines

Botswana

South Africa

Iran, Islamic Republic of

Macedonia, Republic of

Not different	0
Lower	▼

David makes a solution by dissolving 10 grams of salt in 100 ml of water. He vants a solution that is half as concentrated. What should he add to the riginal solution to obtain a solution that is about half as concentrated? (A) 50 ml of water (B) 100 ml of water (C) 5 grams of salt (Latvia 55 Hungary 50 Estonia 50 Lithuania 46 Chinese Taipei 46 Japan 46 Hong Kong, SAR 46 Russian Federation 43 Sweden 42 Karaa Bapublic of 40	Content Domain	Main Topic	Cognitive Doma	in
Avid makes a solution by dissolving 10 grams of salt in 100 ml of water. He rants a solution that is half as concentrated. What should he add to the triginal solution to obtain a solution that is about half as concentrated? So ml of water 50 ml of water 50 grams of salt 50 grams of salt 10 grams of salt 10 grams of salt 10 grams of salt 10 grams of salt 20 10 grams of salt Moldova, Republic of 40 Belginaria (Hermity) 40 Moldova, Rep. of 40 Belginaria 33 Singapore 40 Bulgaria 38 Solutia 33 Sourcial 33 Sourcial 33 Mumber: S032564	CHEMISTRY		Conceptual Understa	Indin
bavid makes a solution by dissolving 10 grams of salt in 100 ml of water. He Hungary 50 iriginal solution to obtain a solution that is about half as concentrated? 50 50 ml of water 50 j 50 ml of water 50 100 ml of water 60 50 grams of salt 50 j 10 grams of salt 50 Storena 46 hong Kong, SAR 40 Storeal 40 Storeal 40 Storeal 40 Moldova, Republic of 40 Storeal 31 International average 30 International average 30 Norway 30 Italy 29 Storeal 21 Kor	lution half as concentrated		Overall Percent	Corre
 b 50 ml of water c Three Taipei d papan d papan d forg Kong, SAR d forg Kong,	wants a solution that is half as concer	ntrated. What should he add to the	Hungary Estonia	50 50
 100 ml of water 5 grams of salt 10 grams of salt			Chinese Taipei	46
S grams of salt Russian Federation 43 S weden 42 Korea, Republic of 40 Belgium (Flemish) 40 Moldova, Rep. of 40 Singapore 40 Bulgaria 38 Slovenia 35 Australia 33 England 32 New Zealand 32 Serbia and Montenegro 31 Romania 31 International average 30 Norway 30 Italy 29 Stock Republic 27 United States 26 South Africa 25 Israel 24 Egypt 23 Cyprus 22 Bahrain 21 Inan, Islamic Republic of 20 Malasia 18 Ghana 18 Sudi Arabia 17 Morocco 18 Malasia 18 Chana 18 Sudi Arabia 17 Morocco				
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Number: \$032564 Moldova, Rep. of 40 Singapore 40 Singapore 40 Singapore 38 Netherlands 38 Sovenia 32 Sovenia 32 Sebia and Montenegro 31 Romania 31 International average 30 Norway 30 Slovak Republic 27 Sotal 21 Italy 29 Slovak Republic 21 Italy 29 Slovak Republic 21 South Africa 25 Israel 24 Egypt 23 Cyprus 23 Cyprus 21 Iran, Islamic Republic of 20 Malaysia 18 Ghana 18 Ghana 18 Philippines 18 Ghana 18 Ghana 18 Ghana 18 Souti Arabia 17 Morocco 16	D 10 grams of salt			
Number: \$032564 Singapore 40 Bulgaria 38 Netherlands 38 Slovenia 35 Australia 33 England 32 Serbia and Montenegro 31 Romania 31 International average 30 Norway 30 Slovak Republic 27 Slovak Republic 28 Slovak Republic 24 Egypt 23 Cyprus 22 Barhain 21 Iran, Islamic Republic of 10 Malaysia 18 Ghana 18 Barbain 18 Ghana 18 Ghana 18 Ghana 18 Ghana 18 Ghana 18 Souid Arabi				
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Number: S032564 Australia 33 Kumbar: S032564 England 32 Numbar: S032564 Serbia and Montenegro 31 Numbar: S032564 International average 30 International average 20 Serbia and Montenegro 31 International average 30 Italy 29 South Africa 26 South Africa 27 Inan, Islamic Republic of 20 Bahrain 21 Lebanon 20 Saudi Arabia 18 Ghana 18 Ghana 16 Batswana 17			Netherlands	38
Number: S032564 England 32 Number: S032564 Salt 31 Number: S032564 Salt 31 Number: S032564 Salt 31			Slovenia	35
Number: S032564 Number: S03256			Australia	
Number: S032564 Subjects of the set of the s				
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Norway 30 Italy 29 Slovak Republic 27 Scotland 27 United States 26 South Africa 25 Israel 24 Egypt 23 Cyprus 22 Bahrain 21 Lebanon 21 Iran, Islamic Republic of 20 Macedonia, Republic of 18 Malaysia 18 Ghana 18 Philippines 18 Saudi Arabia 17 Morocco 16 Botswana 15 Indonesia 14 Chile 13 Tunisia 13				
Italy29Slovak Republic27Scotland27United States26South Africa25Israel24Egypt23Cyprus23Cyprus21Lebanon21Lebanon21Iran, Islamic Republic of20Macedonia, Republic of18Ghana18Ghana18Saudi Arabia17Morocco16Botswana15Indonesia14Chile13Tunisia13				
Number: \$032564 South Africa 21 Equation 10 Number: \$032564 Number: \$032564 Nu				
Number: \$032564 Number: \$032564 Number				
Number: \$032564 Number: \$03256				27
Number: \$032564 Number: \$03256			United States	26
k fight 23 Cyprus 22 Bahrain 21 Lebanon 21 Iran, Islamic Republic of 20 Macedonia, Republic of 18 Malaysia 18 Ghana 18 Ghana 18 Philippines 18 Saudi Arabia 17 Morocco 16 Botswana 15 Indonesia 14 Chile 13 Tunisia 13			South Africa	
Cyrus22Bahrain21Lebanon21Iran, Islamic Republic of20Macedonia, Republic of18Malaysia18Ghana18Philippines18Saudi Arabia17Morocco16Botswana15Indonesia14Chile13Tunisia13				
Number: S032564 Number: S032564 Number				
Lebanon 21 Iran, Islamic Republic of 20 Macedonia, Republic of 18 Malaysia 18 Ghana 18 Philippines 18 Saudi Arabia 17 Morocco 16 Botswana 15 Indonesia 15 Indonesia 14 Chile 13 Tunisia 13				
Iran, Islamic Republic of20Number: S032564Macedonia, Republic of18Malaysia18Ghana18Philippines18Saudi Arabia17Morocco16Botswana15Indonesia14Chile13Tunisia13				
Number: \$032564 Nalaysia 18 Ghana 18 Philippines 18 Saudi Arabia 17 Morocco 16 Botswana 15 Indonesia 14 Chile 13 Tunisia 13				
Number: \$032564Malaysia18Ghana18Ghilippines18Saudi Arabia17Morocco16Botswana15Indonesia14Chile13Tunisia13				
Ghana 18 Philippines 18 Saudi Arabia 17 Morocco 16 Botswana 15 Indonesia 14 Chile 13 Tunisia 13	Number: \$032564			
Philippines18Saudi Arabia17Saudi Arabia16Morocco16Botswana15Indonesia14Chile13Tunisia13	Wanber, 6052004		-	
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Botswana 15 Indonesia 14 Chile 13 Tunisia 13				
Indonesia 14 Chile 13 Tunisia 13			Morocco	16
Chile 13 Tunisia 13			Botswana	15
Tunisia 13				14
Armenia 12				
			Armenia	12

Correct Response:

e: B

Country average vs. International average: Higher ▲ Not different ○ Lower ▼

0

0

▼

▼

Palestinian Nat'l Auth.

Jordan

		e Science Concepts and Science Ite
Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Conceptual Understanding
Vhich substances are elements		Overall Percent Correct
Oxygen, hydrogen, and water are subs Which of these substances are element (A) oxygen, hydrogen and water (B) oxygen and hydrogen only (C) oxygen only (D) water only ************************************		Slovak Republic76Chinese Taipei75Estonia73Hungary71Singapore67Korea, Republic of66Serbia and Montenegro66Slovenia64Japan64Latvia64Latvia64Russian Federation62Macedonia, Republic of60Armenia58Sweden57Moldova, Rep. of55New Zealand54United States54Romania53Morocco50International average49Bulgaria48Jordan48England45Ghana45Cyprus45Malaysia43Australia42Palestinian Nat'l Auth.41Scotland40Hong Kong, SAR38Italy38Egypt37Botswana37Bahrain36Netherlands35Iran, Islamic Republic of33Chile32South Africa31Norway31Lebanon29Saudi Arabia28
Correct Response: B		Belgium (Flemish) 27 Tunisia 0

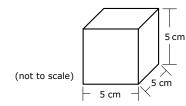
Country average vs. International average:	
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Conceptual Understanding

Metal crown: density of metal block

The scientists decided to compare the densities of the crown and a block of metal just like the original block. The density of a substance is the mass of a sample of the substance divided by its volume (density = mass/volume).

The scientists found the volume of the block and computed its density based on its known mass (2,400 g). The diagram below shows the dimensions of the block of metal that the scientists measured.



What is the density of the block of metal?

Answer: _____ g/cm³

Item Number: S032709

SCORING

Correct Response

- 19.2 g/cm³
- 19 g/cm³ [Rounds to nearest whole unit.]

Incorrect Response

- Shows the set-up for density (mass/volume) but does not compute density or makes a computational error.
- · 125 [Computes volume but not density.]
- 19.3 [No work shown ; indicates density copied from table.]
- · Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Singapore	64	
Hong Kong, SAR	53	
Japan	47	
Chinese Taipei	43	
Hungary	40	
Armenia	40	
Lithuania	39	
Estonia	38	
Korea, Republic of	33	
Russian Federation	33	
Belgium (Flemish)	31	
Italy	30	
Slovak Republic	29	
Latvia	28	
Netherlands	28	
England	26	0
Sweden	26	
United States	25	
Slovenia	23	0
Moldova, Rep. of	23	0
Romania	22	0
International average	22 21	0
Australia	20	0
	20	0
	20	0
Scotland	20 20	0
Scotland Serbia and Montenegro	20	0
Scotland Serbia and Montenegro Malaysia	20 18	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth.	20 18 17	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand	20 18 17 17	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan	20 18 17 17 17	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of	20 18 17 17 17 17	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel	20 18 17 17 17 16 16	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria	20 18 17 17 17 16 16 11	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus	20 18 17 17 16 16 11 10	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain	20 18 17 17 16 16 11 10 10	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway	20 18 17 17 16 16 11 10 10 10	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt	20 18 17 17 16 16 11 10 10 10 9	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon	20 18 17 17 16 16 11 10 10 9 9	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile	20 18 17 17 16 16 11 10 10 9 9 6	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana	20 18 17 17 16 16 11 10 10 9 9 6 6	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia	20 18 17 17 16 16 11 10 10 9 9 6 6 6	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines	20 18 17 17 16 16 11 10 10 9 9 6 6 6 5	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia	20 18 17 17 16 16 11 10 10 9 6 6 6 5 5	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia Morocco	20 18 17 17 16 16 11 10 10 9 6 6 6 5 5 4	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia Morocco Iran, Islamic Republic of	20 18 17 17 16 16 11 10 10 9 6 6 5 5 4 2	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia Morocco Iran, Islamic Republic of South Africa	20 18 17 17 16 16 11 10 10 9 6 6 5 5 4 2 2	
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia Morocco Iran, Islamic Republic of South Africa Saudi Arabia	20 18 17 17 16 16 11 10 10 9 6 6 5 5 4 2 2 1	0
Scotland Serbia and Montenegro Malaysia Palestinian Nat'l Auth. New Zealand Jordan Macedonia, Republic of Israel Bulgaria Cyprus Bahrain Norway Egypt Lebanon Chile Botswana Indonesia Philippines Tunisia Morocco Iran, Islamic Republic of South Africa	20 18 17 17 16 16 11 10 10 9 6 6 5 5 4 2 2	

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Metal crown: density of metal block (continued)

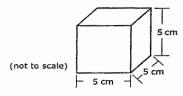
Item Number: S032709

Student Responses

Correct Response:

The scientists decided to compare the densities of the crown and a block of metal just like the original block. The density of a substance is the mass of a sample of the substance divided by its volume (density = mass/volume).

The scientists found the volume of the block and computed its density based on its known mass (2400g). The diagram below shows the dimensions of the block of metal that the scientists measured.



What is the density of the block of metal?

Answer: _____ g/cm³

GIVEN:

$$M = 2400$$
 $V = 5 \times 5 \times 5$
= 125 cm³

FORMULA

$$D = \frac{M}{V} = \frac{2400 \,\text{g}}{125 \,\text{cm}^3} = 19.2 \,\text{g/cm}^3$$

Metal crown: density of metal block (continued)

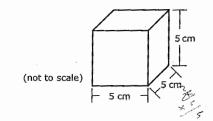
Item Number: S032709

Student Responses (continued)

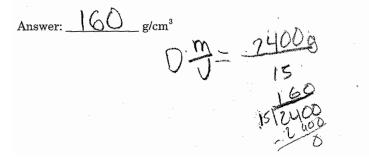
Incorrect Response:

The scientists decided to compare the densities of the crown and a block of metal just like the original block. The density of a substance is the mass of a sample of the substance divided by its volume (density = mass/volume).

The scientists found the volume of the block and computed its density based on its known mass (2,400 g). The diagram below shows the dimensions of the block of metal that the scientists measured.



What is the density of the block of metal?



Content Domain	Main Topic	Cognitive Doma	in
CHEMISTRY	Classification and Composition of Matter	Factual Knowled	ge
bstance type of black/white p	owder	Overall Percent	Corre
A powder made up of both white spec	ks and black specks is likely to be	Lithuania	92 90
	r	Hungary Estonia	90 90
(A) a solution		Slovenia	88
B a pure compound		Slovak Republic	88
-		Latvia Netherlands	84
0		Sweden	84 84
D an element		Japan	83
		Bulgaria	82
		United States	82
		Romania	81
		Singapore Israel	80 79
		Moldova, Rep. of	79 79
		Chinese Taipei	79
		Belgium (Flemish)	78
		England	77
		Australia	77
		Korea, Republic of Russian Federation	77 77
		Hong Kong, SAR	75
		Macedonia, Republic of	74
		Serbia and Montenegro	74
		Armenia	74
		International average	72
		Italy New Zeeland	70 70
		New Zealand Malaysia	70 69
		Scotland	68
		Tunisia	67
		Jordan	67
		Palestinian Nat'l Auth.	66
		Norway	65 65
Number 2010010		Chile Botswana	65 64
n Number: S012016		Botswana Egypt	64 63
		Lebanon	63
		Bahrain	63
		Morocco	60
		Iran, Islamic Republic of	60
		Saudi Arabia	59
		Philippines	58
		Cyprus Ghana	57 52
		Indonesia	52 50

Country average vs. International average:	
Higher	
Not different	0
Lower	•

91

Content Domain	Main Topic	Cognitive Doma	in
CHEMISTRY	Classification and Composition of Matter	Factual Knowled	ge
eaction of chlorine and sodium		Overall Percent	Corre
When chlorine gas reacts with sodium formed?	metal, what type of substance is	Bulgaria Cyprus	68 63
lormeu.		Bahrain Lithuania	60 59
A mixture		Chinese Taipei	59
B A compound		Slovenia	59
0		Singapore	58
\bigcirc An element		Japan	56
D An alloy		Hungary Estonia	56 55
(E) A solution		Sweden	55
		Armenia	55
		Egypt	53
		Russian Federation	53
		Latvia	51
		Jordan	50
		Lebanon Slovak Republic	50 50
		Serbia and Montenegro	50 50
		Israel	49
		Korea, Republic of	49
		England	47
		Scotland	47
		Palestinian Nat'l Auth.	45
		Macedonia, Republic of	44
		United States International average	42 41
		Moldova, Rep. of	37
		Italy	36
		Saudi Arabia	35
		New Zealand	34
		Romania	33
		Chile	33
		Hong Kong, SAR	32
Number: S022206		Malaysia Australia	32 32
Number: S022206		Indonesia	32 30
		Tunisia	28
		Ghana	26
		Belgium (Flemish)	24
		Iran, Islamic Republic of	23
		Philippines	23
		South Africa	18
		Botswana	13 12
		Morocco	13
		Netherlands	13

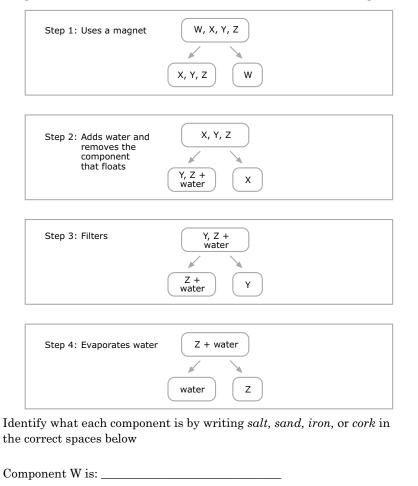
Country avera International av	•	
Higher		
Not different	0	
Lower	•	

92

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Reasoning and Analysis

Separation of salt/sand/iron filings mixture

Teresa is given a mixture of salt, sand, iron filings, and small pieces of cork. She separates the mixture using a 4-step procedure as shown in the diagram. The letters W, X, Y, and Z are used to stand for the four components but do not indicate which letter stands for which component.



Component X is:	

Component	Y is:	

Component Z is:

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Singapore	68	
Chinese Taipei	67	
Japan	58	
	58	
Hong Kong, SAR		
Estonia	56	
Korea, Republic of	54	
Hungary	51	
Slovak Republic	51	
Latvia	49	
England	48	
Scotland	48	
Netherlands	47	
Sweden	47	
Lithuania	47	
New Zealand	46	
Malaysia	46	
Russian Federation	45	
Australia	44	
Belgium (Flemish)	44	
Armenia	42	
Slovenia	42	0
	39	0
Italy		
United States	35	0
Jordan	35	0
Romania	35	0
Romania International average	35 34	0
Romania International average Moldova, Rep. of	35 34 34	0
Romania International average Moldova, Rep. of Israel	35 34 33	0
Romania International average Moldova, Rep. of	35 34 33 26	0 0 0 0
Romania International average Moldova, Rep. of Israel	35 34 33	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway	35 34 33 26	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon	35 34 33 26 26	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile	35 34 33 26 26 26	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of	35 34 33 26 26 26 25	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain	35 34 33 26 26 26 25 23	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt	35 34 33 26 26 26 25 23 22	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria	35 34 33 26 26 26 25 23 22 21	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro	35 34 33 26 26 26 25 23 22 21 20	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth.	35 34 33 26 26 26 25 23 22 21 20 20 19	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia	35 34 33 26 26 26 25 23 22 21 20 20 19 15	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia	35 34 33 26 26 26 25 23 22 21 20 20 19 15 14	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of	35 34 33 26 26 26 25 23 22 21 20 20 19 15 14 14	
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12	
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia Philippines	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12 11	
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia Philippines South Africa	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12 11 8	
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia Philippines South Africa Botswana	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12 11 8 7	
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia Philippines South Africa Botswana Morocco	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12 11 8 7 6	0 0 0 V
Romania International average Moldova, Rep. of Israel Norway Lebanon Chile Iran, Islamic Republic of Bahrain Egypt Bulgaria Palestinian Nat'l Auth. Serbia and Montenegro Cyprus Tunisia Saudi Arabia Macedonia, Republic of Indonesia Philippines South Africa Botswana	35 34 33 26 26 25 23 22 21 20 20 19 15 14 14 12 11 8 7	

Country avera International a	
Higher	▲
Not different	○
Lower	▼

Item Number: S032562

SCORING

Note: To receive full credit, responses must correctly identify all four components. Partial credit is given for responses that list at least two components correctly. If a component is listed more than once, none of the entries for that component will be considered as correct. For example, a response that lists Iron, Salt, Salt, Salt is incorrect.

Correct Response

• Identifies all four components correctly: W = iron; X = cork; Y = sand; Z = salt.

Partially Correct Response

- Identifies iron and cork correctly (W and X); sand and/or salt are missing or incorrect. Examples: Iron, Cork, Salt, Sand Iron, Cork, Sand, Blank
- Identifies iron and salt correctly (W and Z); cork and/or sand are missing or incorrect. Examples: Iron, Sand, Cork, Salt Iron, Blank, Blank, Salt
- · Identifies sand and salt correctly (Y and Z); iron and/or cork are missing or incorrect.

Examples: Cork, Iron, Sand, Salt Blank, Blank, Sand, Salt Water, Cork, Sand, Salt

· Other partially correct (that identifies at least two components correctly).

Incorrect Response

- · Identifies only iron correctly (W), all other components are missing or incorrect.
- · Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Item Number: S032562

Student Responses

Correct Response:

Teresa is given a mixture of salt, sand, iron filings, and small pieces of cork. She separates the mixture using a 4-step procedure as shown in the diagram. The letters W, X, Y, and Z are used to stand for the four components but do not indicate which letter stands for which component.

Step 1: Uses a magnet	W, X, Y, Z X, Y, Z W
Step 2: Adds water and removes the component that floats	$\begin{array}{c} \hline X, Y, Z \\ \hline Y, Z + \\ \hline water \end{array} \qquad $
Step 3: Filters	Y, Z + water Z + water Y
Step 4: Evaporates water	Z + water

	water Z	
د		2

Identify what each component is by writing *salt, sand, iron,* or *cork* in the correct spaces below

Component W is: 1 CON	
Component X is: Sand	
Component Y is: Cor L	
Component Z is: Salt	

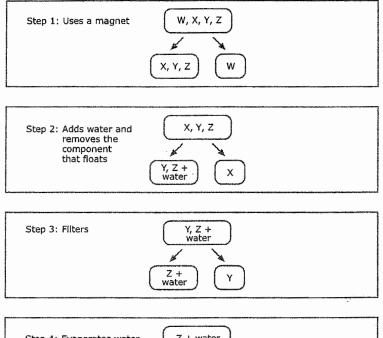
.

Item Number: S032562

Student Responses (continued)

Partially Correct Response:

Teresa is given a mixture of salt, sand, iron filings, and small pieces of cork. She separates the mixture using a 4-step procedure as shown in the diagram. The letters W, X, Y, and Z are used to stand for the four components but do not indicate which letter stands for which component.



	Step 4: Evaporates water	Z + water
		s star i star
1		
1		water Z
	,	
1		
1		

Identify what each component is by writing *salt, sand, iron,* or *cork* in the correct spaces below

Component W is: Water			, A Constant of the Constant	- 1948	ſ
Component X is: CORE	te Gi		÷		
Component Y is: Gond	1	•			
Component Z is: Soult	1	-	/		

Item Number: S032562

Student Responses (continued)

Incorrect Response:

Teresa is given a mixture of salt, sand, iron filings, and small pieces of cork. She separates the mixture using a 4-step procedure as shown in the diagram. The letters W, X, Y, and Z are used to stand for the four components but do not indicate which letter stands for which component.

Step 1: Uses a magnet	W, X, Y, Z X, Y, Z W	
Step 2: Adds water and removes the component that floats	X, Y, Z X, Y, Z Y, Z + water X	
Step 3: Filters	$\begin{array}{c} Y, Z + \\ water \end{array}$	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
		· .
Step 4: Evaporates water	Z + water water Z	

Identify what each component is by writing *salt, sand, iron,* or *cork* in the correct spaces below

Component W is: <u>IFON</u>				
Component X is: Sand	ţ.		1. The second	
Component Y is: Salt	the second secon			
Component Z is: Cor K	N. N	 /		,

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Reasoning and Analysis

Metal crown: what metal block was made of

The table below lists the density for different metals.

Metal	Density (g/cm³)
Platinum	21.4
Gold	19.3
Silver	10.5
Copper	8.9
Zinc	7.1
Aluminum	2.7

A. Look at the density you computed for the block of metal. What was the block of metal most likely made of?

Answer: ____

Explain your answer.

B. The density of the crown was found to be 12.0 g/cm³. What would you report to the king about what metal or mixture of metals the jeweler used to make the crown?

Item Number: S032713A

Hungary	37	
Singapore	36	
Japan	36	
Chinese Taipei	29	
United States	28	
Russian Federation	27	
Estonia	27	
Lithuania	26	
Belgium (Flemish)	26	
Hong Kong, SAR	23	
England	23	
Australia	22	
Latvia	22	
Slovak Republic	21	
New Zealand	21	
Netherlands	20	
Sweden	18	0
Slovenia	18	0
Scotland	18	0
Korea, Republic of	18	0
Jordan	16	0
Norway	16	0
International average	16	0
Romania	14	0
		0
Moldova, Rep. of	13	0
Moldova, Rep. of Egypt	13 13	
Moldova, Rep. of	13	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia	13 13 13	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy	13 13 13 13	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia	13 13 13 13 13 12	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel	13 13 13 13 13 12 12	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia	13 13 13 13 13 12 12 12 11	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of	13 13 13 13 13 12 12 12 11 11	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth.	13 13 13 13 13 12 12 12 11 11 11	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain	13 13 13 13 13 12 12 12 11 11 11 10	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco	13 13 13 13 12 12 11 11 11 10 9	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile	13 13 13 13 12 12 11 11 11 10 9 8	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria	13 13 13 13 12 12 11 11 11 10 9 8 8	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon	13 13 13 12 12 11 11 11 10 9 8 8 6 6	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia	13 13 13 12 12 11 11 11 10 9 8 8 6 6 5	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon	13 13 13 12 12 11 11 11 10 9 8 8 6 6	$\begin{array}{c} \bullet \\ \bullet $
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3	$\begin{array}{c} \bullet \\ \bullet $
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines Ghana	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3 2	$\begin{array}{c} \bullet \\ \bullet $
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines Ghana Botswana	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3	$\begin{array}{c} \bullet \\ \bullet $
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines Ghana Botswana South Africa	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3 2 2	
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines Ghana Botswana South Africa Tunisia	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3 2 2 2	$\begin{array}{c} \bullet \\ \bullet $
Moldova, Rep. of Egypt Serbia and Montenegro Armenia Italy Malaysia Israel Macedonia, Republic of Palestinian Nat'l Auth. Morocco Bahrain Bulgaria Chile Cyprus Lebanon Indonesia Philippines Ghana Botswana South Africa Tunisia Iran, Islamic Republic of	13 13 13 12 12 11 11 11 10 9 8 6 6 5 4 3 2 2 2 2 1	$\begin{array}{c} \bullet \\ \bullet $

Country average International av	•	
Higher		
Not different	0	
Lower	•	

Metal crown: what metal block was made of (continued)

Item Number: S032713A

SCORING

Codes for Identifying Metal in Block

Note: To receive credit, responses must identify gold AND give an explanation based on density. Responses that identify gold with no or incorrect explanation are incorrect. It is possible that a different metal or metal(s) may be identified based on an incorrect density computation in the previous question. These types of responses may scored as correct, provided the explanation is reasonable based on the computed density.

Correct Response

- GOLD with an explanation based on correct density computed in previous question (19.2 g/cm3). *Examples: Gold. Because it had the closest density.*
 - Gold. The density is the same.
- Other correct.

Incorrect Response

- GOLD with no explanation or incorrect explanation that is NOT based on density. *Examples: Gold. Because that is what crowns are always made of.*
- SILVER (alone or mixed). [Confuses density of crown with density of the metal block.] Examples: It is mostly silver because the density is 12 and that's the closest one.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Metal crown: what metal block was made of (continued) Item Number: S032713A

Student Responses

Correct Response:

The table below lists the density for different metals.

· · · · · · · · · · · · · · · · · · ·	
Density (g/cm³)	
21.4	
19.3	
10.5	
8.9	
7.1	
2.7	

, :

A. Look at the density you computed for the block of metal. What was the block of metal most likely made of?

Answer: _____ Add Explain your answer. the for block of metal was only 0, 1 owny from 19, 3 ninch was gold so that is the closest thing toit

Incorrect Response:

The table below lists the density for different metals.

Metal	Density (g/cm³)
Platinum	21.4
Gold	19.3
Silver	.10.5
Соррег	8.9
Zinc	7.1
Aluminum	2.7

A. Look at the density you computed for the block of metal. What was the block of metal most likely made of?

Answer: (104 Because everything listed under metal tooy are made out Clay.

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Reasoning and Analysis

Metal crown: what crown was made of

The table below lists the density for	or different metals.
---------------------------------------	----------------------

Metal	Density (g/cm ³)
Platinum	21.4
Gold	19.3
Silver	10.5
Copper	8.9
Zinc	7.1
Aluminum	2.7

A. Look at the density you computed for the block of metal. What was the block of metal most likely made of?

Answer: _____

Explain your answer.

B. The density of the crown was found to be 12.0 g/cm³. What would you report to the king about what metal or mixture of metals the jeweler used to make the crown?

Item Number: S032713B

Chinese Taipei	25	
Hong Kong, SAR	20	
Singapore	20	
Hungary	20	
Korea, Republic of	19	
Slovenia	18	
Estonia	15	
Norway	13	
Latvia	12	
Sweden	12	
Slovak Republic	12	
Jordan	11	
United States	11	
Netherlands	10	0
Russian Federation	10	0
Lithuania	10	0
Armenia	10	0
New Zealand	9	0
Scotland	9	0
Australia	9	0
	8	0
Egypt International average	8	0
Romania	•	0
Nomania	0	
Malaycia	0	\cap
Malaysia Maldaya Ban of	8	0
Moldova, Rep. of	8	0
Moldova, Rep. of Belgium (Flemish)	8 8	0
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of	8 8 6	0
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus	8 8 6 5	0
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England	8 8 6 5 5	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel	8 8 6 5 5 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of	8 8 5 5 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon	8 8 5 5 4 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia	8 8 6 5 5 4 4 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco	8 8 5 5 4 4 4 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria	8 8 5 5 4 4 4 4 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth.	8 6 5 4 4 4 4 4 4 4 4	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile	8 8 5 5 4 4 4 4 4 4 3	0
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain	8 8 5 5 4 4 4 4 4 4 4 3 2	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa	8 8 5 5 4 4 4 4 4 4 4 4 3 2 2	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines	8 6 5 4 4 4 4 4 4 4 3 2 2 2	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan	8 8 5 5 4 4 4 4 4 4 4 4 3 2 2 2 1	
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia	8 6 5 4 4 4 4 4 4 4 4 3 2 2 2 1 1	
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia Tunisia	8 6 5 4 4 4 4 4 4 4 4 3 2 2 1 1 1	
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia Tunisia Ghana	8 6 5 4 4 4 4 4 4 4 3 2 2 1 1 1 1	
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia Tunisia Ghana Botswana	8 8 5 5 4 4 4 4 4 4 4 4 4 4 3 2 2 1 1 1 1 1	
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia Tunisia Ghana Botswana Serbia and Montenegro	8 8 5 5 4 4 4 4 4 4 4 4 4 4 4 2 2 1 1 1 1 1 1	0 0 • •
Moldova, Rep. of Belgium (Flemish) Macedonia, Republic of Cyprus England Israel Iran, Islamic Republic of Lebanon Indonesia Morocco Bulgaria Palestinian Nat'l Auth. Chile Bahrain South Africa Philippines Japan Saudi Arabia Tunisia Ghana Botswana	8 8 5 5 4 4 4 4 4 4 4 4 4 4 3 2 2 1 1 1 1 1	

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Metal crown: what crown was made of (continued)

Item Number: S032713B

SCORING

Codes for Reporting Composition of Crown

Note: To receive credit, responses must indicate that the crown is composed of a mixture of metals (alloy) AND identify the metals that might be included based on the density (crown density between the densities of the pure metals). Responses that indicate that the crown is made of a mixture (alloy) or is not pure gold with no further information about what other metals are included are scored as incorrect. If responses indicate that the crown is made of Palladium (not in the table but with a density of 12 g/cm3), they should be scored as correct.

Correct Response

• Reports that the crown is made of a mixture (alloy) AND names specific metal(s) that might be included (reasonable composition based on density).

Examples: The jeweler used some silver as well as gold.

- It might have had some copper mixed in because that would lower the density and the cost.
- The jeweler most likely used all silver except for a thin coat of gold to make it look pure gold even though it wasn't.

• Other correct.

Incorrect Response

• Reports only that the crown is made of a mixture or is NOT pure gold (or similar); NO specific metals are named.

Examples: The jeweler didn't use the block of metal that the king gave him. The jeweler used four more metals to make the crown.

- Reports SILVER (density closest to 12 g/cm3). Examples: The metal used is silver.
- Reports an incorrect mixture of metals based on additive densities.

Examples: It's silver and aluminum (10.5 + 2.7) Mixture of silver and aluminum as their density adds up to 12.0 approximately. Copper and aluminum.

• Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Metal crown: what crown was made of (continued) Item Number: S032713B

Student Responses

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Correct Response:

The table below lists the density for different metals.

·	
Density (g/cm³)	
21.4	
19.3	
10.5	
8.9	
7.1	
2.7	

B. The density of the crown was found to be 12.0 g/cm³. What would you report to the king about what metal or mixture of metals the jeweler used to make the crown?

to used silver and gold

Incorrect Response:

The table below lists the density for different metals.

1 ³)
1. A. A.

B. The density of the crown was found to be 12.0 g/cm³. What would you report to the king about what metal or mixture of metals the jeweler used to make the crown?

I would tell him that the main that used the crown he used Platinum, gold, copper, 3inc and Alminium. 1. 1. 1.

CHEMISTRY	Particulate Structure			_
	of Matter	Conceptual Understa	Conceptual Understanding	
oms removed from chair		Overall Percent	Corr	'e
If you took all of the atoms out of a chair, what	at would be left?	Lithuania	78	
If you took all of the atoms out of a chair, what	it would be left.	Sweden	73	
(A) The chair would still be there, but it wou	ld weigh less	Singapore	69 69	
9	-	Estonia United States	68 68	
B The chair would be exactly the same as i	t was before.	Hungary	68 67	
C There would be nothing left of the chair.		Korea, Republic of	66	
0	a	Japan	65	
D Only a pool of liquid would be left on the	floor.	England	64	
		Armenia	64	
		Latvia	62	
		Slovenia	62	
		Russian Federation	60	
		Israel	60	
		Slovak Republic	59	
		Australia	59	
		New Zealand	55	
		Scotland	55	
		Norway	54	
		Italy	53	
		Chinese Taipei	52	
		Bahrain	51	
		International average Romania	51 51	
		Palestinian Nat'l Auth.	51	
		Netherlands	50	
		Macedonia, Republic of	50	
		Bulgaria	48	
		Jordan	47	
		Hong Kong, SAR	47	
		Moldova, Rep. of	47	
		Egypt	46	
		Chile	46	
			46 45	
		Chile		
n Number: S012040		Chile Cyprus	45	

Correct Response:

С

Saudi Arabia

Iran, Islamic Republic of South Africa

Botswana

Ghana Tunisia

Malaysia

Morocco

Philippines

Indonesia

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▼

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43

42

37

35

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24

13

	Main Topic	Cognitive Doma	in
CHEMISTRY	Particulate Structure of Matter	Factual Knowledge	
rticles in nucleus of atom		Overall Percent	Corr
The nucleus of MOST atoms consists of	f	Macedonia, Republic of	79 71
	-	Slovak Republic Estonia	69
A neutrons only		Serbia and Montenegro	68
B protons and neutrons		Slovenia	67
0 -		Armenia	66
C protons and electrons		Singapore	65
D neutrons and electrons		Chinese Taipei Russian Federation	63 62
		Romania	61
		Egypt	57
		United States	57
		Lithuania	56
		Lebanon	55
		Moldova, Rep. of Palestinian Nat'l Auth.	54 52
		Bulgaria	52 51
		Iran, Islamic Republic of	48
		New Zealand	48
		International average	47
		Hungary	47
		Italy	46
		Jordan Israel	46 45
		Bahrain	45 45
		Indonesia	44
		England	43
		Korea, Republic of	43
		Philippines	42
		Chile	42
		Australia	41
		Tunisia Ghana	40 40
		Cyprus	40 39
		Japan	37
Number: S012025		Latvia	36
		Netherlands	35
		Saudi Arabia	34
		Sweden	32
		Norway	32
		Scotland	32
		Scotland Morocco	32 31
		Scotland Morocco Hong Kong, SAR	32 31 31
		Scotland Morocco	32 31

Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Content Domain	Main Topic	Cognitive Doma	in
CHEMISTRY	Particulate Structure of Matter	Factual Knowledge	
eutral atom gains electron		Overall Percent	Corre
What is formed when a neutral atom a	zains an electron?	Singapore	79
what is formed when a neutral atom s		Bahrain Estonia	73 72
(A) A mixture		Slovak Republic	71
-		Armenia	71
0		Lithuania	71
© A molecule		Hungary	71
(D) A metal		Slovenia	69
\smile		Lebanon	69
		Russian Federation	69 64
		Israel Serbia and Montenegro	64 61
		Egypt	61
		Iran, Islamic Republic of	60
		Sweden	60
		Romania	60
		Palestinian Nat'l Auth.	58
		Macedonia, Republic of	58
		Chile	58
		Jordan	58
		Bulgaria Chinese Taipei	56 54
		Hong Kong, SAR	54 51
		Ghana	50
		Latvia	49
		Italy	49
		Japan	48
		International average	47
		United States	46
		Moldova, Rep. of	44
		Saudi Arabia England	40 32
		Australia	32 30
		Netherlands	29
		Philippines	28
m Number: S022202		Malaysia	27
		Scotland	26
		New Zealand	24
		Morocco	22
		Belgium (Flemish)	22
		Cyprus	22 22
		Norway Korea, Republic of	22 21
		Botswana	21 19
		Tunisia	19
		South Africa	18
Correct Response: B			

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain	
EARTH SCIENCE	Earth in the Solar System and Universe	Conceptual Understanding	

Appearance of Jupiter and Moon

The planet Jupiter is bigger than Earth's moon but it appears to be smaller when viewed from Earth. Why is this?

Item Number: S022283

SCORING

Note: A correct response is based on the relative distances of Jupiter and the Moon from Earth. An implicit comparison is correct as long as it is clear from the student response that a greater distance from Jupiter is implied. Actual distances may be used to convey the relative difference. The distances do not have to be completely accurate as long as the relative distances are correct. Responses that mention ONLY the great distance of Jupiter OR the close distance of the Moon without comparative language are also scored as correct.

Correct Response

- Refers to the greater distance of Jupiter and/or the shorter distance of the Moon (from Earth), implicitly or explicitly.
 - Examples: Jupiter is farther away from Earth than the Moon.
 - The Moon is much closer than Jupiter.
 - Jupiter is farther.
 - It (Jupiter) is a long distance from Earth.
 - Because Jupiter is so far away.
 - The Moon is so close to the Earth that it looks bigger.
- Other correct.

Incorrect Response

- Refers to distance but explanation does not clearly communicate the effect of Jupiter's or the Moon's distance on the appearance of size.
- Examples: Because of distance.
 - Jupiter's moons are closer.
- Refers to the Moon being further, or Jupiter being closer to Earth.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

England	92	
Netherlands	88	
Estonia	86	
Australia	86	
New Zealand	86	
United States	85	
Russian Federation	84	
Korea, Republic of	83	
Norway	83	
Scotland	83	
Belgium (Flemish)	82	
Sweden	81	
Singapore	81	
Hungary	77	
Italy	76	
Moldova, Rep. of	76	
Hong Kong, SAR	76	
Japan	75	
Latvia	75	
Slovenia	74	
Armenia	72	
Lithuania	72	
Malaysia	70	
Chinese Taipei	67	0
Slovak Republic	66	0
Jordan	66	0
Indonesia	66	0
Israel	66	0
International average	65	
Palestinian Nat'l Auth.	64	0
Bulgaria	64	0
Iran, Islamic Republic of	63	0
Bahrain	62	0
Cyprus	61	0
Serbia and Montenegro	56	• • •
Chile	55	
Tunisia	52	
Macedonia, Republic of	47	
Romania	45	
Egypt	42	
Saudi Arabia	41	
Morocco	40	-
Philippines	39	
Lebanon	35	_
Botswana	18 12	* * * *
South Africa	13	-
Ghana	8	•

Country avera International a	
Higher	▲
Not different	○
Lower	▼

Appearance of Jupiter and Moon (continued)

Item Number: S022283

Student Responses

Correct Response:

The planet Jupiter is bigger than Earth's moon but it appears to be smaller when viewed from Earth. Why is this?

Because the moon is closer than Jupiter 50 뉝 bigger. looks Earth \mathcal{O}

Incorrect Response:

The planet Jupiter is bigger than Earth's moon but it appears to be smaller when viewed from Earth. Why is this?

Because the moon is far away from the Earth.

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and Universe	Conceptual Understanding

Why the moon changes shape

The shape of the moon appears to change regularly during each month. Which of the following best explains why the shape of the moon appears to change?

- The Earth turns on its axis. (A)
- The Moon turns on its axis. (B)
- The Moon orbits around the Earth. \bigcirc
- Clouds cover the Moon. (D)

Item Number: S032437

Correct Response:

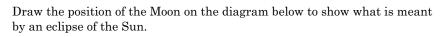
С

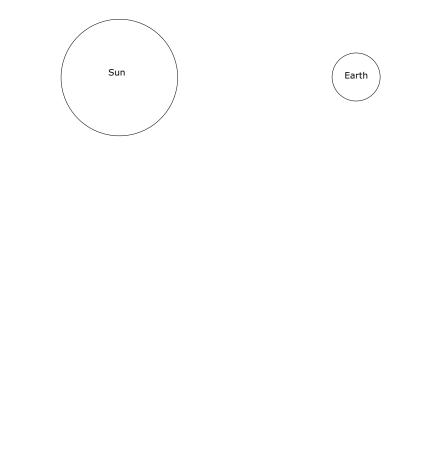
Hong Kong, SAR	72	
Malaysia	63	
Japan	58	
Singapore	58	
New Zealand	58	
Korea, Republic of	58	
Chinese Taipei	57	
Norway	56	
Hungary	55	
Estonia	54	
Serbia and Montenegro	54	
Australia	54	0
Bahrain	53	0
Sweden	53	0
Chile	53	0
Bulgaria	53	0
Scotland	53	0
Philippines	53	0
England	52	0
Egypt	52	0
United States	51	0
Armenia	51	0
Lithuania	51	0
Lebanon	50	0
International average	50 49	0
	50	0
International average Iran, Islamic Republic of	50 49	
International average Iran, Islamic Republic of Italy	50 49 49	0
International average Iran, Islamic Republic of Italy Jordan	50 49 49 49	0
International average Iran, Islamic Republic of Italy Jordan Netherlands	50 49 49 49 49	0 0 0
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel	50 49 49 49 48 47	0 0 0
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia	50 49 49 49 48 47 47	0 0 0 0 0
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia	50 49 49 48 47 47 47	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth.	50 49 49 48 47 47 47 47	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish)	50 49 49 48 47 47 47 47 47	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of	50 49 49 48 47 47 47 47 47 46 45	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia	50 49 49 48 47 47 47 47 47 45 45	0 0 0 0 0
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic	50 49 49 49 48 47 47 47 47 45 45 45 45	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana	50 49 49 48 47 47 47 47 46 45 45 45 45 45 44	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation	50 49 49 49 48 47 47 47 47 45 45 45 45 45	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus	50 49 49 48 47 47 47 47 46 45 45 45 45 45 44 43	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus Romania	50 49 49 48 47 47 47 47 46 45 45 45 45 44 43 43 42	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus Romania Macedonia, Republic of	50 49 49 48 47 47 47 47 46 45 45 45 45 44 43 43 42 41	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus Romania Macedonia, Republic of South Africa	50 49 49 48 47 47 47 47 46 45 45 45 45 44 43 43 42	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus Romania Macedonia, Republic of South Africa Morocco	50 49 49 48 47 47 47 47 46 45 45 45 45 43 43 42 41 40	
International average Iran, Islamic Republic of Italy Jordan Netherlands Israel Slovenia Palestinian Nat'l Auth. Saudi Arabia Belgium (Flemish) Moldova, Rep. of Latvia Slovak Republic Russian Federation Ghana Cyprus Romania Macedonia, Republic of South Africa Morocco Botswana	50 49 49 48 47 47 47 47 45 45 45 45 45 43 43 42 41 40 39	

Country average vs. International average:	
Higher	
Not different	0
Lower	V

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and Universe	Conceptual Understanding

Position of the moon during solar eclipse





Item Number: S032532

SCORING

Note: To receive credit, the Moon should be located between the Earth and the Sun within the shaded region shown in the diagram below. Responses may also show the shadow cast by the Moon on Earth. Credit should be given for responses based on the correct position of the Moon even if incorrect shadows are shown. Because it is not explicitly required in the item, errors in the relative size or distance of the moon will not be considered.

Correct Response

• Moon is located between the Sun and Earth within the shaded region.

Incorrect Response

- · Moon is drawn on the other side of Earth (lunar eclipse).
- · Moon is drawn overlapping the Sun (concentric or partially "eclipsed" circles).
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Armenia	93	
Malaysia	79	
Hong Kong, SAR	76	
Singapore	70	
New Zealand	69	
Australia	68	
Estonia	66	
United States	66	
England	64	
Netherlands	63	
Sweden	63	
Chinese Taipei	62	
Japan	61	
Iran, Islamic Republic of	61	
Italy	61	
Slovak Republic	60	
Latvia	60	
Korea, Republic of	59	
Hungary	59	0
Russian Federation	59	0
Jordan	58	0
Bulgaria	58	0
Serbia and Montenegro	57	0
Palestinian Nat'l Auth.	57	0
Scotland	56	0
Indonesia	56	0
Israel	55	0
Norway	55 54	0
International average	53	0
Slovenia	52	0
Bahrain	52	0
Belgium (Flemish)	52	0
Romania	49	0
Saudi Arabia	46	▼
Philippines	44	.
Cyprus	43	• • •
Egypt	42	÷
Chile	41	÷.
Lithuania	40	÷
Moldova, Rep. of	35	÷
Lebanon	33	÷.
Macedonia, Republic of	33	-
Tunisia	32	-
		.
Morocco	22	-
Ghana	19 17	* * *
Botswana	17 17	-
South Africa	17	

Country average vs. International average:	
Higher	
Not different	0
Lower	V

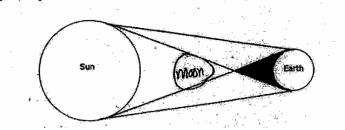
Position of the moon during solar eclipse (continued)

Item Number: S032532

Student Responses

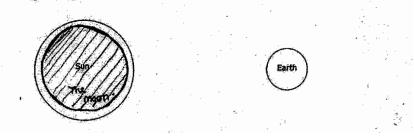
Correct Response:

Draw the position of the Moon on the diagram below to show what is meant by an eclipse of the Sun.



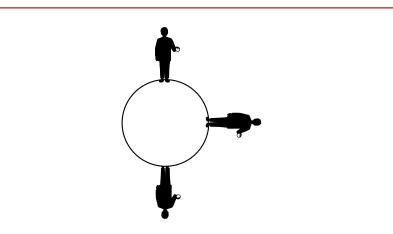
Incorrect Response:

Draw the position of the Moon on the diagram below to show what is meant by an eclipse of the Sun.



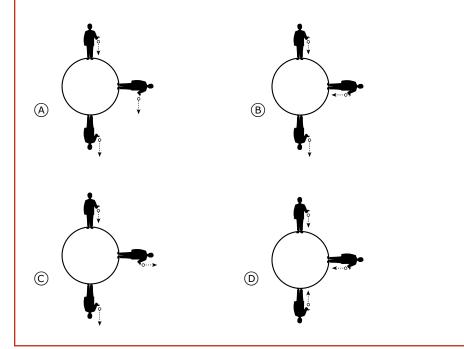
Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and Universe	Conceptual Understanding

Direction dropped ball will fall



The diagram above shows a person holding a ball standing at three different places on Earth. If the person drops the ball, gravity will make it fall.

Which of the following diagrams best shows the direction the dropped ball will fall at the three different positions?



Item Number: S032714

Correct Response: D

Japan	92	
Estonia	91	
Korea, Republic of	90	
Hungary	88	
Sweden	87	
Netherlands	87	
Malaysia	86	
Chinese Taipei	86	
Norway	84	
Slovenia	83	
Russian Federation	82	
Lithuania	81	
New Zealand	81	
Hong Kong, SAR	81	
Latvia	80	
Singapore	80	
Slovak Republic	80	
Australia	79	
Serbia and Montenegro	78	
England	78	
Belgium (Flemish)	77	
United States	75	
Scotland	73	0
Armenia	72	0
Lebanon	72	0
Lebanon Italy	72 71	0 0
		-
Italy	71	-
Italy International average	71 70	0
Italy International average Romania	71 70 70	0
Italy International average Romania Iran, Islamic Republic of	71 70 70 67	0
Italy International average Romania Iran, Islamic Republic of Bahrain	71 70 67 67	0 0 0 0 0 0
Italy International average Romania Iran, Islamic Republic of Bahrain Jordan Moldova, Rep. of Israel	71 70 67 67 66	
Italy International average Romania Iran, Islamic Republic of Bahrain Jordan Moldova, Rep. of	71 70 67 67 66 66	0 0 0 0 0 0 0 0
Italy International average Romania Iran, Islamic Republic of Bahrain Jordan Moldova, Rep. of Israel	71 70 67 67 66 66 65	
Italy International average Romania Iran, Islamic Republic of Bahrain Jordan Moldova, Rep. of Israel Philippines	71 70 67 66 66 65 65	0 0 0 0 0 0 0 0
Italy International average Romania Iran, Islamic Republic of Bahrain Jordan Moldova, Rep. of Israel Philippines Indonesia Bulgaria Botswana	71 70 67 66 66 65 65 65 62	
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Country average vs. International average:	
Higher	
Not different	0
Lower	\blacksquare

TIMSS 2003 8th-Grade Science Concepts and Science Iter			
Content Domain	Main Topic	Cognitive Doma	in
EARTH SCIENCE	Earth in the Solar System and Universe	Factual Knowled	ge
Sun is an example of a star		Overall Percent	Correct
The Sun is an example of which of the (A) comet (B) planet (C) galaxy (D) star	following?	Italy New Zealand Slovak Republic Sweden United States Australia Chile Bulgaria England Serbia and Montenegro Norway Scotland Lithuania Latvia Russian Federation Estonia Slovenia Belgium (Flemish) Netherlands Hong Kong, SAR	90 A 87 A 86 A 84 A 83 A 83 A 83 A 83 A 83 A 80 A 79 A 79 A 77 A 65 A 65 A 65 A 65 A 65 A
		Macedonia, Republic of Jordan Moldova, Rep. of Romania International average Bahrain Philippines Hungary Singapore Malaysia Chinese Taipei	62 O 61 O 60 O 60 O 59 O 58 O 56 V 54 V 52 O
Item Number: S032150		Iran, Islamic Republic of Palestinian Nat'l Auth. Egypt Armenia Lebanon Cyprus Botswana South Africa Indonesia Japan Saudi Arabia Ghana Morocco Korea, Republic of	52 ▼ 52 ▼ 51 ▼ 48 ▼ 47 ▼ 43 ▼ 41 ▼ 40 ▼ 37 ▼ 33 ▼ 29 ▼ 29 ▼
Correct Response: D		Israel Tunisia	26 V 9 V

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and Universe	Reasoning and Analysis

The surface temperatures of Venus and Mercury

	Average Surface Temperature (°C)	Atmospheric Composition	Mean Distance from the Sun (millions of km)	Time to Revolve Around the Sun (Number of Days)
Venus	470	Mostly Carbon Dioxide	108	225
Mercury	300	Trace amounts of gases	58	88

Which of the following best explains why the surface temperature of Venus is higher than that of Mercury?

- There is less absorption of sunlight on Mercury because of the lack of (A) atmospheric gases.
- (B) The high percentage of carbon dioxide in the atmosphere of Venus causes a greenhouse effect.
- The longer time for Venus to revolve around the Sun allows it to (C) absorb more heat from the Sun.
- The Sun's rays are less direct on Mercury because it is closer to (D) the Sun.

Item Number: S032301

Correct Response:

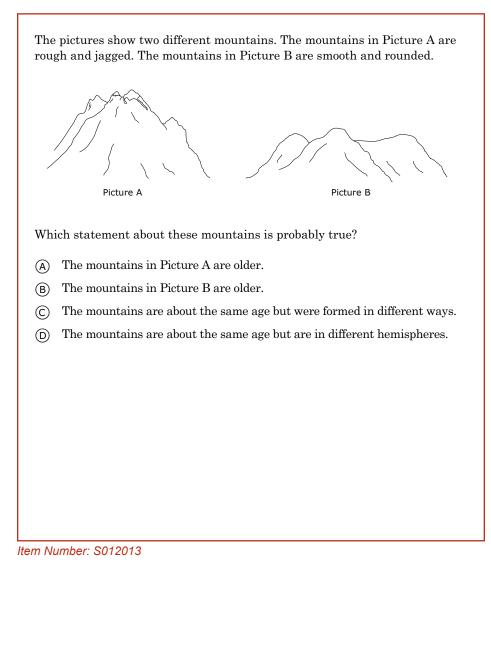
В

Korea, Republic of	70	
Hong Kong, SAR	69	
Chinese Taipei	69	
Singapore	60	
United States	49	
Australia	48	
Japan	47	
Egypt	46	
Sweden	46	
New Zealand	45	
England	44	
Lithuania	44 44	
Estonia	44 43	
Israel	45 41	
	41	
Hungary Scotland	41	0
	40 39	0
Slovenia	55	
Latvia	38	0
Italy	38	0
Netherlands	38	0
Slovak Republic	38	0
Belgium (Flemish)	38	0
Russian Federation	37	0
International average	36	
Serbia and Montenegro	34	0
Serbia and Montenegro Norway	34 34	0
Serbia and Montenegro Norway Iran, Islamic Republic of	34 34 33	0
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Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Conceptual Understanding

True statement of mountain age



Correct Response:

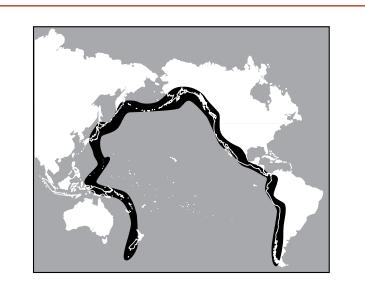
В

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	Chile Indonesia Saudi Arabia	11 7 5	• • •

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Conceptual Understanding

Pacific Ring of Fire



The diagram above shows the Pacific Ring of Fire. Earthquakes and volcanic activity occur along the Ring of Fire. Which of the following best explains why?

- (A) It is located at the boundaries of tectonic plates.
- (B) It is located at the boundary of deep and shallow water.
- (C) It is located where the major ocean currents meet.
- (D) It is located where ocean temperature is the highest.

Α

Item Number: S032656

Correct Response:

Sweden		
	82	
Hong Kong, SAR	77	
England	77	
Russian Federation	76	
Scotland	75	
Lithuania	75	
Japan	74	
Latvia	71	
United States	71	
Chinese Taipei	70	
Italy	70	
Estonia	69	
Slovak Republic	66	
New Zealand	64	
Australia	64	
Netherlands	63	
Singapore	63	
Slovenia	62	
Korea, Republic of	62	
Romania	62	
Norway	60	
Bulgaria	56	
Cyprus	54	
Hungary	54	
Moldova, Rep. of	53	
Iran, Islamic Republic of	52	
International average	48	
Chile	44	▼
Israel	42	
Israel Armenia	42 42	•
		▼ ▼ ▼
Armenia	42	• • •
Armenia Macedonia, Republic of	42 38	* * *
Armenia Macedonia, Republic of Serbia and Montenegro	42 38 37	* * * *
Armenia Macedonia, Republic of Serbia and Montenegro Philippines Indonesia	42 38 37 34	* * * * *
Armenia Macedonia, Republic of Serbia and Montenegro Philippines	42 38 37 34 33	 * *<
Armenia Macedonia, Republic of Serbia and Montenegro Philippines Indonesia Belgium (Flemish)	42 38 37 34 33 31	 <
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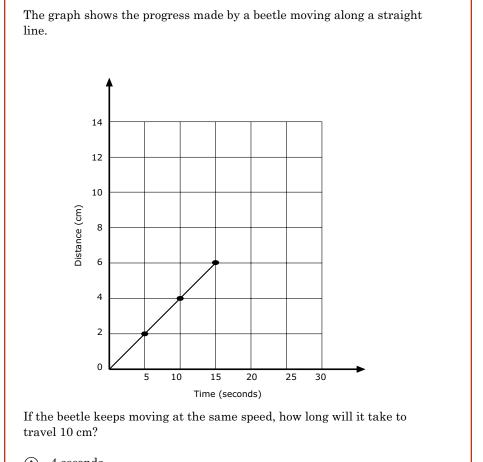
Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Doma	in
EARTH SCIENCE	Earth Processes, Cycles and History	Factual Knowledge	
Substance NOT a fossil fuel		Overall Percent	Correct
 Which is NOT a fossil fuel? (A) Coal (B) Oil (C) Wood (D) Natural gas 		Lithuania Chinese Taipei Malaysia Bahrain Bulgaria Singapore Jordan Netherlands Estonia Belgium (Flemish)	87 ▲ 87 ▲ 86 ▲ 83 ▲ 83 ▲ 77 ▲ 76 ▲ 74 ▲ 72 ▲
		Armenia Korea, Republic of United States Russian Federation Slovak Republic Japan Hong Kong, SAR Palestinian Nat'l Auth. Indonesia Moldova, Rep. of	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
		England Scotland Serbia and Montenegro Italy International average Slovenia	64 0 64 0 63 0 62 0 62 0 61 0
		Botswana Egypt Romania Tunisia Australia Philippines Latvia	61 ○ 60 ○ 59 ○ 58 ○ 57 ○ 57 ▼ 56 ▼
ltem Number: S012018		Lebanon Chile Sweden New Zealand Saudi Arabia Israel Iran, Islamic Republic of Morocco	55 ▼ 55 ▼ 54 ▼ 53 ▼ 52 ▼ 52 ▼ 52 ▼ 52 ▼ 52 ▼ 46 ▼
Correct Response: C		Macedonia, Republic of Norway Ghana Cyprus South Africa Hungary	39 ▼ 36 ▼ 35 ▼ 33 ▼ 25 ▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Factual Knowledge

Rock at bottom of lake/ocean



- (A) 4 seconds
- B 6 seconds
- \bigcirc 20 seconds
- \bigcirc 25 seconds

Item Number: S012041

Correct Response:

С

Lithuania	89	
Hungary	88	
Korea, Republic of	85	
Hong Kong, SAR	85	
Estonia	85	
Chinese Taipei	80	
Iran, Islamic Republic of	80	
Tunisia	74	
Japan	74	
England	71	
Latvia	70	
Armenia	70	
Morocco	68	
Israel	65	
Singapore	65	
Russian Federation	65	
Jordan	65	
Bahrain	64	
United States	60	
Palestinian Nat'l Auth.	57	0
Italy	56	0
International average	54	
Philippines	52	0
Australia	52	0
		-
Moldova, Rep. of	52	0
Moldova, Rep. of Saudi Arabia	52 51	0
Moldova, Rep. of Saudi Arabia Egypt	52 51 50	0 0 0
Moldova, Rep. of Saudi Arabia Egypt Slovenia	52 51 50 47	0
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro	52 51 50 47 44	0 0 0 V
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland	52 51 50 47 44 44	
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands	52 51 50 47 44 44 43	0 0 0 V
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania	52 51 50 47 44 44 43 43	0 0 7 7 7 7
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus	52 51 50 47 44 43 43 43 41	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia	52 51 50 47 44 43 43 43 41 41	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon	52 51 50 47 44 43 43 43 41 41 40	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria	52 51 50 47 44 43 43 41 41 40 39	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand	52 51 50 47 44 43 43 43 41 41 40 39 37	0 0 7 7 7 7
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana	52 51 50 47 44 43 43 41 41 40 39 37 36	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden	52 51 50 47 44 43 43 41 41 40 39 37 36 34	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden	52 51 50 47 44 43 43 41 41 40 39 37 36 34	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34	
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana Slovak Republic	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34 31	
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana Slovak Republic Norway	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34 31 28	
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana Slovak Republic Norway Indonesia	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34 31 28 27	
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana Slovak Republic Norway Indonesia Belgium (Flemish)	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34 31 28 27 26	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Moldova, Rep. of Saudi Arabia Egypt Slovenia Serbia and Montenegro Scotland Netherlands Romania Cyprus Malaysia Lebanon Bulgaria New Zealand Botswana Sweden Ghana Slovak Republic Norway Indonesia Belgium (Flemish) Macedonia, Republic of	52 51 50 47 44 43 43 41 41 40 39 37 36 34 34 31 28 27 26 22	

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Factual Knowledge
ossil fuels		Overall Percent Corre
Fossil fuels were formed from		Jordan 82
		Singapore 81 Chinese Taipei 79
(A) volcanoes		Hong Kong, SAR 77
-		England 71
9		Indonesia 69
© gases in the atmosphere		Iran, Islamic Republic of 67
D water trapped inside rocks		Serbia and Montenegro 66
		United States 65
		Estonia 64
		Botswana 61
		Macedonia, Republic of 59
		Italy 57
		Hungary 57 Sweden 57
		Scotland 56
		Lithuania 56
		Korea, Republic of 56
		Slovenia 54
		Bulgaria 53
		Romania 53
		Norway 52
		International average 52
		Armenia 51
		Japan 51
		Netherlands 51
		Egypt 50
		Palestinian Nat'l Auth. 49 Slovak Republic 48
		New Zealand 46
		Australia 46
		Israel 45
		Malaysia 45
		Belgium (Flemish) 45
		Latvia 44
n Number: S022074		Russian Federation 43
-		Moldova, Rep. of 43
		Lebanon 42
		Philippines 41
		Bahrain 39
		Chile 35
		Saudi Arabia 26
		Tunisia 22
		South Africa 22
		Cyprus 21
		Ghana 19

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

0

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Morocco

Correct Response:

В

119

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Reasoning and Analysis

Time/temperature table

The table gives the temperature at a certain place at different times of the day for three days.

	6 a.m.	9 a.m.	12 noon	3 p.m.	6 p.m.
Monday	$15^{\circ}\mathrm{C}$	$17^{\circ}\mathrm{C}$	$20^{\circ}\mathrm{C}$	$21^{\circ}\mathrm{C}$	19°C
Tuesday	$15^{\circ}\mathrm{C}$	$15^{\circ}\mathrm{C}$	$15^{\circ}\mathrm{C}$	$5^{\circ}\mathrm{C}$	$4^{\circ}\mathrm{C}$
Wednesday	8°C	$10^{\circ}\mathrm{C}$	$14^{\circ}\mathrm{C}$	$14^{\circ}\mathrm{C}$	$13^{\circ}\mathrm{C}$

When did the wind become much colder?

- (A) Monday morning
- Monday afternoon (B)
- © Tuesday morning
- Tuesday afternoon (D)
- (E) Wednesday afternoon

Item Number: S012027

Correct Response:

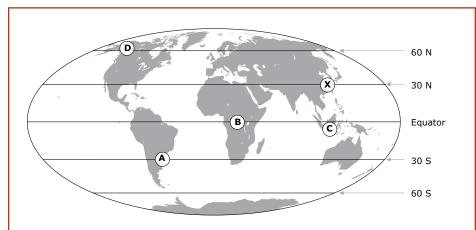
D

Japan	96	
Netherlands	93	
Hungary	93	
Australia	92	
Sweden	89	
Streden	89	
Singapore Belgium (Flemish)	89 89	
-	88	
England		
New Zealand	87	
Korea, Republic of	87	
Hong Kong, SAR	87	A
Chinese Taipei	87	
Estonia	87	
Malaysia	85	
Slovenia	84	
United States	84	
Israel	83	
Italy	83	
Scotland	82	
Serbia and Montenegro	82	
Latvia	82	
Bulgaria	79	
Slovak Republic	79	
Cyprus	76	
Lithuania	76	0
Chile	76	0
Norway	75	0
Macedonia, Republic of	75	0
International average	73	
Romania	71	0
Jordan	69	0
Tunisia	69	
Moldova, Rep. of	68	0
Russian Federation	68	•
Morocco	65	
Bahrain	63	▼ ▼ ▼
Palestinian Nat'l Auth.	60	.
Lebanon	57	÷
Iran, Islamic Republic of	56	÷
Indonesia	44	. <u>.</u>
		-
Egypt	43 20	-
Armenia Saudi Arabia	39 26	-
Saudi Arabia	36	-
Botswana	35	-
Philippines	33	• • •
South Africa	26	_
Ghana	0	•

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth Processes, Cycles and History	Reasoning and Analysis

Map of the world with lines of latitude



The diagram above shows a map of the world with the lines of latitude marked. Which of the following places marked on the map is most likely to have an average yearly temperature similar to location \mathbf{X} ?

- location A (A)
- (B) location B
- location C \bigcirc
- (D) location D

Item Number: S032652

Correct Response:

Α

Estonia Netherlands	73	
Netherlands	70	
	70	
Hungary	68	
Malaysia	67	
Chinese Taipei	65	
Korea, Republic of	64	
Slovak Republic	64	
Singapore	63	
Sweden	61	
Slovenia	58	
Italy	57	
Australia	55	
Latvia	53	
England	53	0
Moldova, Rep. of	53	0
United States	51	
Serbia and Montenegro	51	0
Hong Kong, SAR	51	0
Japan	49	0
, Belgium (Flemish)	49	0
New Zealand	49	0
Macedonia, Republic of	49	0
Israel	48	0
Bulgaria	48	0
Indonesia	48	0
International average	48	
Russian Federation	46	0
Romania	45	0
Jordan	45	0
Iran, Islamic Republic of	44	▼
Scotland	44	0
Bahrain	43	▼
Norway	42	▼
Cyprus	42	* * * *
Lithuania	42	▼
Chile	41	▼
Palestinian Nat'l Auth.	39	▼
Philippines	39	▼
Armenia	37	▼
Saudi Arabia	35	▼
Egypt	35	▼
Lebanon	34	▼
Morocco	30	▼
Ghana	26	▼
Botswana	25	▼
	21	
South Africa	21	
Morocco Ghana Botswana	30 26 25	* * *

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Structure and Physical Features	Factual Knowledge
one in underground caves		Overall Percent Corr
Most underground caves are formed by	y the action of water on	Slovenia 91
hibst underground caves are formed by	y the action of water on	Slovak Republic 85 Hungary 85
(A) granite		Korea, Republic of 78
0		Chinese Taipei 75
\bigcirc		Serbia and Montenegro 74
© sandstone		Cyprus 63
D shale		Netherlands 62
		Belgium (Flemish) 59
		Bulgaria 58
		Romania 58 Italy 57
		Sweden 56
		Malaysia 55
		England 53
		Macedonia, Republic of 53
		Lebanon 52
		Singapore 47
		Israel 46
		International average 46 Norway 45
		Norway 45 United States 45
		Estonia 44
		Australia 41
		Bahrain 40
		Russian Federation 40
		New Zealand 40
		Morocco 40
		Scotland 38
		Philippines 37
		Chile 36 Ghana 36
		Moldova, Rep. of 35
		Botswana 35
		Jordan 32
Number: S012030		Iran, Islamic Republic of 31
		Armenia 30
		Egypt 30
		Lithuania 29
		Indonesia 28
		Japan 26
		Hong Kong, SAR 25
		Hong Kong, SAR25South Africa24
		Hong Kong, SAR25South Africa24Latvia24
		Hong Kong, SAR25South Africa24

Country avera	•
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Doma	in	
EARTH SCIENCE	Earth's Structure and Physical Features	Factual Knowled	ge	
oundance of gases in atmosphe	ere	Overall Percent	Corı	re
	1 1	Chinese Taipei	56	_
Three gases found in Earth's atmosphe oxygen. What is their order of abundan		Hong Kong, SAR Japan	56 49	
(A) nitrogen, oxygen, carbon dioxide		Armenia	44	
0		Estonia Slovak Republic	44 43	
B nitrogen, carbon dioxide, oxygen		Palestinian Nat'l Auth.	43	
© oxygen, nitrogen, carbon dioxide		Hungary	40	
0		Singapore	39	
D carbon dioxide, oxygen, nitrogen		Bulgaria	38	
		Korea, Republic of	36	
		Malaysia	34	
		Romania	32	
		Macedonia, Republic of	31	
		Russian Federation	31	
		Slovenia	30	
		Israel	30	
		Scotland	29	
		Philippines	29	
		Egypt Serbia and Montenegro	28 28	
		International average	28	
		England	27	
		Lithuania	27	
		Latvia	26	
		Indonesia	26	
		Italy	23	
		Ghana	23	
		Moldova, Rep. of	22	
		Saudi Arabia	22	
		Jordan	21	
		Lebanon	21	
		United States	21	
		Netherlands	21	
Number 202225		Norway New Zealand	20	
n Number: S022275		New Zealand Bahrain	20 19	
		Australia	19	
		Sweden	18	
		Botswana	18	
		Cyprus	17	
		Morocco	16	
		South Africa	15	
		Iran, Islamic Republic of	13	
		Belgium (Flemish)	12	
		Chile	11	
		Cline		

Country avera	
Higher	
Not different	0
Lower	•

123

Content Domain	Main Topic	Cognitive Doma	in
EARTH SCIENCE	Earth's Structure and Physical Features	Reasoning and Ana	llysis
anges in river shape/speed		Overall Percent	Corre
 A small, fast-moving river is in a V-shamountain. If you follow the river to wh will the river most likely look like commountain? (A) Much the same (B) Deeper and faster (C) Slower and wider (D) Straighter 	ere it passes through a plain, what	Japan Russian Federation Estonia Netherlands Chinese Taipei Slovenia Slovak Republic Hungary Belgium (Flemish) Sweden Latvia Norway Israel Singapore Romania Korea, Republic of	84 79 74 73 71 71 68 66 65 65 63 62 62 61 50
		Iran, Islamic Republic of Australia Italy Malaysia United States England Bulgaria Serbia and Montenegro Scotland International average	59 58 57 57 57 56 52 52 52 52
		Indonesia New Zealand Moldova, Rep. of Lithuania Armenia Hong Kong, SAR Macedonia, Republic of Chile	52 50 50 49 48 46 44
n Number: S012006		Cyprus Morocco Jordan Tunisia Philippines Botswana Palestinian Nat'l Auth.	37 37 36 36 33 31 27

С

Country average vs. International average: Higher Not different 0

Lower

Egypt

Saudi Arabia

22

15

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Content Domain	Main Topic	Cognitive Doma	in
ENVIRONMENTAL SCIENCE	Changes in Environment	Factual Knowled	ge
creased carbon dioxide in atm	osphere	Overall Percent	Correc
The burning of fossil fuels has increas	sed the carbon dioxide content of the	Singapore Japan	83 80
atmosphere. What is a possible effect dioxide is likely to have on our planet	that the increased amount of carbon	Hong Kong, SAR Netherlands	72 71
		Malaysia	67
A warmer climate		Sweden	66
0		Korea, Republic of	65
B A cooler climate		England	65
C Lower relative humidity		Australia	64
D More ozone in the atmosphere		Norway	62
D More ozone in the atmosphere		Chinese Taipei	62
		Scotland	62
		Estonia	58
		United States	56
		New Zealand	56 4 56 4
		Hungary Indonesia	56 4 52 4
		Israel	52
		Italy	48
		Latvia	47
		Moldova, Rep. of	46
		Belgium (Flemish)	45 (
		International average	45
		Iran, Islamic Republic of	45
		Slovenia	44
		Russian Federation	43
		Bulgaria	43
		Slovak Republic	43
		Cyprus Chile	42 40
		Romania	40 ' 40 '
		Macedonia, Republic of	40 35 '
		Armenia	35 '
		Lithuania	34 '
		Philippines	32
n Number: S012017		Morocco	32
		Serbia and Montenegro	30
		Botswana	27
		South Africa	23
		Lebanon	21
		Jordan Ghana	21 ` 21 `
		Bahrain	18
		Egypt	17
		Tupicio	17

e: A

Country average vs. International average:

17

15

11

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Higher	
Not different	0
Lower	•

Tunisia

Saudi Arabia

Palestinian Nat'l Auth.

Content Domain	Main Topic	Cognitive Doma	in
ENVIRONMENTAL SCIENCE	Changes in Environment	Factual Knowled	ge
ain cause of acid rain		Overall Percent	Corı
One of the main causes of acid rain is		Chinese Taipei Singapore	67 61
		Hong Kong, SAR	56
(A) Waste from nuclear power plants		Malaysia	51
B Spills from chemical manufacturi	ng plants	Lithuania	49
0		Slovenia	47
© Gases from burning fossil fuels		England	46
D Gases from aerosol spray cans		Korea, Republic of	40
		Bulgaria Tunisia	40 39
		Scotland	39
		Japan	38
		Jordan	38
		Cyprus	37
		Egypt	36
		Botswana	35
		Australia	35
		United States	35
		Armenia	34
		Estonia	34 33
		International average Latvia	32
		Slovak Republic	32
		Indonesia	31
		Palestinian Nat'l Auth.	30
		Hungary	29
		South Africa	29
		Sweden	28
		New Zealand	27
		Saudi Arabia	27
		Philippines Serbia and Montenegro	27 26
		Ghana	26 26
		Iran, Islamic Republic of	26 26
		Romania	25
n Number: S022240		Netherlands	25
		Bahrain	25
		Chile	23
		Russian Federation	23
		Lebanon	23
		Israel	23
		Italy Moldova Rop of	20
		Moldova Pas at	10

С

Country average vs. International average: Lliah

19 🔻

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19 ▼ ▼

17

13

12

Moldova, Rep. of

Belgium (Flemish)

Macedonia, Republic of

Norway

Morocco

Higher	
Not different	0
Lower	

Content Domain	Main Topic	Cognitive Doma	in
ENVIRONMENTAL SCIENCE	Changes in Environment	Factual Knowled	ge
tivity to reduce air pollution in	a city	Overall Percent	Corr
Which of these daily activities can mo	st directly help reduce air pollution in	Korea, Republic of	91
a city?	st directly help reduce all pollution in	Hong Kong, SAR	84
a city:		Sweden	84
(A) turning down the volume on the	television	Singapore Chinese Taipei	81 79
0		Belgium (Flemish)	79 78
B using biodegradable materials		Netherlands	78
© using public transportation inste	ad of driving	New Zealand	76
0		Hungary	75
D recycling paper		England	75
		Scotland	73
		Australia	72
		Norway	68
		Iran, Islamic Republic of	67
		Italy	67
		United States	63
		Cyprus Japan	61 58
		Bahrain	57
		Slovenia	56
		Lithuania	56
		Jordan	56
		International average	55
		Moldova, Rep. of	55
		Russian Federation	53
		Malaysia	53
		Estonia	52
		Latvia Palestinian Nat'l Auth.	51 50
		Lebanon	50 49
		Slovak Republic	49 47
		Israel	46
		Saudi Arabia	44
		Chile	43
		Armenia	42
n Number: S032446		Philippines	42
		Morocco	41
		Romania Masadapia Bapublis of	38
		Macedonia, Republic of Serbia and Montenegro	38 36
		Tunisia	30 33
		Indonesia	31
		Bulgaria	25
		South Africa	24
		Chapa	24

С

Country average vs. International average: Higher .

Ghana

Egypt

Botswana

24

20

0

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Higher	
Not different	0
Lower	▼

Content Domain	Main Topic	Cognitive Doma	in
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Conceptual Understa	anding
onrenewable natural resource		Overall Percent	Correc
 Oil is an example of a natural resource another example of a nonrenewable another example of		Singapore Hong Kong, SAR Chinese Taipei England Korea, Republic of Scotland Jordan Italy Palestinian Nat'l Auth. Lebanon Bulgaria Estonia United States Slovenia Lithuania Romania Indonesia Moldova, Rep. of Netherlands Egypt Australia Hungary Saudi Arabia New Zealand International average Botswana Slovak Republic Russian Federation Malaysia Bahrain Norway Belgium (Flemish) Serbia and Montenegro Cyprus Israel Tunisia Armenia Latvia Japan Morocco	86 80 80 79 69 69 68 65 61 60 60 60 59 6 59 6 59 6 56 6 56 6 55 55 55 55 55 55 51 6 51 6 48 4 45 4 43 4 41 39 39 39

Country average International av	
Higher	
Not different	0
Lower	V

Content Domain	Main Topic	Cognitive Domain
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Conceptual Understanding

Renewable energy source

Write down one renewable energy source and describe one way that people make use of it.

Energy Source: _

Use:

Item Number: S032242

SCORING

Note: For credit, responses must name a renewable energy source or device and a use that indicates how the energy from the source/device is applied. Credit is NOT given for responses that name a renewable source/device with no or inadequate description of its use.

Correct Response

- Sun or sunlight (solar energy) with a correct description of its use. Examples: Sun. It is used to heat water by solar panels. Sunlight. It keeps us warm.
- Wind (windmills) with a correct description of its use. Examples: Windmills. Are for grinding corns or for pumping water. Wind turbines to generate electricity.
- Water (waves, tides, water wheels, etc.) with a correct description of its use. Examples: Tidal barrage. To generate electricity. Water. To generate electricity.
- Other correct.

Examples: Food. To give the body energy. Wood. It is used in wood stoves for cooking.

Incorrect Response

- Names any fossil fuel (e.g., coal, oil, gasoline). *Examples: Gas. You can use it for heating.*
- Names a renewable energy source/device with no or inadequate description of use. *Examples: Water. You can heat, freeze and melt it.*
 - Sunlight.
 - Windmill.
- Names "light" (without connection to the Sun) with or without a correct description of use. *Examples: Light energy. It help us to see.*

Light.

 Other incorrect (including crossed out/erased, stray marks, illegible or off task) *Examples: Electricity. Used for cooking. Batteries. To power a torch.*

Hong Kong, SAR64ASingapore47AEngland43AItaly41AJordan40ASlovak Republic38AChinese Taipei36ASlovenia35ASlovenia35APalestinian Nat'l Auth.34AHungary34ANew Zealand29OUnited States29OSoveden29OIsrael27OLebanon27OAustralia27OLatvia26OMalaysia26OIthuania26OMacedonia, Republic of27ORosain Federation23ORomania24OMacedonia, Republic of23OBelgium (Flemish)23OBahrain22VSerbia and Montenegro20VBulgaria19VPhilippines13VBulgaria13VPhilippines13VGhana12VJapan9VJapan9VMoldova, Rep. of2VMoldova, Rep. of2V			
Singapore47AEngland43AItaly41AJordan40ASlovak Republic38AChinese Taipei36AEstonia35ASlovenia35APalestinian Nat'l Auth.34AHungary34ANew Zealand32AScotland290United States290Israel270Lebanon270Itan, Islamic Republic of270Australia260Itatvia260Malaysia260Itatvia260Norway220Bahrain220Bahrain220Bulgaria19TPhilippines19TEgypt18TIndonesia17TSaudi Arabia12TSaudi Arabia12TSouth Africa7TSouth Africa7TSouth Africa7T	Hong Kong, SAR	64	
England43AItaly41AJordan40ASlovak Republic38AChinese Taipei36AEstonia35ASlovenia35APalestinian Nat'l Auth.34AHungary34ANew Zealand32AScotland29OUnited States29ASweden27OIsrael27OLebanon27ONetherlands27OIran, Islamic Republic of27OAustralia26OIthuania26OMalaysia26OIthuania25ORomania24ONorway22OBahrain22VSerbia and Montenegro20VBulgaria19VPhilippines19VEgypt18VIndonesia17VSaudi Arabia12VSaudi Arabia12VJapan9VMorocco4V			
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Country avera International av	•
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Renewable energy source (continued)

Item Number: S032242

Student Responses

Correct Response:

Write down one renewable energy source and describe one way that people make use of it.

Energy Source: Schlight Use: We use the schlight to power Sdar powercd things such as a calculator

Incorrect Response:

Write down one renewable energy source and describe one way that people make use of it.

Ener	gy Source:		Coal	
Use:	Coul	Can	be reused again and	
	again	01	your grill and also many	
	o the	itens,		

Content Domain	Main Topic	0 111 0	
		Cognitive Doma	in
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Conceptual Understa	anding
Group of renewable energy sou	rces	Overall Percent	Corre
 Which group of energy sources are A: (A) coal, oil, and natural gas (B) solar, oil, and geothermal (C) wind, solar, and tidal (D) natural gas, solar, and tidal (D) natural gas, solar, and tidal 	LL renewable?	Hong Kong, SAR Korea, Republic of Lithuania Singapore Hungary Chinese Taipei Estonia Italy England Slovenia Scotland Japan Russian Federation Malaysia Slovak Republic Sweden Latvia Netherlands Jordan United States Belgium (Flemish) Armenia New Zealand International average Cyprus Australia Bahrain Norway Romania Palestinian Nat'l Auth. Serbia and Montenegro Lebanon Egypt Bulgaria Indonesia Israel Moldova, Rep. of Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Iran, Islamic Republic of Iran, Islamic Republic of Chile Tunisia Philippines	84 4 77 4 76 4 76 4 74 4 73 4 73 4 73 4 73 4 73 4 70 4 68 4 63 4 60 5 55 5 53 5 50 5 50 4 40 4 30 2 28 8
Correct Response: C		Macedonia, Republic of Iran, Islamic Republic of Chile Tunisia	43 40 40 30

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Content Domain	Main Topic	Cognitive Domain
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Factual Knowledge

Overgrazing by livestock

Overgrazing of land by livestock contributes to a major problem. That problem is

- $\textcircled{\sc A}$ depletion of ground water
- B increased pollution
- © erosion of soil
- (D) acid rain

Item Number: S012005

Correct Response:

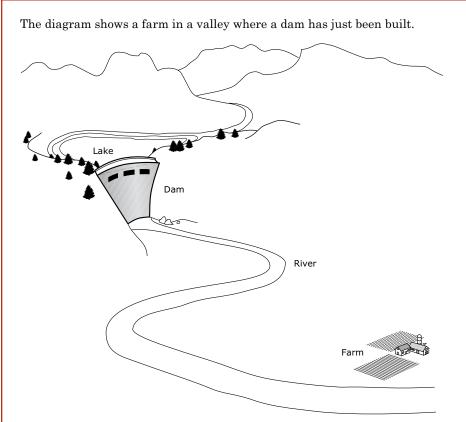
С

Chinese Taipei	88	
Botswana	80	
Malaysia	79	
Australia	74	
Netherlands	72	
Estonia	71	
	70	
Singapore	68	
Hong Kong, SAR Russian Federation	67	
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United States	65	
Hungary	64	
Romania	63	
Japan	63	
Indonesia	63	
Ghana	63	
Jordan	63	
Latvia	61	
Belgium (Flemish)	60	
England	60	0
Italy	59	0
Palestinian Nat'l Auth.	59	0
Morocco	57	0
Slovenia	57	0
Scotland	57	0
International average	56	
International average Norway	56 56	0
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Norway Iran, Islamic Republic of Bulgaria Armenia New Zealand Tunisia Slovak Republic Serbia and Montenegro Bahrain Macedonia, Republic of Cyprus Sweden Chile Philippines Lithuania Moldova, Rep. of	56 54 54 52 52 51 48 48 47 46 46 45 45 42	
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Content Domain	Main Topic	Cognitive Domain
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Reasoning and Analysis

Positive/negative effect of dam



The presence of the dam can have both positive and negative effects on farming in the valley.

- A. Describe one positive effect of the dam on farming.
- B. Describe one negative effect of the dam on farming.

Item Number: S022088A

Chinese Taipei	87	
Korea, Republic of	83	
Netherlands	82	
Belgium (Flemish)	79	
Hong Kong, SAR	78	
United States	77	
Japan	77	
Australia	75	
Iran, Islamic Republic of	74	
Estonia	74	
Singapore	72	
Slovenia	72	
Latvia	72	
Slovak Republic	72	
Malaysia	71	
New Zealand	71	
England	70	
Italy	67	
Norway	67	
Lithuania	65	
Romania	64	0
Jordan	63	0
Israel	61	0
Indonesia	61	0
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International average	60	<u> </u>
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International average	60	
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International average Macedonia, Republic of Cyprus	60 59 59	0
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Country average vs. International average:		
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Item Number: S022088A

SCORING

Codes for Positive Effects

Note: For credit, responses must clearly indicate a positive effect of the dam related to farming in the valley.

Correct Response

- · Mentions that the dam prevents flooding.
 - Examples: Without the dam, a big storm could cause a flood. There is no chance of flooding.

It slows down the river so it does not overflow and ruin the crops.

- Mentions that the dam controls the water supply.
- Examples: It stores water for the summer.
 - The dam releases just the right amount of water.
 - It brings more water closer to the farm.
 - It would be easier to irrigate.
- · Mentions a soil-related benefit of the dam.

Examples: More top soil.

Controls erosion.

The ground will be more fertile because of the large supply of water.

• Mentions the dam as a source of power. Examples: The farmer will have a good power supply.

The farm can use the hydroelectric power for energy.

• Other correct.

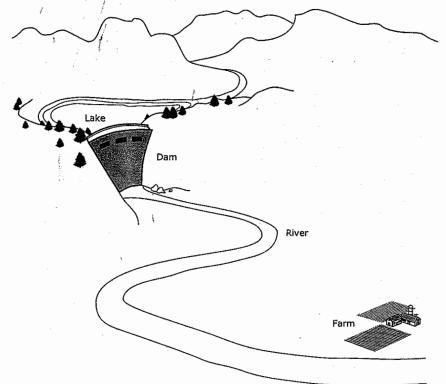
Incorrect Response

- Mentions a positive effect but does not clearly address the issue of farming or the effect of the dam.
- Examples: It provides better drinking water.
 - Water is good for the crops.
 - It makes the river small for swimming and fishing.
- · Gives a negative effect.
- Examples: It might prevent the farm from getting enough water. The water could become too high and overflow.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task)

Item Number: S022088A

Student Responses

Correct Response:



The diagram shows a farm in a valley where a dam has just been built.

The presence of the dam can have both positive and negative effects on farming in the valley.

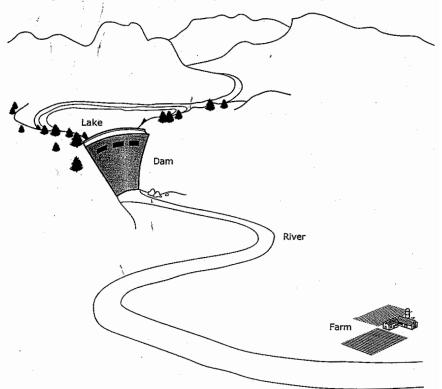
A. Describe one positive effect of the dam on farming. The Dan will prevent the river From Flooding the Farm:

Item Number: S022088A

Student Responses (continued)

Incorrect Response:

The diagram shows a farm in a valley where a dam has just been built.



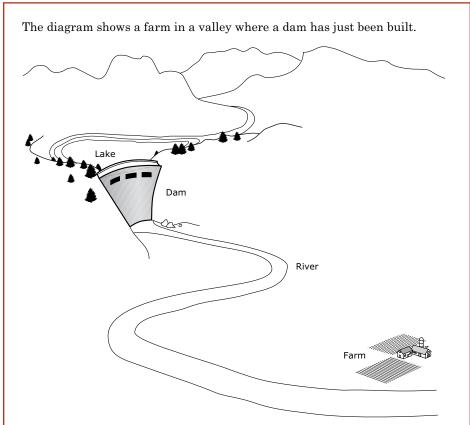
The presence of the dam can have both positive and negative effects on farming in the valley.

A. Describe one positive effect of the dam on farming.

theres more mousture in the ground

Content Domain	Main Topic	Cognitive Domain
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Reasoning and Analysis

Positive/negative effect of dam



The presence of the dam can have both positive and negative effects on farming in the valley.

- A. Describe one positive effect of the dam on farming.
- B. Describe one negative effect of the dam on farming.

Item Number: S022088B

Chinese Taipei	68	
Slovak Republic	64	
Netherlands	63	
Romania	62	
Estonia	61	
United States	59	
Belgium (Flemish)	57	
Latvia	57	
Hong Kong, SAR	57	
Israel	56	
New Zealand	55	
Slovenia	55	
Jordan	55	
Russian Federation	55 54	
Indonesia	53	
Norway	52	
Australia	51	
Iran, Islamic Republic of	50	
Bulgaria	50	
Lithuania	49	
Singapore	46	0
England	46	0
Malaysia	45	0
Bahrain	44	0
barnann	44	0
Italy	44	0
Italy International average		
	44	
International average	44 44	0
International average Korea, Republic of	44 44 41	0
International average Korea, Republic of Palestinian Nat'l Auth.	44 44 41 40	0
International average Korea, Republic of Palestinian Nat'l Auth. Armenia	44 44 41 40 39	0
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International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan	44 41 40 39 38 38	0
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden	44 41 40 39 38 38 38 38	0
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International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of	44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro	44 41 40 39 38 38 38 38 38 38 37 37 35 35 35 35 32	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile	44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 32 30	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus	44 44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 32 30 29	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt	44 44 41 40 39 38 38 38 38 38 38 38 37 35 35 35 35 35 35 32 30 29 26	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt Lebanon	44 44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 35 32 30 29 26 24	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt Lebanon Morocco	44 44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 35 32 30 29 26 24 21	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt Lebanon Morocco Botswana	44 44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 35 32 30 29 26 24 21 19	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt Lebanon Morocco Botswana Ghana	44 44 41 40 39 38 38 38 38 38 38 37 37 35 35 35 35 35 35 32 30 29 26 24 21 19 13	
International average Korea, Republic of Palestinian Nat'l Auth. Armenia Scotland Japan Macedonia, Republic of Sweden Philippines Hungary Saudi Arabia Tunisia Moldova, Rep. of Serbia and Montenegro Chile Cyprus Egypt Lebanon Morocco Botswana	44 44 41 40 39 38 38 38 38 38 38 38 37 37 35 35 35 35 35 35 32 30 29 26 24 21 19	

Country average vs. International average:		
Higher		
Not different	0	
Lower	▼	

Item Number: S022088B

SCORING

Codes for Negative Effects

Note: For credit, responses must clearly indicate a negative effect of the dam related to farming in the valley.

Correct Response

- Mentions the dam breaking (resulting in flooding).
 Examples: If the dam breaks it could flood the valley and the crops.
 If there is a leak, the whole dam could flood and destroy everything.
- Mentions the river drying up or decreasing water supply.
- Examples: No or less irrigation because the dam does not let the water flow through. The fields could dry out from too little water.
 - It slows the river too much and the farm will not have enough water.
- Mentions a soil-related problem of the dam. Examples: Nutrients not replenished by flooding. The rich nutrients from the water are not coming over the fields.
- Mentions upsetting the ecological balance. Examples: The dam could alter the ecology of the farm.
 - The dam might interfere with the farm's ecosystem.

Other correct.

Incorrect Response

 Mentions a negative effect but it does not clearly address the issue of farming or the effect of the dam.

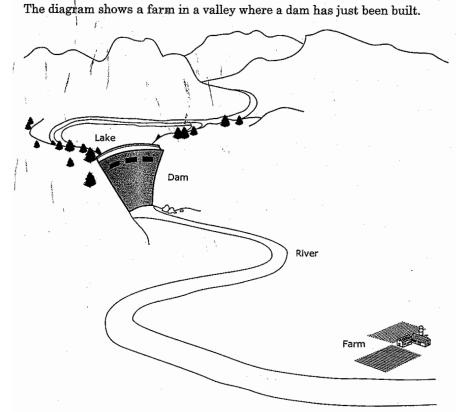
Examples: It bursts.

- It is now going to be a tourist attraction. Flooding. [Does not mention how the dam causes this.] A lot of fish will die because their habitat has been changed. The fish cannot swim upstream.
- Response indicates a misconception of how dams function (controlled release of water). *Examples: The lake could overflow the top of the dam.*
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Item Number: S022088B

Student Responses

Correct Response:



The presence of the dam can have both positive and negative effects on farming in the valley.

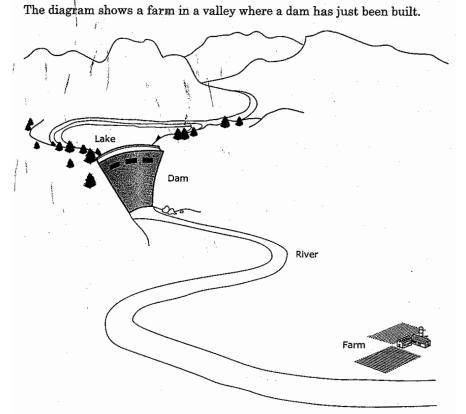
B. Describe one negative effect of the dam on farming.

It would slow down the over pressur and the minimus from up the river wouldn't be eroded to give the farm soil minimus,

Item Number: S022088B

Student Responses (continued)

Incorrect Response:



The presence of the dam can have both positive and negative effects on farming in the valley.

B. Describe one negative effect of the dam on farming.

It disturbs the nature of the farming and could drought.

Content Domain	Main Topic	Cognitive Domain
ENVIRONMENTAL SCIENCE	Use and Conservation of Natural Resources	Reasoning and Analysis

Drinking water from sea water

Sea water contains dissolved salts and is not suitable for drinking. Describe a procedure that can be used to obtain a cup of drinking water from a bucket of sea water.

Item Number: S032063

SCORING

Note: For full credit, responses must give a procedure that clearly indicates the method used to separate water from salt and collect the pure water. The most common procedure is the distillation method, but other correct procedures such as the freezing method or reverse osmosis method are possible. Partial credit should be given for responses that address at least the separation portion of the procedure. Responses that are based on boiling or filtering without indicating how separation of water and salt occurs are scored as incorrect.

Correct Response

- Describes a correct procedure that includes the following basic steps (may use diagrams):
 i) Boiling/evaporation to separate water from salt
 - ii) Collecting the distilled water (condensation)
 - Examples: Heat the salt water, catch the steam on a tray, drip it into a cup and the salt will be left in the bucket and drinking water in the cup.
 - Boil the sea water taking the steam up to a tube and letting steam turn back into water.
- Other fully correct.

Partially Correct Response

Describes boiling/evaporation step to separate water from salt; condensation step is omitted. *Examples: Maybe if you boiled the salt water the salt would separate from the water.*

Take the salt water and boil it and the steam will create great drinking water.

- · States 'distillation' or similar but no description of the process is given.
- Examples: The best way is to use a distillation apparatus. Distill it.
- · Other partially correct.

Incorrect Response

- Mentions boiling but with no or incorrect indication of separation included. [May also mention filtering or other processes.] *Examples: You can boil it.*
- Mentions filtering to separate salt. [Response not based on boiling.] *Examples: Make it go through a filter.*
- · Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Singapore	35	
Korea, Republic of	22	
Estonia	21	
Hong Kong, SAR	20	
Egypt	20	
Japan	19	
New Zealand	16	
Netherlands	15	
Australia	15	
England	14	
Jordan	13	
Iran, Islamic Republic of	12	
Lithuania	12	0
Latvia	11	0
	11	0
Russian Federation	11	0
Slovak Republic		0
Israel	11	
Scotland	10	0
Hungary	10	0
Palestinian Nat'l Auth.	10	0
Bahrain	10	0
Sweden	10	0
International average	10	
Armenia		
	9	0
Slovenia	8	0
Slovenia Norway	8 8	0
Slovenia Norway Chinese Taipei	8 8 7	0
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Slovenia Norway Chinese Taipei Italy Macedonia, Republic of	8 8 7 7 7	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia	8 8 7 7 7 7	0
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Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria	8 7 7 7 7 6 6	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco	8 7 7 7 7 6 6 6	0
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Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon	8 7 7 7 6 6 5 5 5 4 3	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish)	8 7 7 7 6 6 5 5 5 4	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon	8 7 7 7 6 6 5 5 5 4 3 3 3	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa	8 7 7 7 6 6 5 5 4 3 3 3 3 3	
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Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa Chile Serbia and Montenegro	8 7 7 7 6 6 5 5 4 3 3 3 2 2	
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa Chile Serbia and Montenegro Tunisia	8 7 7 7 6 6 5 5 4 3 3 3 2 2 2 2	
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa Chile Serbia and Montenegro Tunisia Ghana	8 7 7 7 6 6 5 5 4 3 3 3 2 2	
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa Chile Serbia and Montenegro Tunisia Ghana Indonesia Philippines	8 7 7 7 6 6 5 5 4 3 3 3 2 2 2 2	0
Slovenia Norway Chinese Taipei Italy Macedonia, Republic of Saudi Arabia United States Bulgaria Morocco Cyprus Romania Malaysia Belgium (Flemish) Lebanon South Africa Chile Serbia and Montenegro Tunisia Ghana Indonesia Philippines	8 7 7 7 6 6 5 5 4 3 3 2 2 2 1	

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

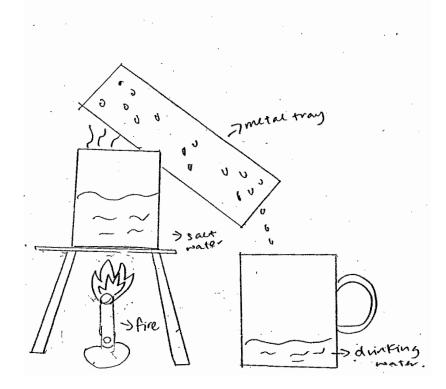
Drinking water from sea water (continued)

Item Number: S032063

Student Responses

Correct Response:

Sea water contains dissolved salts and is not suitable for drinking. Describe a procedure that can be used to obtain a cup of drinking water from a bucket of sea water.



Partially Correct Response:

Sea water contains dissolved salts and is not suitable for drinking. Describe a procedure that can be used to obtain a cup of drinking water from a bucket of sea water.

put gladwrap over the bucket and wait for the safe to evaporate, onto the lunchwrap.

Drinking water from sea water (continued)

Item Number: S032063

Student Responses (continued)

Incorrect Response:

Sea water contains dissolved salts and is not suitable for drinking. Describe a procedure that can be used to obtain a cup of drinking water from a bucket of sea water.

We take the sea water and we try to remove the sails until the water about have any sails then we use presh water and put it together with the sea water.

Content Domain	Main Topic	Cognitive Do	omain
LIFE SCIENCE	Cells and Their Functions	Factual Know	vledge
Main function of red blood cells		Overall Perc	ent Correct
Main function of red blood cells What is the main function of red blood	l cells?	Overall Perc Singapore England Japan	ent Correct

- (B) To carry oxygen to all parts of the body
- © To remove carbon monoxide from all parts of the body
- (D) To produce materials which cause the blood to clot

Item Number: S012038

Correct Response:

В

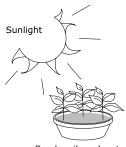
Singapore	90	
England	84	
Japan	84	
Italy	82	
Chinese Taipei	81	
Malaysia	77	
United States	75	
Sweden	75	
Australia	74	
Netherlands	73	
Scotland	70	
New Zealand	69	
Slovak Republic	69	
Hungary	66	
Lebanon	66	
Indonesia	64	
Jordan	64	0
Korea, Republic of	62	0
Israel	61	0
Belgium (Flemish)	60	0
Slovenia	60	0
International average	60	
Hong Kong, SAR	59	0
Norway	58	0
Armenia	57	0
Morocco	56	0
		0
Saudi Arabia	56	
Saudi Arabia Tunisia	56 54	0
		0
Tunisia	54	0
Tunisia Lithuania Bahrain	54 54	0
Tunisia Lithuania	54 54 53 53	0
Tunisia Lithuania Bahrain Philippines Estonia	54 54 53	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro	54 54 53 53 53	0
Tunisia Lithuania Bahrain Philippines Estonia	54 54 53 53 53 53 53 52	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation	54 53 53 53 53 53 52 52	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of	54 54 53 53 53 53 53 52	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation	54 53 53 53 53 53 52 52 52	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth.	54 54 53 53 53 53 53 52 52 52 52 50	
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of	54 54 53 53 53 53 52 52 52 52 50 50 49	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth.	54 54 53 53 53 53 53 52 52 52 52 50 50	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana	54 53 53 53 52 52 52 50 50 49 48	0 • • • • • • • • • • • • •
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana Egypt	54 53 53 53 53 52 52 52 50 50 49 48 46	0 • • • • • • • • • • • • •
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana	54 53 53 53 52 52 52 50 50 49 48 46 45	0 • • • • • • • • • • • • •
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana Egypt Moldova, Rep. of	54 53 53 53 52 52 52 50 50 49 48 46 45 39	
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana Egypt Moldova, Rep. of Latvia	54 53 53 53 52 52 50 50 49 48 46 45 39 39	
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana Egypt Moldova, Rep. of Latvia Ghana	54 53 53 53 52 52 52 50 49 48 46 45 39 39 36	0
Tunisia Lithuania Bahrain Philippines Estonia Serbia and Montenegro Bulgaria Russian Federation Macedonia, Republic of Cyprus Palestinian Nat'l Auth. Iran, Islamic Republic of Romania Botswana Egypt Moldova, Rep. of Latvia Ghana South Africa	54 53 53 53 52 52 52 50 50 49 48 46 45 39 36 34	

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Development and Life Cycle of Organisms	Reasoning and Analysis

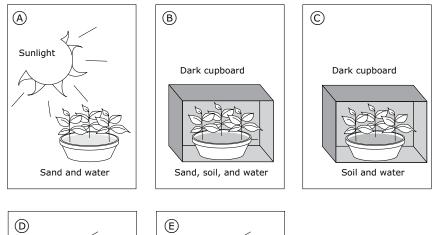
Plant growth experiment

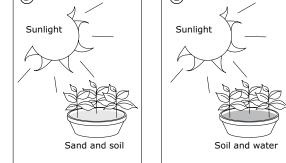
A girl has an idea that green plants need sand in the soil for healthy growth. In order to test her idea she uses two pots of plants. She sets up one pot of plants as shown below.



Sand, soil, and water

Which ONE of the following should she use for the second pot of plants?





Item Number: S022235

Correct Response:

Sweden	81	
Hungary	76	
Hong Kong, SAR	76	
Singapore	76	
Japan	74	
Armenia	73	
Estonia	72	
Chinese Taipei	72	
Norway	72	
United States	70	
Moldova, Rep. of	68	
Romania	67	
Australia	67	
Scotland	66	
Jordan	65	
Bulgaria	65	
England	65	
Russian Federation	65	
	64	
Italy Chile	64 64	
	64 63	
Israel	05	
Saudi Arabia	62	0
New Zealand	62	0
Serbia and Montenegro	62	0
Korea, Republic of	60	0
Netherlands	60	0
Bahrain	60	0
International average	59	
Palestinian Nat'l Auth.	58	0
Slovenia	57	0
Slovak Republic	57	0
Lithuania	57	0
Cyprus	56	0
Egypt	55	0
Malaysia	55	0
Morocco	47	▼
Philippines	44	▼
Botswana	44	▼
Lebanon	42	▼
Tunisia	41	▼
Indonesia	39	▼
Latvia	39	▼
Belgium (Flemish)	36	▼
South Africa	34	▼
Ghana	29	▼
Iran, Islamic Republic of	14	▼
Macedonia, Republic of	0	▼
·		

Country average vs. International average:		
Higher		
Not different	0	
Lower		

Content Domain	Main Topic	Cognitive Domain Conceptual Understanding		
LIFE SCIENCE	Diversity, Adaptation, and Natural Selection			١g
ossils in sedimentary rock		Overall Percent	Corr	e
The fossils that are found in the oldes	- la	Japan	79	
		Korea, Republic of	63	
formed from which types of organisms	<i>:</i>	Slovenia	55	
$\widehat{(A)}$ only organisms that lived in the s		Sweden	53	
0		Hungary	49	
B only organisms that lived on land	l	Hong Kong, SAR	47	
© only organisms that lived in the a	ir.	Slovak Republic	45	
0		Bulgaria Italy	41 37	
(D) organisms that lived on the land,	in the sea and in the air	Iran, Islamic Republic of	35	
		Norway	34	
		Malaysia	33	
		Netherlands	32	
		Chinese Taipei	32	
		Israel	31	
		England	30	
		United States	29	
		Serbia and Montenegro	28	
		International average	28	
		Lithuania	27	
		Scotland	27	
		Estonia	27	
		Morocco	26	
		Australia	25	
		Belgium (Flemish)	25	
		Russian Federation	24	
		Singapore	24 23	
		Romania New Zealand		
		New Zealand Cyprus	20 19	
		Moldova, Rep. of	19	
		Armenia	19	
		Botswana	17	
		Lebanon	17	
		Latvia	17	
n Number: S032083		Egypt	17	
n namber, 6002000		Macedonia, Republic of	16	
		Philippines	15	
		Philippines Bahrain	15 14	
		Philippines		

Correct Response:

Α

Country average vs. International average: Higher Not different 0 ▼ Lower

South Africa

Palestinian Nat'l Auth.

Chile

Ghana

Jordan

Indonesia

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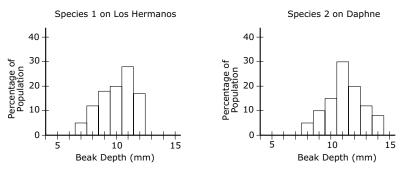
Content Domain	Main Topic	Cognitive Domain
A. LIFE SCIENCE	Diversity, Adaptation and Natural Selection	Reasoning and Analysis
B. LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Conceptual Understanding

Galapagos Islands: compare beak depths of Species 1 and 2

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.



Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



- A. How do the beak depths of Species 1 and Species 2 compare?
- B. A wide variety of seeds exist on the islands, and both Species 1 and Species 2 eat seeds. Based on the beak depths of the two finch species, what would you conclude about the size of seeds that each species eats?

Item Number: S032706A

Japan	66	
Korea, Republic of	65	
Slovenia	56	
	55	
Belgium (Flemish)		
Hong Kong, SAR	54	
Malaysia	46	
Chinese Taipei	46	
Singapore	46	
United States	45	
Latvia	45	
Russian Federation	44	
New Zealand	43	
Estonia	42	
Hungary	42	
	42 41	
Armenia		
Australia	41	
Sweden	39	
Scotland	39	
England	39	
Lithuania	36	
Italy	35	0
Netherlands	34	0
Norway	31	0
International average	30	
Romania	29	0
Romania Chilo	29 26	0
Chile	26	0
Chile Moldova, Rep. of	26 26	0
Chile Moldova, Rep. of Slovak Republic	26 26 23	0
Chile Moldova, Rep. of Slovak Republic Indonesia	26 26 23 22	0
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria	26 26 23	0 0 • •
Chile Moldova, Rep. of Slovak Republic Indonesia	26 26 23 22	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria	26 26 23 22 21	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt	26 26 23 22 21 21	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan	26 26 23 22 21 21 21 19	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of	26 26 23 22 21 21 19 19	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of	26 26 23 22 21 21 19 19 18 17	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus	26 26 23 22 21 21 19 19 19 18 17 17	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco	26 26 23 22 21 19 19 18 17 17 16	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain	26 26 23 22 21 19 19 19 18 17 17 16 14	0 0 • •
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro	26 23 22 21 19 19 18 17 17 16 14 13	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth.	26 23 22 21 19 19 18 17 16 14 13 12	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia	26 23 22 21 19 19 18 17 16 14 13 12 10	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa	26 23 22 21 19 19 18 17 16 14 13 12 10 6	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia	26 23 22 21 19 19 18 17 16 14 13 12 10	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa	26 23 22 21 19 19 18 17 16 14 13 12 10 6	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa Saudi Arabia	26 23 22 21 19 19 18 17 16 14 13 12 10 6 6	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa Saudi Arabia Philippines	26 23 22 21 19 19 18 17 16 14 13 12 10 6 4	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa Saudi Arabia Philippines Botswana	26 23 22 21 19 19 18 17 16 14 13 12 10 6 4 4	0 0 V V
Chile Moldova, Rep. of Slovak Republic Indonesia Bulgaria Egypt Israel Jordan Iran, Islamic Republic of Macedonia, Republic of Macedonia, Republic of Cyprus Morocco Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Tunisia South Africa Saudi Arabia Philippines Botswana Ghana	26 23 22 21 19 19 18 17 16 14 13 12 10 6 4 4 3	0 0 V V

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

Galapagos Islands: compare beak depths of Species 1 and 2 (continued)

Item Number: S032706A

SCORING

Note: Credit will be given for responses that are consistent with the information in the graphs. This includes responses that are based on similarities, differences, or both. Responses that indicate that the two species are 'similar' must refer to specific information from the graphs, such as the range, average, most frequent beak size (mode), etc., in order to receive credit. Responses that state only that the two species are the 'same' or 'similar' with no supporting information are incorrect.

Correct Response

• Gives a description based on **similarities** that is supported with information in the graphs. *Examples: Both are similar in average beak size.*

They are similar because they both have most finches in the 11mm beak range.

- Gives description based on **differences** that is supported with information in the graphs. *Examples: Species 1 is a little bit shorter than Species 2.*
 - s: Species 1 is a little bit shorter than S Species 2 has more that are big.

Species 2 has a wider range of depth than of Species 1.

- Give a description that includes **both** similarities and differences. Examples: Both species have the greatest amount of birds with 11mm beak depths, but Species 1 does not have birds with beak depths bigger than 13mm.
- · Other correct.

Incorrect Response

• States only that the two species are the 'same' or 'similar' without supporting information from the graphs.

Examples: They are nearly the same.

- States that one species is larger or smaller than the other, but does not identify which. *Examples: One of them is a bit different on beak depth.*
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Galapagos Islands: compare beak depths of Species 1 and 2 (continued) Item Number: S032706A

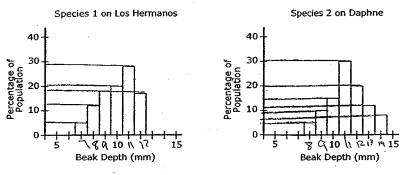
Student Responses

Correct Response:

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.



Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



A. How do the beak depths of Species 1 and Species 2 compare?

species 2 biros have daper beaks, and very few biros with beaks under 10mm. Species 1. biros generally have smaller beales.

Galapagos Islands: compare beak depths of Species 1 and 2 (continued) *Item Number: S032706A*

Item Number: S032706A

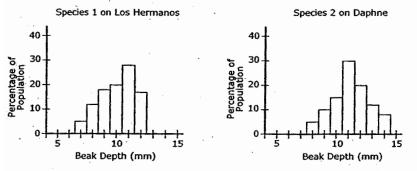
5

Student Responses (continued)

Incorrect Response:

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.

Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



A. How do the beak depths of Species 1 and Species 2 compare?

The book depth is pretty close in graph 1 and 2

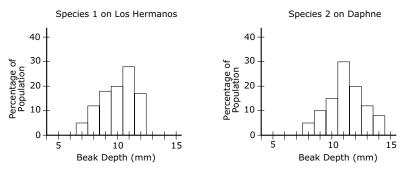
Content Domain	Main Topic	Cognitive Domain
A. LIFE SCIENCE	Diversity, Adaptation and Natural Selection	Reasoning and Analysis
B. LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Conceptual Understanding

Galapagos Islands: size of seeds each species eats

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.



Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



- A. How do the beak depths of Species 1 and Species 2 compare?
- B. A wide variety of seeds exist on the islands, and both Species 1 and Species 2 eat seeds. Based on the beak depths of the two finch species, what would you conclude about the size of seeds that each species eats?

Item Number: S032706B

Korea, Republic of	59	
Japan	51	
Estonia	51	
Belgium (Flemish)	48	
Chinese Taipei	47	
Latvia	45	
Hong Kong, SAR	45	
Singapore	45	
England	42	
Slovenia	42	
Armenia	42	
United States	40	
Lithuania	39	
Malaysia	39	
Hungary	37	
Netherlands	36	
Scotland	34	
Australia	33	0
Russian Federation	32	0
New Zealand	32	0
Slovak Republic	31	0
Sweden	29	0
Norway	29	0
Italy	27	0
the second state of the second state	~~	
International average	27	0
Moldova, Rep. of	26	0
Moldova, Rep. of Romania	26 25	0
Moldova, Rep. of Romania Jordan	26 25 21	0 ▼
Moldova, Rep. of Romania Jordan Chile	26 25 21 20	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain	26 25 21 20 18	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel	26 25 21 20 18 17	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus	26 25 21 20 18 17 15	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt	26 25 21 20 18 17 15 15	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria	26 25 21 20 18 17 15	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth.	26 25 21 20 18 17 15 15 15	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria	26 25 21 20 18 17 15 15 15 14	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of	26 25 21 20 18 17 15 15 15 14 14	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of	26 25 21 20 18 17 15 15 14 14 12	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia	26 25 21 20 18 17 15 15 15 14 14 12 12	0
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro	26 25 21 20 18 17 15 15 15 14 14 12 12 10	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia	26 25 21 20 18 17 15 15 14 14 12 12 10 10	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro Morocco	26 25 21 20 18 17 15 15 15 14 14 12 12 10 10 8	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro Morocco Lebanon	26 25 21 20 18 17 15 15 15 14 12 12 10 10 8 7	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro Morocco Lebanon Botswana Saudi Arabia South Africa	26 25 21 20 18 17 15 15 15 14 12 10 10 8 7 6	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro Morocco Lebanon Botswana Saudi Arabia	26 25 21 20 18 17 15 15 15 14 12 10 10 8 7 6 4 4 2	0 ▼
Moldova, Rep. of Romania Jordan Chile Bahrain Israel Cyprus Egypt Bulgaria Palestinian Nat'l Auth. Macedonia, Republic of Iran, Islamic Republic of Indonesia Tunisia Serbia and Montenegro Morocco Lebanon Botswana Saudi Arabia South Africa	26 25 21 20 18 17 15 15 15 14 12 10 10 8 7 6 4 4	0 ▼

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

Galapagos Islands: size of seeds each species eats (continued)

Item Number: S032706B

SCORING

Note: The response to Part B must be consistent with the comparison of beak sizes given in Part A in order to receive credit. Correct responses can refer explicitly to comparisons of the two "species" or more generally to a comparison of "birds" of different sizes within or across species. It is possible that a correct conclusion may be drawn based on an incorrect response to Part A.

Correct Response

- States that the two species eat the same (similar) types of seeds. [Response to A indicates that the two species have the same or similar size beaks.]
- States that Species 2 eats larger seeds than Species 1. [Response to A indicates that Species 2 is larger.]
- States only that birds (finches) with larger beaks eat larger seeds (or similar). [No explicit comparison of the two species.]
- Other correct.

Incorrect Response

- States that the two species eat the same (similar) types of seeds, but this conclusion is inconsistent with the response given in Part A.
- States that one species eats larger seeds than the other, but this conclusion is inconsistent with the response given in Part A.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

ودباد

Galapagos Islands: size of seeds each species eats (continued) Item Number: S032706B

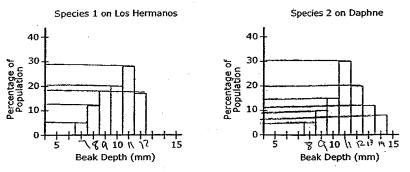
Student Responses

Correct Response:

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.



Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



B. A wide variety of seeds exist on the islands, and both Species 1 and Species 2 eat seeds. Based on the beak depths of the two finch species, what would you conclude about the size of seeds that each species eats?

species I would eat the smally seeds, because they are smaller birds. Species Z would likely part larger seeds.

ودباد

Galapagos Islands: size of seeds each species eats (continued) Item Number: S032706B

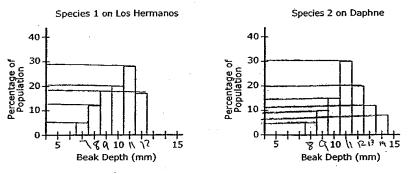
Student Responses (continued)

Incorrect Response:

The Galapagos Islands contain a number of different species of finches (birds) that are thought to have developed from one species. Some species of finches eat certain types of seeds depending on their beak depth. The diagram below shows the head of one species of finch and its beak depth.



Some of the islands have only one species living on them, while other islands have more than one species. Species 1 lives on Los Hermanos Island. Species 2 lives on Daphne Island. The two graphs below show the percentage of the population with different beak depths for each of the two species.



B. A wide variety of seeds exist on the islands, and both Species 1 and Species 2 eat seeds. Based on the beak depths of the two finch species, what would you conclude about the size of seeds that each species eats?

I will check in each species I and a how much they early each day

Content Domain	Main Topic	Cognitive Domain		
LIFE SCIENCE	Diversity, Adaptation and Natural Selection	Reasoning and Ana	lysis	;
alapagos Islands: graphs of be	eak depths for Species 3 and 4	Overall Percent	Corr	e
which also has a range of seed type Which of the following graphs show Species 3 and Species 4 that would on Santa Maria Island? (Circle the letter by the correct grap A $\begin{bmatrix} 40 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	es a range of beak depths for best insure the survival of both species oh.) 40 - 40 - 40 - 40 - 40 - 40 - 40 - 40 -	Singapore Chinese Taipei Korea, Republic of Hong Kong, SAR Scotland Estonia Australia Sweden United States New Zealand Belgium (Flemish) Lithuania England Norway Slovenia Japan Slovak Republic Latvia Italy International average	37 36 26 25 25 23 23 22 21 21 21 21 21 21 15 14 13 12 12 11	
Explain why this range of beak dep	ths would be best.	Russian Federation Netherlands Hungary	9 9 8	(
em Number: S032707 CORING prrect Response		Israel Romania Malaysia Chile Serbia and Montenegro	8 8 4 4 4	(

explanation that indicates a correct interpretation of the graph but refers only to differences in beak size.

Correct Response

- A with an explanation that relates the difference in beak size to reduced competition (or similar). Examples: With the different sized beaks they would not have to share food.
 - One species will eat the small seeds and one will eat the large seeds.
 - There would be no competition between the two species if they ate different seeds. They each have their own food source.
- · Other correct.

Incorrect Response

- · A with a minimal explanation that refers only to the difference in beak size. [Does not explicitly mention competition for seeds or similar.] Examples: Because they are different sizes.
 - Because Species 3 has a smaller beak size.
- A with no explanation or an incorrect explanation.
- Examples: Because their beaks look sharper. Because both species have a large beak to the percentage of population. It's like the other graphs.
- B with no explanation or an incorrect explanation. Examples: Bigger beak depths so they could eat more seeds. Both are nearly equal and are a more normal size. It's better if they are the same size because they eat the same seeds.
- · Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Chinese Taipei	36	
Korea, Republic of	26	
Hong Kong, SAR	26	
Scotland	26	
Estonia	25	
Australia	25	
Sweden	23	
United States	23	
New Zealand	22	
Belgium (Flemish)	21	
Lithuania	21	
England	21	
Norway	15	
Slovenia	14	0
Japan	13	0
Slovak Republic	12	0
Latvia	12	0
Italy	11	0
International average	11	
Russian Federation	9	0
Netherlands	9	0
Hungary	8	0
Israel	8	▼
Romania	8	0
Malaysia	4	$\begin{array}{c} \bullet \\ \bullet $
Chile	4	▼
Serbia and Montenegro	4	▼
Palestinian Nat'l Auth.	3	▼
Jordan	3	
Bulgaria	3	
Bahrain	2	▼
South Africa	2	▼
Egypt	2	
Armenia	2	
Moldova, Rep. of	2	▼
Macedonia, Republic of	2	▼
Indonesia	1	
Philippines	1	
Botswana	1	
Iran, Islamic Republic of	1	▼
Morocco	1	
Lebanon	1	
Cyprus	1	▼
Saudi Arabia	1	▼
Tunisia	1	▼
Ghana	1	▼

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Galapagos Islands: graphs of beak depths for Species 3 and 4 (continued) *Item Number: S032707*

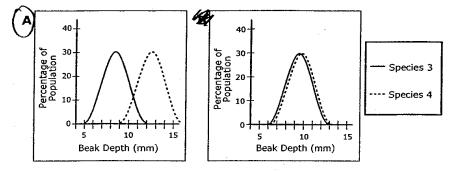
Student Responses

Correct Response:

Two other species (Species 3 and Species 4) live on Santa Maria Island, which also has a range of seed types.

Which of the following graphs shows a range of beak depths for Species 3 and Species 4 that would best insure the survival of both species on Santa Maria Island?

(Circle the letter by the correct graph.)



Explain why this range of beak depths would be best.

Galapagos Islands: graphs of beak depths for Species 3 and 4 (continued) *Item Number:* S032707

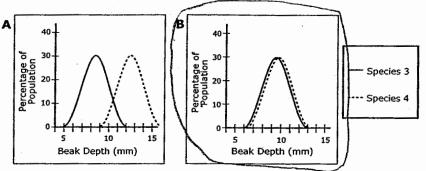
Student Responses (continued)

Incorrect Response:

Two other species (Species 3 and Species 4) live on Santa Maria Island, which also has a range of seed types.

Which of the following graphs shows a range of beak depths for Species 3 and Species 4 that would best insure the survival of both species on Santa Maria Island?

(Circle the letter by the correct graph.)



Explain why this range of beak depths would be best.

They would be good for picking seeds.

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Ecosystems	Conceptual Understanding

Galapagos Islands: plants/animals inhabited island first

Which organisms that live on land most likely inhabited the Galapagos Islands first?

(Check one box.)

Land plants

Land animals

Explain your answer.

Item Number: S032704

SCORING

Note: Credit is given for responses that check PLANTS and give an explanation that refers explicitly to **photosynthesis** or plants making their own food as well those that refer only to the survival or mode of transportation of plants/animals. Responses that check ANIMALS may also receive credit with a reasonable explanation based on transportation and the availability of alternative food sources, e.g., fish.

Correct Response

• **PLANTS** with an explanation based plants being able to make their own food (**photosynthesis**). *Examples: Plants can photosynthesize*.

Because plant make their own food using light, water and chlorophyll.

• **PLANTS** with an explanation based only on survival OR mode of transportation of plants/animals. [Photosynthesis or making food not explicitly mentioned.]

Examples: They could survive there first because plants only need water and air.

Without plants there would not be animals.

First the plants arrived. Then the animals can come and survive by eating the plants. Seeds could just be carried by the wind. Animals would have to swim a long distance. Seeds from South America blew to the islands.

• **ANIMALS** with a reasonable explanation based on transportation **AND** availability of alternative food sources (may be implicit based on the specific type of animal named). *Examples: Birds could fly over to the island to nest and survive by eating fish from the sea.*

Seals can swim there and live on the rocky shore. [Assumes seals eat fish.]

Other correct.

Incorrect Response

• **PLANTS** with no explanation or an incorrect explanation. [May include a correct statement that does not apply to the situation.]

Examples: They just grew from the ground. Because plants grow faster and live longer. They are living organisms. Plants were on Earth before animals.

• ANIMALS with no explanation or an incorrect explanation.

Examples: Birds could just eat the seeds in the ground.

They are everywhere. There will be a surplus of food. Animals can move but plants cannot. Animals migrate.

· Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Estonia	62	
Armenia	55	
Singapore	49	
New Zealand	49	
Japan	48	
Latvia	48	
Lithuania	48	
United States	48	
Sweden	46	
Norway	44	
Hungary	44	
Australia	44	
Russian Federation	43	
Belgium (Flemish)	42	
Netherlands	42	
England	42	
Slovak Republic	41	
Korea, Republic of	40	
Hong Kong, SAR	40	
Scotland	38	
Chinese Taipei	38	
Malaysia	35	0
Slovenia	33	0
International average	31	
Jordan	30	0
Jordan	30	0
Jordan Moldova, Rep. of	30 29	0
Jordan Moldova, Rep. of Israel	30 29 25	0
Jordan Moldova, Rep. of Israel Chile	30 29 25 23	0
Jordan Moldova, Rep. of Israel Chile Cyprus	30 29 25 23 22	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania	30 29 25 23 22 22	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth.	30 29 25 23 22 22 22 21	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy	30 29 25 23 22 22 21 21	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro	30 29 25 23 22 22 21 21 21 20	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of	30 29 25 23 22 21 21 21 20 19	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria	30 29 25 23 22 21 21 21 20 19 18	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain	30 29 25 23 22 21 21 21 20 19 18 16	
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon	30 29 25 23 22 21 21 20 19 18 16 16	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of	30 29 25 23 22 21 21 20 19 18 16 16 15	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia	30 29 25 22 21 21 20 19 18 16 16 15 14	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt	30 29 25 22 21 21 20 19 18 16 16 15 14 12	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt Tunisia	30 29 25 22 21 21 20 19 18 16 16 15 14 12 10	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt Tunisia Morocco	30 29 25 23 22 21 21 20 19 18 16 16 15 14 12 10 10	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt Tunisia Morocco South Africa	30 29 25 23 22 21 21 20 19 18 16 15 14 12 10 10 9 7 6	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt Tunisia Morocco South Africa Botswana	30 29 25 23 22 21 21 20 19 18 16 15 14 12 10 10 9 7	0
Jordan Moldova, Rep. of Israel Chile Cyprus Romania Palestinian Nat'l Auth. Italy Serbia and Montenegro Macedonia, Republic of Bulgaria Bahrain Lebanon Iran, Islamic Republic of Indonesia Egypt Tunisia Morocco South Africa Botswana Philippines	30 29 25 23 22 21 21 20 19 18 16 15 14 12 10 10 9 7 6	○ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Galapagos Islands: plants/animals inhabited island first (continued)

Item Number: S032704

Student Responses

Correct Response:

Which organisms that live on land most likely inhabited the Galapagos Islands first?

(Check one box.)

 ∇ Land plants

Land animals

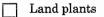
Explain your answer. Without land plants the Earth would hot beable to have land Amings

Incorrect Response:

14

Which organisms that live on land most likely inhabited the Galapagos Islands first?

(Check one box.)



Land animals

Explain your answer.

It does because it gets use to the liveling.

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Ecosystems	Conceptual Understanding

Galapagos Islands: effect of cats

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

A. One effect of **cats**:

B. One effect of **goats**:

Item Number: S032705A

SCORING

Correct Response

• Refers to cats preying upon other organisms, or similar (resulting in a reduction in population). Examples: They will eat the birds and other animals. The cats help them by eating the rats and mice.

Their prey could become extinct.

Other correct.
 Examples: They might pass on diseases to other animals.

Incorrect Response

- Refers **only** to an effect on the cat with no explicit effect on other organisms. *Examples: They cannot survive on the island. Cats might reproduce and get out of control.*
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task). *Examples: The cats might eat all the plants.*

Australia	68	
New Zealand	66	
Estonia	59	
Chinese Taipei	58	
Armenia	56	
Singapore	54	
Slovak Republic	52	
Lithuania	49	
Netherlands	47	
Russian Federation	46	
Hungary	46	
Belgium (Flemish)	46	
Latvia	45	
United States	45	
Hong Kong, SAR	45	
England	45	
Romania	43	
Norway	42	0
Sweden	41	0
Scotland	41	0
Korea, Republic of	40	0
Japan	40	0
Jordan	39	0
International average	36	
Palestinian Nat'l Auth.	36	0
Palestinian Nat'l Auth. Malaysia	36 35	0
Palestinian Nat'l Auth. Malaysia Slovenia	36 35 33	0
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro	36 35 33 33	0 0 0
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Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus	36 35 33 33 30 29 28	0 0 0
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Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia	36 35 33 30 29 28 27 27	0 0 0
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria	36 35 33 30 29 28 27 27 26	0 0 0
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of	36 35 33 30 29 28 27 27 26 26	0 0 0
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of Italy	36 35 33 30 29 28 27 27 26 26 24	0 0 0
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Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of Italy Bahrain Iran, Islamic Republic of Botswana Indonesia Lebanon South Africa Morocco Saudi Arabia	36 35 33 30 29 28 27 27 26 26 24 23 22 21 20 16 14 12 9	
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of Italy Bahrain Iran, Islamic Republic of Botswana Indonesia Lebanon South Africa Morocco Saudi Arabia Macedonia, Republic of	36 35 33 30 29 28 27 26 26 24 23 22 21 20 16 14 12 9 8	
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of Italy Bahrain Iran, Islamic Republic of Botswana Indonesia Lebanon South Africa Morocco Saudi Arabia Macedonia, Republic of Philippines	36 35 33 30 29 28 27 26 26 24 23 22 21 20 16 14 12 9 8 8 8	0 0 0
Palestinian Nat'l Auth. Malaysia Slovenia Serbia and Montenegro Chile Israel Cyprus Egypt Tunisia Bulgaria Moldova, Rep. of Italy Bahrain Iran, Islamic Republic of Botswana Indonesia Lebanon South Africa Morocco Saudi Arabia Macedonia, Republic of	36 35 33 30 29 28 27 26 26 24 23 22 21 20 16 14 12 9 8	

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Galapagos Islands: effect of cats (continued)

Item Number: S032705A

Student Responses

Correct Response:

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

A. One effect of cats:

Cats could enter scare away some of the smaller animals already settled there.

Incorrect Response:

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

A. One effect of cats:

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Ecosystems	Conceptual Understanding

Galapagos Islands: effect of goats

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

A. One effect of **cats**:

B. One effect of **goats**:

Item Number: S032705B

SCORING

Correct Response

- Refers **only** to the goats eating plants (resulting in a reduction of the amount of plant life on the island).
 - Examples: The goats will eat all the grass on the island.
 - It could lead to erosion if the goats clear the land by eating all the plants.
 - Large pieces of grass will disappear as the goats eat it.
- Refers to an effect of the goat on other animals (e.g., competition for food/habitat, as a food source for predators, etc.). [Note: may also refer to the goats eating plants.]
- Examples: The animals that eat goats would have more food. They might become a source of food.
 - The goats will eat up the plants and the populations that depend on plants will decrease.
- Other correct.

Incorrect Response

- Refers **only** to an effect on the goat with no explicit effect on other organisms. *Examples:* Goats would have more babies. They would die because they don't have any food.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task). *Examples: Goats might eat the cats.*

Singapore	74	
5 1		
Australia	74	
Chinese Taipei	73	
Korea, Republic of	70	
Hong Kong, SAR	69	
Estonia	69	
New Zealand	68	
Malaysia	63	
England	62	
United States	60	
	58	
Hungary		
Russian Federation	58	
Netherlands	58	
Scotland	57	
Armenia	57	
Japan	54	
Slovak Republic	53	
Lithuania	51	
Sweden	48	0
Latvia	48	0
Jordan	48	0
Belgium (Flemish)	47	0
Palestinian Nat'l Auth.	47	0
Romania	45 45	0
		0
International average	45	
International average Norway	45 44	0
International average	45	0
International average Norway	45 44	0
International average Norway Chile	45 44 41	0
International average Norway Chile Israel	45 44 41 38	0
International average Norway Chile Israel Egypt Slovenia	45 44 41 38 37	0
International average Norway Chile Israel Egypt	45 44 41 38 37 37	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro	45 44 41 38 37 37 37	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia	45 44 41 38 37 37 37 37 36	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia	45 44 41 38 37 37 37 36 34 33	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria	45 44 41 38 37 37 37 36 34 33 32	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain	45 44 41 38 37 37 37 36 34 33 32 32 32	0
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International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus	45 44 41 38 37 37 37 36 34 33 32 32 31 27	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of	44 41 38 37 37 36 34 33 32 32 31 27 25	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines	45 44 41 38 37 37 37 36 34 33 32 32 31 27 25 24	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22	
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of Lebanon	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22 22	
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22	
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of Lebanon	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22 22	
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of Lebanon Iran, Islamic Republic of	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22 22 20	
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of Lebanon Iran, Islamic Republic of Morocco	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22 22 20 15	0
International average Norway Chile Israel Egypt Slovenia Serbia and Montenegro Italy Indonesia Tunisia Bulgaria Bahrain Botswana Cyprus Macedonia, Republic of Philippines Moldova, Rep. of Lebanon Iran, Islamic Republic of Morocco Saudi Arabia	45 44 41 38 37 37 36 34 33 32 31 27 25 24 22 22 20 15 11	

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Galapagos Islands: effect of goats (continued) Item Number: S032705B

Student Responses

Correct Response:

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

B. One effect of goats:

Goats could eat all the vegetation, rawsing the other animals to not have food.

Incorrect Response:

When settlers came to live on the Galapagos Islands, they brought with them a number of new animals such as cats and goats. Write down one effect the introduction of cats and goats could have on the animals and plants already living on the islands.

B. One effect of goats:

Content Domain	Main Topic	Cognitive Domai	n
LIFE SCIENCE	Ecosystems	Factual Knowledg	е
lements that make up animals a	and plants	Overall Percent C	Correc
Animals and plants are made up of a relements. What happens to all of these plants die? (A) They die with the animal or plant (B) They evaporate into the atmosphe (C) They are recycled back into the er (D) They change into different element	e elements when animals and t. ere. nvironment.	Chinese Taipei Estonia Hungary Singapore Sweden United States Tunisia Australia Philippines New Zealand Japan Korea, Republic of Hong Kong, SAR England Romania Israel Italy Norway Slovenia Slovak Republic Morocco Netherlands International average Macedonia, Republic of Bulgaria Scotland Iran, Islamic Republic of Russian Federation Malaysia Chile Botswana Egypt	70 4 70 6 63 4 60 4 55 4 53 4 53 4 54 4 45 4 44 4 44 4 44 4 40 6 38 6 38 6 38 6 36 6 33 3 32 3 30 2 23 2 24 2 37 30 29 28
em Number: S032682		Palestinian Nat'l Auth. Armenia Moldova, Rep. of Latvia Belgium (Flemish)	25 25 24 24 24 24
		Saudi Arabia Cyprus Indonesia South Africa Jordan Lithuania Lebanon Ghana Serbia and Montenegro	22 22 21 21 21 21 20 20 17 15

Country average International av	
Higher	
Not different	0
Lower	•

14

▼

Bahrain

Correct Response: C

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Ecosystems	Reasoning and Analysis

Community of mice, snakes and wheat plants



The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

Item Number: S032202

SCORING

Note: For full credit, responses must include an explicit statement of the effect on BOTH the mice population and the wheat plants. Partial credit is given for responses that refer to one but not both of these.

Correct Response

- States that mice (population) will increase AND wheat plants will decrease.
- Examples: The population of mice would increase because there are no snakes. The increase in mice would then cause the amount of wheat plants to decrease.
 - Then we would get more mice and less wheat plants.
- States that the mice would eat more (all) of the wheat plants AND that the mice (population) will
 decrease as the wheat decreases. [May also refer to the initial increase in population of mice.]
 Examples: Mice would eat all the plants, then the plants would die out, then the mice would not
 have anything to eat so then they would die.
 - Mice would become overpopulated and eat all the wheat. Then all the mice would starve because there is no food left.
- · Other fully correct.

Partially Correct Response

- States **only** that the mice will increase. [No explicit mention of the effect on wheat.] Examples: The number of mice would increase because there are no snakes to eat them. There would be lots of mice.
- States only that the mice will eat more (all) of the wheat plants (or similar). [No explicit mention of the effect on mice.]
 Examples: If people killed the snakes the mice would destroy all the wheat plants.
- Other partially correct.

Incorrect Response

• Refers to an effect on the whole community (ecosystem) but too vague to interpret. *Examples: The whole community will be affected. The ecosystem would be unbalanced.*

Everything dies.

Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Singapore	78	
Malaysia	68	
England	57	
Chinese Taipei	55	
Estonia	52	
Australia	50	
Sweden	48	
Hungary	48	
Belgium (Flemish)	46	
Netherlands	45	
United States	44	
Scotland	42	
Slovak Republic	41	
Lithuania	41	
Iran, Islamic Republic of	40	
Jordan	39	
Russian Federation	38	
Korea, Republic of	38	
Hong Kong, SAR	37	0
Romania	37	0
New Zealand	35	0
Egypt	34	0
Armenia	34	0
International average	33	0
Slovonia	22	\cap
Slovenia Latvia	33 32	0
Latvia	32	0
Latvia Serbia and Montenegro	32 32	0
Latvia Serbia and Montenegro Macedonia, Republic of	32 32 32	0 0 0
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Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel	32 32 31 31 30 30	0 0 0 0 0
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy	32 32 31 31 30 30 27	0 0 0 0 0
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of	32 32 31 31 30 30 27 26	0 0 0 0 0
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia	32 32 31 31 30 30 27 26 26	0 0 0 0 0
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia	32 32 31 31 30 30 27 26 26 24	0 0 0 0 0
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Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain	32 32 31 31 30 27 26 24 22 18 16 16	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth. Morocco	32 32 31 31 30 27 26 24 22 18 16 16 16	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth.	32 32 31 31 30 27 26 26 24 22 18 16 16 16 16	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth. Morocco Philippines	32 32 31 30 30 27 26 26 24 22 18 16 16 16 16	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth. Morocco Philippines Lebanon	32 32 31 30 30 27 26 24 22 18 16 16 16 16 16 9	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth. Morocco Philippines Lebanon Botswana	32 32 31 30 30 27 26 24 22 18 16 16 16 16 16 9 6	
Latvia Serbia and Montenegro Macedonia, Republic of Japan Norway Indonesia Israel Italy Moldova, Rep. of Tunisia Saudi Arabia Bulgaria Cyprus Chile Bahrain Palestinian Nat'l Auth. Morocco Philippines Lebanon Botswana South Africa	32 32 31 30 30 27 26 24 22 18 16 16 16 16 16 9 6 6	

Country average vs. International average:	
Higher	
Not different	0
Lower	▼

Community of mice, snakes and wheat plants (continued) *Item Number:* S032202

Student Responses

Correct Response:



The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

The	mice	would	become	overpopulated	and	eat
dil	the w	heat pla	unts,	- 3 5	•	

Partially Correct Response:



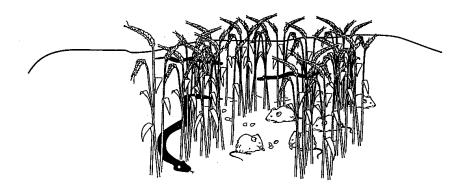
The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

If they killed the snakes, then the snakes wouldn't be able to eat the mice. Then the mice would eat up the wheat plants. Community of mice, snakes and wheat plants (continued) *Item Number: S032202*

Student Responses (continued)

Incorrect Response:



The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

It wouldn't be a community anymore because who would eat the mice !

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Human Health	Factual Knowledge

Leafy vegetables important for human health

Eating leafy vegetables is important for human health. This is because leafy vegetables are a good source of which of the following?

- (A) protein
- (B) carbohydrates
- © minerals
- (D) fat

Item Number: S032637

Correct Response:

С

Korea, Republic of	65	
Japan	65	
Slovenia	63	
Israel	62	
Chinese Taipei	59	
Estonia	58	
Hungary	57	
England	55	
Netherlands	53	
Singapore	52	
United States	48	
Macedonia, Republic of	46	
Belgium (Flemish)	46	
Italy	45	
New Zealand	44	
Latvia	44 42	
	42 41	
Malaysia	41	0
Hong Kong, SAR		
Bulgaria	41	0
Australia	40	0
Lithuania	40	0
International average	38	0
Scotland	37 34	0 0
Romania		
Egypt	34	0
Serbia and Montenegro	34	
	22	~
Morocco	33	0
Sweden	33	▼
Sweden Moldova, Rep. of	33 32	▼ ▼
Sweden Moldova, Rep. of Norway	33 32 32	▼ ▼ ▼
Sweden Moldova, Rep. of Norway Bahrain	33 32 32 30	• • •
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth.	33 32 32 30 29	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines	33 32 32 30 29 28	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon	 33 32 32 30 29 28 28 	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of	33 32 32 30 29 28 28 28 28	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia	33 32 32 30 29 28 28 28 28 28 28	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation	33 32 32 30 29 28 28 28 28 28 28 28 28	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan	33 32 32 30 29 28 28 28 28 28 28 28 28 28 28 25	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation	33 32 32 30 29 28 28 28 28 28 28 28 28	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia	33 32 32 30 29 28 28 28 28 28 28 28 28 25 24 24	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile	 33 32 32 30 29 28 28 28 28 28 28 28 28 24 24 24 	* * * * * * * * * * * * * * * * * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic Botswana	33 32 32 30 29 28 28 28 28 28 28 28 28 25 24 24	* * * * * * * * * * * * * * * * * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic	 33 32 32 30 29 28 28 28 28 28 28 28 28 24 24 24 	* * * * * * * * * * * * * * * * * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic Botswana	 33 32 32 30 29 28 28 28 28 28 28 28 28 24 24 24 23 	* * * * * * * * * * * * * * * * * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic Botswana Saudi Arabia	 33 32 32 30 29 28 28 28 28 28 28 28 28 24 24 24 23 20 	* * * * * * * * * * * * * * * * * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic Botswana Saudi Arabia South Africa	 33 32 32 30 29 28 28 28 28 28 28 28 28 28 24 24 24 24 23 20 20 	* * * *
Sweden Moldova, Rep. of Norway Bahrain Palestinian Nat'l Auth. Philippines Lebanon Iran, Islamic Republic of Tunisia Russian Federation Jordan Chile Armenia Slovak Republic Botswana Saudi Arabia South Africa Ghana	 33 32 32 30 29 28 28 28 28 28 28 28 28 29 24 24 24 24 24 24 23 20 20 19 	* * * * * * * * * * * * * * * * * * *

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Human Health	Reasoning and Analysis

Transmission of cold in classroom

Scott went to school with a cold. Several days later, half of his classmates also had colds. What is one likely reason some classmates had colds but others did not?

Item Number: S022154

SCORING

Note: To receive credit, responses must include some reference to transmission of 'germs' (viruses, bacteria, etc.), either explicitly or through a description of a method of transmission (sneezing/ coughing, direct physical contact, etc.), or to defense mechanisms (immunity, resistance, etc.). A response that includes only a general reference to proximity without any description of a method of transmission will be scored as incorrect.

Correct Response

• Refers explicitly to transmission of 'germs' (viruses, bacteria, etc.) from Salil to some classmates (or not to others).

Examples: Some students were hanging around Salil with him sneezing his germs onto them. The ones exposed to the virus caught it.

- Refers to some students having better defense mechanisms (immunity, resistance).
 Examples: Some of the students have just got over a cold.
 Some students' immunity was low because they went outside in the cold.
- Refers to a specific method of transmission involving physical contact or exposure without mentioning germs explicitly (e.g. sneezing/coughing, shaking hands, drinking from same glass, breathing same air).

Examples: He sneezed on the ones that got it.

They touched something Salil touched.

· Other correct.

Incorrect Response

• Includes ONLY a general or vague response relating to proximity or "catching the cold" from Salil. [No explicit description of a method of transmission is given.]

Examples: Some of his classmates did not like him so probably were not near him a lot.

The ones who were his friends got it.

The kids who sat by him caught the cold.

Some caught it from Salil.

Salil gave it to some of the class.

Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	84	
Slovak Republic	78	
Hungary	75	
Singapore	73	
Romania	71	
Slovenia	70	
Estonia	69	
Hong Kong, SAR	68	
Latvia	68	
Palestinian Nat'l Auth.	68	
Belgium (Flemish)	67	
Lithuania	66	
Armenia	66	
Netherlands	65	
Norway	65	
Moldova, Rep. of	64	
Sweden	63	
Jordan	63	
United States	61	
Italy	60	
Korea, Republic of	57	
Iran, Islamic Republic of	57	0
Israel	56	0
Russian Federation	54	0
Bahrain	54	0
Egypt	54	0
Serbia and Montenegro	54	0
New Zealand	54	0
Bulgaria	53	0
Macedonia, Republic of	53	0
International average	53	
England	50	0
Chile	48	 <
Scotland	47	▼
Australia	46	▼
Malaysia	43	▼
Japan	43	▼
Indonesia	39	▼
Cyprus	37	▼
Saudi Arabia	37	
Philippines	34	
Morocco	31	* * * *
Lebanon	24	
Tunisia	18	▼
South Africa	13	▼
Botswana	10	
Ghana	6	•

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Transmission of cold in classroom (continued) Item Number: S022154

Student Responses

Correct Response:

Salil went to school with a cold. Several days later, half of his classmates also had ___ colds. What is one likely reason some classmates had colds but others did not?

The classmates that are sick Most likely had physical contact with Salil

Incorrect Response:

Salil went to school with a cold. Several days later, half of his classmates also had colds. What is one likely reason some classmates had colds but others did not?

Germs. Stronger Han other

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Reproduction and Heredity	Conceptual Understanding

Son inherits traits

A son can inherit traits

- A only from his father
- (B) only from his mother
- (C) from both his father and his mother
- (D) from either his father or his mother, but not from both

Item Number: S012026

Correct Response:

С

Netherlands	94	
United States	93	
Latvia	92	
Belgium (Flemish)	92	
Chinese Taipei	91	
England	91	
Hungary	91	
Norway	90	
Sweden	90	
Korea, Republic of	90	
Russian Federation	90	
Lithuania	89	
Romania	88	
Chile	87	
Slovak Republic	87	
Italy	87	
· ·	86	
Hong Kong, SAR Scotland	86	
Scotland		
Israel Estonia	85 85	
	85 85	
Slovenia		
Bulgaria	83	
Moldova, Rep. of	83	
Cyprus	82	A
Armenia	82	A
Macedonia, Republic of	81	
Singapore	79	0
Australia	77	0
International average	76	
Serbia and Montenegro	75	0
New Zealand	73	0
Iran, Islamic Republic of	69	▼
Egypt	68	
Japan	65	
Lebanon	65	
Bahrain	64	* * * *
Morocco	63	
Philippines	60	
Jordan	60	▼
Tunisia	60	
Palestinian Nat'l Auth.	57	
Saudi Arabia	52	▼
South Africa	51	▼
Ghana	48	▼ ▼ ▼
Malaysia	47	▼
Indonesia	44	▼
Botswana	43	▼

Country average International av	-
Higher	
Not different	0
Lower	\mathbf{V}

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Reproduction and Heredity	Conceptual Understanding

Traits transferred from generations

Correct Response:

Traits are transferred from generation to generation through the
(A) sperm only
(B) egg only
© sperm and the egg
(D) testes
Harra Murraham 2040020
Item Number: S012039

С

Chinese Taipei	97	
Hong Kong, SAR	97	
Korea, Republic of	91	
Hungary	88	
England	88	
Sweden	87	
Netherlands	86	
Singapore	86	
United States	86	
Israel	85	
Scotland	83	
Estonia	83	
Belgium (Flemish)	83	
Chile	83	
Romania	80	
Slovak Republic	79	
Italy	79	
Malaysia	79	
Norway	78	
Latvia	77	
Bulgaria	76	0
5	76	0
Philippines Japan	76	0
Slovenia	76 76	0
Bahrain	76 75	0
Russian Federation	74	0
Russian Federation International average	74 74	0
Russian Federation International average Australia	74 74 73	0
Russian Federation International average Australia Lithuania	74 74 73 72	0
Russian Federation International average Australia Lithuania Egypt	74 74 73 72 71	0
Russian Federation International average Australia Lithuania Egypt Armenia	74 74 73 72 71 71	0
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand	74 73 72 71 71 70	0
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of	74 73 72 71 71 70 68	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of	74 73 72 71 71 70 68 68	0
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro	74 73 72 71 71 70 68 68 68 67	0
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia	74 73 72 71 71 70 68 68 68 67 67	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco	74 73 72 71 71 70 68 68 68 67 67 66	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia	74 73 72 71 71 70 68 68 68 67 67 66 64	0
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus	74 73 72 71 71 70 68 68 67 67 66 64 63	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth.	74 73 72 71 71 70 68 68 67 67 66 64 63 62	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan	74 73 72 71 71 70 68 68 67 67 66 64 63 62 57	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana	74 73 72 71 71 70 68 68 67 67 66 64 63 62 57 57	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia	74 73 72 71 71 70 68 68 67 67 66 64 63 62 57 57 52	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia South Africa	74 73 72 71 70 68 68 67 67 66 64 63 62 57 57 52 52 52	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia South Africa Iran, Islamic Republic of	74 73 72 71 70 68 68 67 67 66 64 63 62 57 57 52 52 50	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia South Africa Iran, Islamic Republic of Ghana	74 73 72 71 70 68 68 67 67 66 64 63 62 57 57 52 52 50 50	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia South Africa Iran, Islamic Republic of	74 73 72 71 70 68 68 67 67 66 64 63 62 57 57 52 52 50	
Russian Federation International average Australia Lithuania Egypt Armenia New Zealand Moldova, Rep. of Macedonia, Republic of Serbia and Montenegro Indonesia Morocco Tunisia Cyprus Palestinian Nat'l Auth. Jordan Botswana Saudi Arabia South Africa Iran, Islamic Republic of Ghana	74 73 72 71 70 68 68 67 67 66 64 63 62 57 57 52 52 50 50	

Country average International av	-
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Doma	in	
LIFE SCIENCE	Reproduction and Heredity	Conceptual Understa	andir	וg
ological control of insect popul	ation	Overall Percent	Corı	re
Why would male insects be treated to		United States Australia Singapore	71 69 68	
A To increase the number of female		England New Zealand	67 66	
(B) To reduce the total population of	insects	Scotland	66 65	
© To produce new species of insects		Belgium (Flemish)	62	
0 -		Sweden	60	
D To prevent insects from mating		Israel	59	
		Slovak Republic	58	
		Malaysia	57	
		Netherlands	57	
		Japan	54	
		Korea, Republic of	53	
		Hong Kong, SAR	52	
		Bulgaria	52	
		Hungary	50	
		Lithuania	49	
		Estonia Norway	47 47	
		Botswana	47	
		Serbia and Montenegro	46	
		Chile	45	
		International average	44	
		Italy	44	
		Chinese Taipei	44	
		Bahrain	42	
		Indonesia	42	
		Jordan	41	
		Latvia	40	
		Romania	39	
		Slovenia	38	
		Cyprus Masadania Banublis of	37	
		Macedonia, Republic of	34 22	
m Number: 5022117		Philippines Russian Federation	33 32	
m Number: S022117		Palestinian Nat'l Auth.	32 31	
		raiesuman nat i Auth.	51	

Correct Response:

В

Country average vs. International average: Lliab

29

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Higher	
Not different	0
Lower	

Armenia

Iran, Islamic Republic of

Moldova, Rep. of

Ghana

Egypt

Tunisia

Morocco

Lebanon

South Africa

Saudi Arabia

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Reproduction and Heredity	Factual Knowledge

Fertilization in animals

Which of the following takes place during fertilization in animals?

- (A) production of sperm and egg
- (B) joining of sperm and egg
- \bigcirc division of egg
- (D) development of embryo

Item Number: S032008

Correct Response:

В

Hong Kong, SAR	88	
Lithuania	87	
Chinese Taipei	86	
Estonia	85	
Japan	85	
Korea, Republic of	83	
Belgium (Flemish)	82	
Hungary	78	
England	77	
Netherlands	75	
Latvia	75	
Russian Federation	74	
Israel	73	
Sweden	72	
Morocco	69	
Slovak Republic	69	
Bulgaria	68	
United States	67	
Scotland	67	
Tunisia	67	
Slovenia	66	
Australia	65	
Singapore	64	
Malaysia	63	0
International average	60	
International average Norway	60 60	0
Norway		0
-	60	
Norway Cyprus	60 57	0
Norway Cyprus New Zealand Jordan	60 57 56	0 0 0
Norway Cyprus New Zealand	60 57 56 56	0 0 0
Norway Cyprus New Zealand Jordan Italy Bahrain	60 57 56 56 55	0 0 0
Norway Cyprus New Zealand Jordan Italy	60 57 56 56 55 54	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro	60 57 56 56 55 54 53	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth.	60 57 56 55 54 53 50	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile	60 57 56 55 54 53 50 48	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of	60 57 56 55 54 53 50 48 47	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile	60 57 56 55 54 53 50 48 47 47	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt	60 57 56 55 54 53 50 48 47 47 47	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania	60 57 56 55 54 53 50 48 47 47 47 46 44	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia	60 57 56 55 54 53 50 48 47 47 47 46 44 40	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa	60 57 56 55 54 53 50 48 47 47 47 46 44	0 0 7 7 7
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of	60 57 56 55 54 53 50 48 47 47 47 46 44 40 39 38	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of Botswana	60 57 56 55 54 53 50 48 47 47 47 46 44 40 39 38 37	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of Botswana Lebanon	60 57 56 55 54 53 50 48 47 47 47 46 44 40 39 38 37 37	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of Botswana Lebanon Philippines	60 57 56 55 54 53 50 48 47 47 47 47 46 44 40 39 38 37 37 31	
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of Botswana Lebanon	60 57 56 55 54 53 50 48 47 47 47 46 44 40 39 38 37 37	0 0 V V V
Norway Cyprus New Zealand Jordan Italy Bahrain Serbia and Montenegro Palestinian Nat'l Auth. Indonesia Chile Macedonia, Republic of Egypt Armenia Romania Saudi Arabia South Africa Moldova, Rep. of Botswana Lebanon Philippines Iran, Islamic Republic of	60 57 56 55 54 53 50 48 47 47 47 47 46 44 40 39 38 37 37 31 22	

Country average International av	•
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Conceptual Understanding

Bodily process to prevent overheating

What processes take place in the human body that prevent it from overheating during exercise?

Item Number: S022152

SCORING

Note: If perspiration or sweating is mentioned, score as correct, even if other correct responses such as increased blood flow to the skin are also included.

Correct Response

- Refers to perspiration (sweating) AND the cooling effect of evaporation.
 - Examples: When people sweat, it evaporates to cool them down. Sweating. When the sweat evaporates, it cools the skin. Perspiration cools you down when it evaporates.
- Refers to perspiration (sweating), without explicitly mentioning the cooling effect of evaporation. *Examples: The body sweats.*
 - Perspiration keeps you from overheating.
 - The perspiration cools you off and you don't stay hot.
- Refers to increased blood flow to the skin. Examples: The blood rushes to your face and cools you down.
- · Other correct.

Incorrect Response

• Refers only to drinking water to cool down.

Refers to an effect of exercise but does not specifically address overheating and/or cooling.
 Examples: The blood pumps faster. Breathing increases.

Your body is working hard and using up more food energy.

• Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Japan	86	
Korea, Republic of	85	
Australia	72	
United States	72	
New Zealand	69	
Scotland	69	
Estonia	67	
England	66	
Belgium (Flemish)	63	
Lithuania	61	
Latvia	61	
Netherlands	61	
Hong Kong, SAR	60	
Israel	59	
Italy	55	
Hungary	55	
Russian Federation	55	
Bulgaria	50	
Slovenia	48	
Singapore	48	
Sweden	47	0
Slovak Republic	45	0
Armenia	45	0
Moldova, Rep. of	44	0
International average	44	
International average Malaysia	44 42	0
Malaysia Romania		0 0
Malaysia Romania	42	
Malaysia	42 42	0
Malaysia Romania Serbia and Montenegro	42 42 41	0 0 0
Malaysia Romania Serbia and Montenegro Norway	42 42 41 41	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei	42 42 41 41 39	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile	42 42 41 41 39 37	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain	42 42 41 41 39 37 35	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of	42 42 41 39 37 35 32	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia	42 41 41 39 37 35 32 31	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of	42 41 41 39 37 35 32 31 29	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan	42 41 41 39 37 35 32 31 29 29	0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth.	42 41 41 39 37 35 32 31 29 29 24	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt	42 41 41 39 37 35 32 31 29 29 24 20	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia	42 41 41 39 37 35 32 31 29 29 24 20 19	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia	42 41 41 39 37 35 32 31 29 29 24 20 19 18	
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines	42 41 41 39 37 35 32 31 29 29 24 20 19 18 18	
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines Botswana	42 41 41 39 37 35 32 31 29 24 20 19 18 18 18 17	
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines Botswana Cyprus	42 41 41 39 37 35 32 31 29 24 20 19 18 18 18 17 15	
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines Botswana Cyprus South Africa	42 41 41 39 37 35 32 31 29 24 20 19 18 18 17 15 9	0 0 0
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines Botswana Cyprus South Africa Lebanon	42 41 41 39 37 35 32 31 29 24 20 19 18 18 17 15 9 7	
Malaysia Romania Serbia and Montenegro Norway Chinese Taipei Chile Bahrain Iran, Islamic Republic of Saudi Arabia Macedonia, Republic of Jordan Palestinian Nat'l Auth. Egypt Indonesia Tunisia Philippines Botswana Cyprus South Africa Lebanon Morocco	42 41 41 39 37 35 32 31 29 24 20 19 18 18 17 15 9 7 6	

Country average vs. International average:	
Higher	
Not different	0
Lower	V

Bodily process to prevent overheating (continued)

Item Number: S022152

Student Responses

Correct Response:

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What processes take place in the human body that prevent it from overheating during exercise?

1

Incorrect Response:

What processes take place in the human body that prevent it from overheating during exercise?

one process in the human body to keep it from overneating is dyndration. It you drink enough water as you exercise than you don't get over heated or Denydrated.

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Conceptual Understanding

Advantage of having two ears

What is the advantage of having two ears to hear with rather than one ear?	
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Item Number: S022160

SCORING

Note: Credit is given for both higher-level responses referencing locating the source of sound as well as less sophisticated responses referencing hearing sounds from both sides and retaining hearing if one ear does not function.

Correct Response

• Mentions being able to locate the position, direction and/or distance of the source of sound. *Examples: By having two ears, you can actually tell where a sound came from.*

With two ears you could hear which direction a noise is coming from.

- With two ears you can judge the distance the sound is away from you. With two ears you can tell if the sound is near or far.
- Mentions hearing sounds from both sides (direction) with no mention of locating the source. *Examples: You can hear on both sides of you.*
 - You can hear sounds from all around, not just one side. With two ears you can hear from more than one way.
- Mentions that if hearing is lost in one ear, the other may still function. *Examples: In the result of being deaf in one ear, you have another one that is used. If you lost the hearing in one ear, the other one might still work.*
- · Other correct.

Incorrect Response

- Gives only a general or vague response relating to how well one can hear. *Examples: You hear better.*
 - You can hear half as much with one ear.
 - Two ears lets you hear a lot more.
 - The volume is greater.
- Mentions only that hearing is uneven/unbalanced with one ear. Examples: If you had one ear, the sound would be uneven.
 - Your hearing would be out of balance.
 - You hearing gets balanced better with two ears.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Sweden	70	
Netherlands	70	
New Zealand	64	
Australia	64	
England	62	
Belgium (Flemish)	61	
United States	58	
Scotland	56	
Hungary	55	
Slovenia	53	
Norway	52	
Lithuania	50	
Latvia	48	A
Israel	41	
Estonia	41	
Singapore	40	
Jordan	37	0
Egypt	36	0
Korea, Republic of	35	0
International average	34	
Malaysia	33	0
Italy	32	0
Hong Kong, SAR	32	0
Chinese Taipei	30	
Palestinian Nat'l Auth.	30	$\begin{array}{c} \bullet \\ \bullet $
Macedonia, Republic of	29	▼
Cyprus	28	
Botswana	28	▼
Japan	27	•
Bahrain	25	▼
Romania	25	
Russian Federation	23	•
Chile	22	
Morocco	22	, v
Saudi Arabia	21	•
Slovak Republic	21	.
Armenia	20	÷
Serbia and Montenegro	20	÷
Moldova, Rep. of	20 19	÷
		÷.
Iran, Islamic Republic of Bulgaria	19 16	-
5		. <u>.</u>
Philippines	15 12	* * * *
Lebanon	12	-
South Africa	9	-
Ghana	8	_
Tunisia	7	_
Indonesia	6	•

Country average vs. International average:		
Higher		
Not different	0	
Lower 🔻		

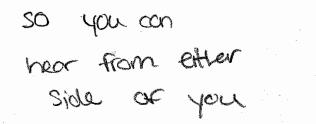
Advantage of having two ears (continued)

Item Number: S022160

Student Responses

Correct Response:

What is the advantage of having two ears to hear with rather than one ear?



Incorrect Response:

What is the advantage of having two ears to hear with rather than one ear?

With two ears, you can hear twice as much and with one ear you can only hear half as much.

Content Domain	Main Topic	Cognitive Doma	in
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Factual Knowledge	
gan NOT in abdomen		Overall Percent	Corr
Which of the following organs is NO	T situated in the abdomen?	Chinese Taipei Hungary Netherlands	94 83 83
(A) liver		Sweden	82
B kidney		Belgium (Flemish)	80
© stomach		Slovak Republic Bulgaria	78 77
\bigcirc		Macedonia, Republic of	77
D bladder		Lithuania	77
E heart		Russian Federation	77
		Armenia	76
		Hong Kong, SAR	75
		Serbia and Montenegro Australia	75 74
		Latvia	74
		United States	73
		Estonia	71
		Romania	69
		Singapore	68
		Israel	67
		Cyprus England	67 67
		Chile	66
		New Zealand	65
		Scotland	63
		International average	60
		Saudi Arabia	59
		Bahrain	58
		Japan Korea, Republic of	58 52
		Jordan	52 51
		Norway	50
		Slovenia	48
		Egypt	48
		Indonesia	47
n Number: S012001		Morocco	46 45
		Italy Philippines	45 45
		Tunisia	45 45
		Iran, Islamic Republic of	43
		Palestinian Nat'l Auth.	42
		Moldova, Rep. of	32
		Botswana	30
		Lebanon	26
		South Africa	26

Country average vs. International average:		
Higher Not different	0	
Lower	•	

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Malaysia

Ghana

Correct Response:

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Content Domain	Main Topic	Cognitive Doma	in
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Factual Knowledge	
Message from eyes to brain		Overall Percent	Correct
 When a person sees something, what the brain? (A) arteries (B) glands (C) muscles (D) nerves (E) veins 	carries the message from the eyes to	Chinese Taipei Japan Hong Kong, SAR Korea, Republic of Netherlands Slovak Republic Belgium (Flemish) Hungary Singapore Lithuania Indonesia Russian Federation Sweden Slovenia England Australia Iran, Islamic Republic of United States New Zealand Macedonia, Republic of Estonia Bulgaria Serbia and Montenegro Malaysia Italy Moldova, Rep. of Latvia Scotland Saudi Arabia Jordan International average Bahrain Romania Israel Armenia Tunisia Palestinian Nat'l Auth. Norway Philippines Egypt Botswana Cyprus Morocco Lebanon	94 A 93 A 93 A 92 A 91 A 87 A 86 A 85 A 81 A 81 A 81 A 81 A 81 A 80 A 79 A 70 O 71 O 72 O 70 O 70 O 63 V 59 V 56 V 46 V
Correct Response: D		Chile South Africa Ghana	36 ▼ 29 ▼ 17 ▼

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

	TIMSS 2003 8th-Grade	Science Concepts and Sci	ence l	lter
Content Domain	Main Topic	Cognitive Doma	ain	
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Factual Knowledge		
bsorbtion of food into the blo	od stream	Overall Percent	Corr	ec
In humans, where does the absorpt take place? (A) stomach (B) mouth (C) large intestines (D) small intestines	ion of food into the blood stream mainly	Singapore Japan Armenia Jordan Malaysia Slovenia Hong Kong, SAR Sweden Moldova, Rep. of Chinese Taipei Saudi Arabia Egypt Morocco Belgium (Flemish) Philippines New Zealand Korea, Republic of Bahrain Slovak Republic	71 58 44 43 42 38 37 35 34 33 33 33 31 30 29 29 29 29 29 28	
		International average Palestinian Nat'l Auth. Netherlands Australia United States Russian Federation Ghana Romania Lithuania	28 27 27 27 26 26 26 25 25	
		Hungary Lebanon	25 25	C

Item Number: S032386

Correct Response:

D

Country average vs. International average: Higher 0 Not different ▼ Lower

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England

Indonesia

Botswana

Bulgaria

Chile

Tunisia

Scotland

Estonia

Norway

Cyprus

South Africa

Latvia

Israel

Macedonia, Republic of

Serbia and Montenegro

Iran, Islamic Republic of

Italy

Content Domain	Main Topic	Cognitive Doma	in	
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Factual Knowledge		
sh organ like human lung		Overall Percent	Corr	'e
Which of the following organs in fish l	has the same function	Italy	91	
as the human lung?		Korea, Republic of Hungary	90 85	
0		Russian Federation	84	
A) kidney		Netherlands	83	
0		Iran, Islamic Republic of	82	
B heart		Chinese Taipei	80	
c) gill		Belgium (Flemish)	78	
-		Moldova, Rep. of	77	
D skin		Sweden	76	
		Bahrain	76	
		Bulgaria	76	
		Hong Kong, SAR	75	
		Slovenia	74	
		Estonia	74	
		Romania	72	
		Slovak Republic	71	
		Japan	68	
		Morocco	68	
		Israel	64	
		Jordan	64	
		England	64	_
		International average	63	
		Serbia and Montenegro	63	
		Saudi Arabia	63	
		Singapore	62 62	
		Lithuania	62 62	
		Egypt Macedonia, Republic of	62 62	
		Malaysia	62	
		Australia	62 61	
		Latvia	61	
		Chile	60	
		United States	60	
		Scotland	59	
Number: S032607		Armenia	58	
		Palestinian Nat'l Auth.	56	
		Norway	55	
		Indonesia	54	
		New Zealand	49	
		Lebanon	45	
		Tunisia		

Correct Response:

С

Country average vs. International average: Higher Not different 0 ▼

Lower

South Africa

Tunisia Philippines

Cyprus Botswana

Ghana

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Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Structure, Function and Life Processes in Organisms	Reasoning and Analysis

How glasses/contact lenses work

Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

Item Number: S022161

SCORING

Note: Credit is given for higher-level responses that demonstrate knowledge of vision by describing how lenses modify the way light enters the eye and hits the **retina** or back of the eye (as well as less sophisticated responses based on helping eyes to focus, to see objects at different distances or to magnification.

Correct Response

- Mentions that glasses/contact lenses bend (refract) or focus light rays onto the retina (or back of the eye). [May use a diagram to show this.]
 Examples: The glasses focus the light onto the retina.
- Mentions the curvature (shape) of lenses (concave/convex) and/or bending of light by lenses. [Based primarily on the properties of lenses with no explicit mention of the focusing of light on the retina or back of eye.]

Examples: You can focus better because glasses bend the light into your eye.

- Mentions that glasses/contact lenses help the eyes focus and/or allow (near-sighted/far-sighted) people to see images at a distance or close up.
- Examples: Some people can see close up but need glasses in order to see things far away. Far-sighted people can only read with glasses that correct their close-up vision. Eyeglasses can help your eyes to focus more clearly on things.

· Mentions that glasses/contact lenses magnify or enlarge (images).

Examples: They magnify.

The magnification in the glasses make things more clear and bigger. The lenses make things look bigger.

· Other correct.

Incorrect Response

 Gives only a vague reference to glasses/contact lenses helping people see more clearly or containing prescriptions (chemicals, special type/shape/thickness of glass, etc.) without further explanation of vision or how lenses work.

Examples: They make you see more clearly.

- If you are near sighted, you need glasses to help you see. Contacts help vision because of the prescription injected into them. Lenses are prescribed to fix eye problems.
- The lenses in glasses are made thick so you can see better.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

New Zealand	68	
Jordan	64	
Estonia	56	
England	56	
Bahrain	55	
Australia	55	
Armenia	54	
Moldova, Rep. of	53	
Latvia	52	
Korea, Republic of	52	
Russian Federation	51	
Palestinian Nat'l Auth.	50	
Netherlands	50	
Sweden	49	
Lithuania	48	
Hungary	48	
United States	48	
Scotland	48	
Norway	47	
Hong Kong, SAR	46	
Slovak Republic	44	
Singapore	44	
Chile	42	0
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Israel	42	0
Israel Slovenia	42 41	0
Slovenia Egypt	41 39	
Slovenia	41	0
Slovenia Egypt	41 39	0
Slovenia Egypt International average	41 39 39	0
Slovenia Egypt International average Romania Bulgaria Malaysia	41 39 39 37 37 35	0
Slovenia Egypt International average Romania Bulgaria	41 39 39 37 37 35 34	0
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Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Serbia and Montenegro Italy	41 39 37 37 35 34 34 33 32 30 30	0
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei	41 39 37 35 34 34 33 32 30 30 28	0
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia	41 39 37 37 35 34 34 33 32 30 30 28 26	0
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Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco	41 39 37 37 35 34 34 33 30 30 28 26 19 18 17 15	
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco Philippines	41 39 37 37 35 34 34 33 32 30 30 28 26 19 18 17 15 14	
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco Philippines Botswana	41 39 37 37 35 34 34 33 32 30 30 28 26 19 18 17 15 14 12	
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco Philippines Botswana South Africa	41 39 37 37 35 34 34 33 32 30 30 28 26 19 18 17 15 14 12 9	
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco Philippines Botswana South Africa Lebanon	41 39 37 37 35 34 34 33 32 30 30 28 26 19 18 17 15 14 12 9 6	0
Slovenia Egypt International average Romania Bulgaria Malaysia Belgium (Flemish) Japan Macedonia, Republic of Iran, Islamic Republic of Serbia and Montenegro Italy Chinese Taipei Indonesia Saudi Arabia Tunisia Cyprus Morocco Philippines Botswana South Africa	41 39 37 37 35 34 34 33 32 30 30 28 26 19 18 17 15 14 12 9	

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How glasses/contact lenses work (continued) Item Number: S022161

Student Responses

Correct Response:

Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

Eveglasses and contact lenses bind the light rays so the hit the retina at the right angle to make them see showly. Pegubr (No contacts) Contacts S02216

Incorrect Response:

Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

Glasses and contacts have Perscriptions in them of what your eyesite percentage is, (Because you go to the eye. doctor to get tested.)

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Types, Characteristics and Classification of Living Things	Conceptual Understanding

Characteristics of animal groups

A person sorted some animals into the two groups listed on the table. Which characteristic of animals was used for the sorting?

(A)	Legs
B	Eyes

(D) Skin

(C) Nervous system

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

Overall Percent Correct

Korea, Republic of	79	
Japan	76	
Australia	70	
New Zealand	68	
Chinese Taipei	66	
England	66	
Scotland	64	
Malaysia	63	
Hong Kong, SAR	62	
Estonia	62	
Slovak Republic	62	
United States	62	
Norway	60	
Singapore	59	
Netherlands	58	
Israel	57	
Latvia	56	
Sweden	54	
Belgium (Flemish)	53	
Hungary	49	
Russian Federation	48	0
Italy	47	0
Slovenia	46	0
International average	45	0
Armenia	43	0
Armenia Cyprus	43 42	0
Cyprus	43 42 41	0
	42	0
Cyprus Moldova, Rep. of	42 41 40	0 0 V
Cyprus Moldova, Rep. of Lithuania Bahrain	42 41 40 37	0 0 V
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria	42 41 40 37 36	0 0 • •
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro	42 41 40 37 36 35	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania	42 41 40 37 36 35 33	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of	42 41 40 37 36 35 33 32	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth.	42 41 40 37 36 35 33 32 31	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia	42 41 40 37 36 35 33 32 31 31	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth.	42 41 40 37 36 35 33 32 31 31 31	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia	42 41 40 37 36 35 33 32 31 31 31 26	0 0 • •
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco	42 41 40 37 36 35 33 32 31 31 31 26 25	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt	42 41 40 37 36 35 33 32 31 31 31 26 25 25	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan	42 41 40 37 36 35 33 32 31 31 26 25 25 24	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan Indonesia	42 41 40 37 36 35 33 32 31 31 26 25 25 24 24	0 0 * *
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan Indonesia Botswana	42 41 40 37 36 35 33 32 31 31 26 25 25 24 24 23	
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Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan Indonesia Botswana Philippines Iran, Islamic Republic of	42 41 40 37 36 35 33 32 31 31 31 26 25 24 24 23 23 23	
Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan Indonesia Botswana Philippines Iran, Islamic Republic of South Africa	42 41 40 37 36 35 33 32 31 31 31 26 25 24 24 23 23 23 19	0 0 * *
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Cyprus Moldova, Rep. of Lithuania Bahrain Bulgaria Serbia and Montenegro Romania Macedonia, Republic of Palestinian Nat'l Auth. Tunisia Chile Saudi Arabia Morocco Egypt Jordan Indonesia Botswana Philippines Iran, Islamic Republic of South Africa Lebanon	42 41 40 37 36 35 33 32 31 31 31 26 25 24 23 23 23 23 19 19	

Country average International av	
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Item Number: S012028

Correct Response: A

185

Japan

Malaysia

Singapore

Bulgaria

Italy

Armenia Estonia

Latvia Lithuania

Hungary

Slovenia

Romania

England

Australia

Botswana

Philippines

Lebanon

Scotland

Netherlands

South Africa

Saudi Arabia

Palestinian Nat'l Auth.

Jordan

Egypt

Bahrain

Ghana

Cyprus

Sweden

Norway

Indonesia

Morocco

Tunisia

Chile

New Zealand

Belgium (Flemish)

United States

Hong Kong, SAR

Macedonia, Republic of

International average

Serbia and Montenegro

Iran, Islamic Republic of

Korea, Republic of

Slovak Republic

Israel

Russian Federation

Moldova, Rep. of

Chinese Taipei

Content Domain	Main Topic	Cognitive Domain
LIFE SCIENCE	Types, Characteristics and Classification of Living Things	Conceptual Understanding

Cats most closely related to which animal

A	s are most closely related to which of the following animals? crocodiles	
B	whales	
C		
D	penguins	
n N	umber: \$032595	

Overall Percent Correct

65

47

46

43

42

41

40

39

36

35

35

33

32

31

31

28

27

26

26

25

25

25

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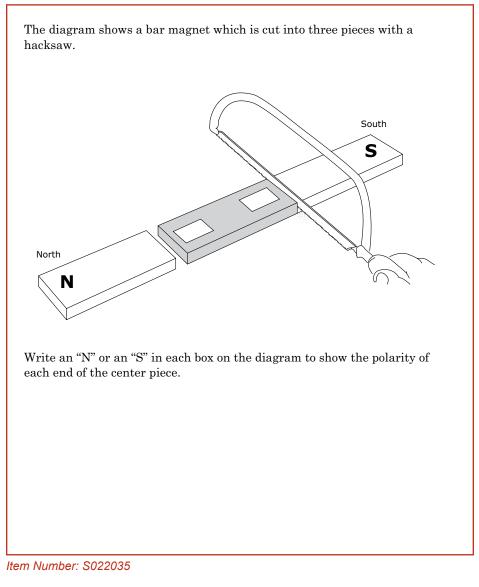
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Correct Response:

e: B

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Conceptual Understanding

Poles on cut magnet



SCORING

Note: To receive credit, the polarity of BOTH ends of the center piece must be indicated. Answer is correct if polarity is indicated correctly (N-S), but letters are shown above, below, or outside the boxes, as long as the polarity of both ends of the center piece is clear.

Correct Response

• N-S

Incorrect Response

- S-N
- · Pole of cut ends of outer pieces are indicated (S N) instead of poles on center piece.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Japan	64	
Singapore	62	
Macedonia, Republic of	62	
Korea, Republic of	59	
Bahrain	58	
Sweden	58	
Lithuania	56	
Belgium (Flemish)	55	
Cyprus	53	
Russian Federation	52	
New Zealand	51	
Australia	51	
United States	51	
Estonia	51	
Serbia and Montenegro	51	
Israel	51	
Netherlands	49	0
Bulgaria	48	0
Italy	48	0
Morocco	47	0
Scotland	47	0
Moldova, Rep. of	46	0
Romania	46	0
England	46	0
England		Ŭ
Latvia	45	0
Latvia Slovenia	45 45	0
Slovenia	45	0 0
Slovenia International average		0
Slovenia International average Chinese Taipei	45 44 44	0
Slovenia International average Chinese Taipei Slovak Republic	45 44 43	0
Slovenia International average Chinese Taipei Slovak Republic Hungary	45 44 43 43	0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia	45 44 43	0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway	45 44 43 43 43	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR	45 44 43 43 43 43 41 40	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway	45 44 43 43 43 43 41	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan	45 44 43 43 43 43 41 40 39 38	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana	45 44 43 43 43 41 40 39	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia	45 44 43 43 43 43 41 40 39 38 37	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile	45 44 43 43 43 41 40 39 38 37 36	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines	45 44 43 43 43 41 40 39 38 37 36 35 34	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia	45 44 43 43 43 41 40 39 38 37 36 35 34 33	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia	45 44 43 43 43 41 40 39 38 37 36 35 34	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of	45 44 43 43 43 41 40 39 38 37 36 35 34 33 32 32 32	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of Egypt	45 44 43 43 43 41 40 39 38 37 36 35 34 33 32 32 32 30	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of	45 44 43 43 41 40 39 38 37 36 35 34 33 32 32 32 30 27	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of Egypt Palestinian Nat'l Auth. Armenia	45 44 43 43 41 40 39 38 37 36 35 34 33 32 32 32 30 27 25	0 0 0 0 0 0 0
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of Egypt Palestinian Nat'l Auth.	45 44 43 43 41 40 39 38 37 36 35 34 33 32 32 32 30 27	
Slovenia International average Chinese Taipei Slovak Republic Hungary Malaysia Norway Hong Kong, SAR Botswana Jordan Saudi Arabia Lebanon Chile Philippines Tunisia Indonesia Iran, Islamic Republic of Egypt Palestinian Nat'l Auth. Armenia Ghana	45 44 43 43 41 40 39 38 37 36 35 34 33 32 32 30 27 25 19	

Country avera International a	
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Not different	○
Lower	▼

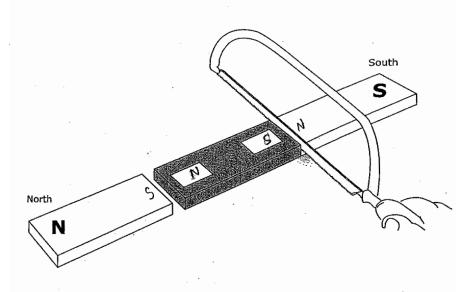
Poles on cut magnet (continued)

Item Number: S022035

Student Responses

Correct Response:

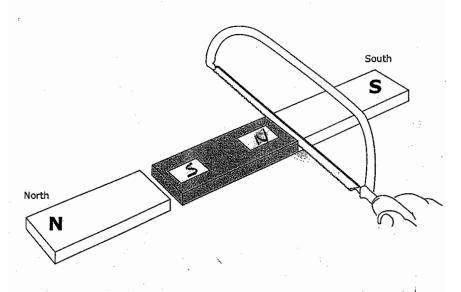
The diagram shows a bar magnet which is cut into three pieces with a hacksaw.



Write an "N" or an "S" in each box on the diagram to show the polarity of each end of the center piece.

Incorrect Response:

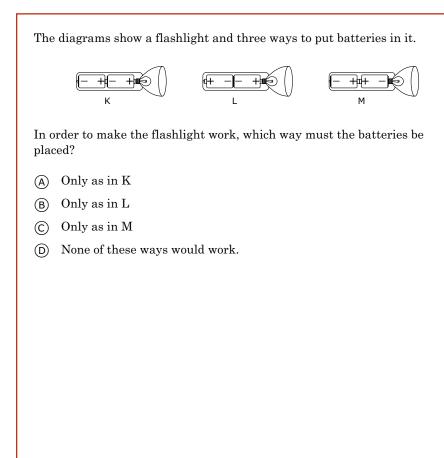
The diagram shows a bar magnet which is cut into three pieces with a hacksaw.



Write an "N" or an "S" in each box on the diagram to show the polarity of each end of the center piece.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Factual Knowledge

Diagram of batteries in a flashlight



Item Number: S012037

Correct Response:

Α

Cingonoro	97	
Singapore		A
England	95	A
Korea, Republic of	93	
Japan	93	
Hong Kong, SAR	93	
Russian Federation	93	
Slovak Republic	93	
Estonia	93	
Chinese Taipei	92	
Malaysia	91	
Romania	91	
Latvia	91 91	
Hungary	91	
Bulgaria	91	
Bahrain	90	
Lithuania	90	
Moldova, Rep. of	90	
Sweden	89	
United States	89	
Armenia	88	
New Zealand	88	0
Slovenia	87	
Lebanon		0
Netherlands	86	-
	86	0
Australia	85	0
Belgium (Flemish)	85	0
Cyprus	85	0
International average	85	
Scotland	84	0
Indonesia	84	0
Serbia and Montenegro	84	0
Macedonia, Republic of	84	0
Italy	83	0
Iran, Islamic Republic of	83	0
Chile	82	0
Israel	82	0
Norway	81	Ť
Botswana	81	.
	81	Ŏ
Morocco	υ.	0
Jordan Caudi Arabia	78	<u> </u>
Saudi Arabia	78	-
Palestinian Nat'l Auth.	78	
Philippines	77	
Egypt	67	
Tunisia	59	
Ghana	55	* * * *
South Africa	52	▼

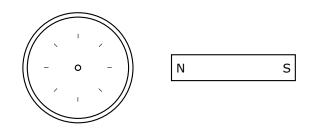
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Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Reasoning and Analysis

Compass placed next to a magnet/draw



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.



- A. Draw the compass needle in the circle on the diagram above. Label the North (N) and South (S) poles of the needle.
- B. Explain your answer using your knowledge of magnets.

Item Number: S032625A

SCORING

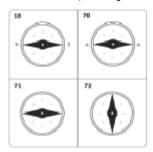
Correct Response

• Draws a "horizontal" needle with N to the left and S to the right. [See diagram below.]

Note: Credit should be given even if one label is missing (N to the left OR S to the right shown).

Incorrect Response

- Draws a "horizontal" needle with poles reversed (N to the right and/or S to the left). [See diagram below.]
- · Draws a "horizontal" needle with no poles indicated. [See diagram below.]
- Draws a "vertical" needle with or without poles indicated. [See diagram below.]
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).



Japan	88	
Korea, Republic of	87	
Chinese Taipei	86	
Singapore	76	
Slovak Republic	74	
Hungary	67	
England	65	
Hong Kong, SAR	61	
Malaysia	58	
Bulgaria	57	
Bahrain	56	
Armenia	54	
Sweden	52	
Australia	50	
Russian Federation	48	
Romania	45	
Serbia and Montenegro	45	
United States	45	
Netherlands	44	0
Iran, Islamic Republic of	43	0
Scotland	41	0
International average	40	0
Jordan	38	0
Moldova, Rep. of	37	0
	57	0
	33	•
Italy	33 33	▼
Italy Macedonia, Republic of	33	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth.	33 33	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon	33 33 31	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand	33 33 31 31	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway	33 33 31 31 30	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia	 33 33 31 31 30 29 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco	 33 33 31 31 30 29 28 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel	 33 33 31 31 30 29 28 27 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia	 33 33 31 31 30 29 28 27 26 	▼
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Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia	 33 33 31 31 30 29 28 27 26 26 25 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish)	 33 33 31 30 29 28 27 26 26 25 25 	* * * * * * * * * * * * * * * * * * *
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia	 33 33 31 30 29 28 27 26 26 25 25 24 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia	 33 33 31 31 30 29 28 27 26 26 25 24 23 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania	 33 33 31 30 29 28 27 26 26 25 24 23 21 	 * *<
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania Cyprus	 33 33 31 30 29 28 27 26 26 25 24 23 21 20 	 * *<
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania Cyprus Philippines	 33 33 31 30 29 28 27 26 26 25 24 23 21 20 17 	 * *<
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania Cyprus Philippines Saudi Arabia	 33 33 31 30 29 28 27 26 26 25 24 23 21 20 17 16 	 * *<
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Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania Cyprus Philippines Saudi Arabia Chile Botswana	 33 31 31 30 29 28 27 26 26 25 24 23 21 20 17 16 15 14 	 * *<
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Latvia Lithuania Cyprus Philippines Saudi Arabia Chile Botswana South Africa	 33 31 31 30 29 28 27 26 26 25 24 23 21 20 17 16 15 14 5 	▼
Italy Macedonia, Republic of Palestinian Nat'l Auth. Lebanon New Zealand Norway Estonia Morocco Israel Indonesia Egypt Slovenia Belgium (Flemish) Tunisia Latvia Lithuania Cyprus Philippines Saudi Arabia Chile Botswana	 33 31 31 30 29 28 27 26 26 25 24 23 21 20 17 16 15 14 	 * *<

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Compass placed next to a magnet/draw (continued)

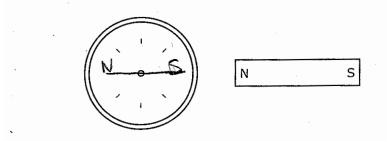
Item Number: S032625A

Student Responses

Correct Response:



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.

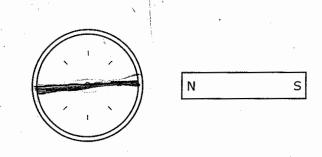


A. Draw the compass needle in the circle on the diagram above. Label the North (N) and South (S) poles of the needle.

Incorrect Response:



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.



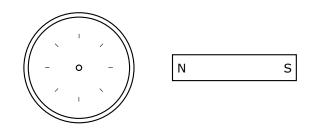
A. Draw the compass needle in the circle on the diagram above. Label the North (N) and South (S) poles of the needle.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Reasoning and Analysis

Compass placed next to a magnet/explain



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.



- A. Draw the compass needle in the circle on the diagram above. Label the North (N) and South (S) poles of the needle.
- B. Explain your answer using your knowledge of magnets.

Item Number: S032625B

Scoring for Explanation

Correct Response

• Explains that opposite poles attract (N toward S, etc.) or like poles repel (or similar).

Examples: The south point of the compass is attracted to the north pole of the magnet. North and south attract together.

The magnets which have different poles attract one another.

- The N pole on the magnet will attract the S pole on the compass. Opposites attract and likes repel.
- The magnet pushes the N pole of the compass away.
- Other correct.

Incorrect Response

- Refers to magnetic attraction/repulsion but with an incorrect application.
 - Examples: Because the same pole will be attracted.
 - The magnet is closer to the compass and will have a stronger attraction to the N end. The needle of the compass is metal, so it is attracted to the magnet and turns. It attracts the needle to North and South poles.
- Explains that the compass needle always points North, or similar. Examples: The needle of North always goes to the magnetic North. North always goes toward North.
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Korea, Republic of	81	
Japan	77	
Chinese Taipei	70	
	67	
Singapore		
Hungary	59	
England	59	
Slovak Republic	56	
Hong Kong, SAR	47	
Armenia	45	
Bahrain	43	
Malaysia	43	
Bulgaria	42	
Australia	41	
Iran, Islamic Republic of	40	
Sweden	39	
United States	37	
Serbia and Montenegro	37	
Romania	33	0
		0
Netherlands	31	
Jordan	30	0
Palestinian Nat'l Auth.	30	0
International average	29	
Russian Federation	29	0
Maldava Dan of	28	0
Moldova, Rep. of	28	
Scotland	28 28	0
		0
Scotland	28	0
Scotland Macedonia, Republic of	28 21	0
Scotland Macedonia, Republic of Italy	28 21 20	0
Scotland Macedonia, Republic of Italy Indonesia	28 21 20 20	0
Scotland Macedonia, Republic of Italy Indonesia Egypt	28 21 20 20 17 17	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel	28 21 20 20 17 17 16	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon	28 21 20 20 17 17 16 16	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco	28 21 20 20 17 17 16 16 14	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia	28 21 20 20 17 17 16 16 14 13	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway	28 21 20 20 17 16 16 16 14 13 13	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana	28 21 20 20 17 16 16 14 13 13 11	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish)	28 21 20 20 17 16 16 14 13 13 11 11	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia	28 21 20 20 17 16 16 14 13 13 11 11 10	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia	28 21 20 20 17 16 16 14 13 13 11 11	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia	28 21 20 17 17 16 16 14 13 13 11 11 10 9 9	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia	28 21 20 17 17 16 16 14 13 13 11 11 10 9	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia	28 21 20 17 17 16 16 14 13 11 11 10 9 8 8 8	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines	28 21 20 17 17 16 16 14 13 13 11 11 10 9 8	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines Latvia	28 21 20 17 17 16 16 14 13 11 11 10 9 8 8 8	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines Latvia Chile	28 21 20 17 17 16 16 14 13 11 11 10 9 8 8 5	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines Latvia Chile Lithuania South Africa	28 21 20 17 17 16 16 14 13 11 11 10 9 8 8 5 5 5	
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines Latvia Chile Lithuania	28 21 20 17 17 16 16 14 13 11 11 10 9 8 8 5 5 4	0
Scotland Macedonia, Republic of Italy Indonesia Egypt New Zealand Israel Lebanon Morocco Estonia Norway Botswana Belgium (Flemish) Slovenia Saudi Arabia Tunisia Philippines Latvia Chile Lithuania South Africa Cyprus	28 21 20 17 16 16 14 13 13 11 11 10 9 8 8 5 5 4 4	

Country average vs. International average:		
Higher	▲	
Not different	○	
Lower	▼	

Compass placed next to a magnet/explain (continued)

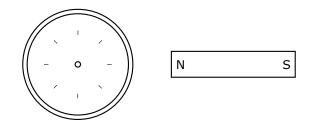
Item Number: S032625B

Student Responses

Correct Response:



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.

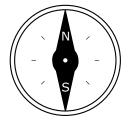


B. Explain your answer using your knowledge of magnets. OPPOSITES attract and the north side of the mognet is facing the compased so the needle with south on it will point to the magnet Compass placed next to a magnet/explain (continued)

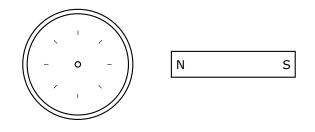
Item Number: S032625B

Student Responses (continued)

Incorrect Response:



The diagram above shows a compass needle with its North and South poles labeled (N and S). It is placed next to a strong magnet as shown in the diagram below.



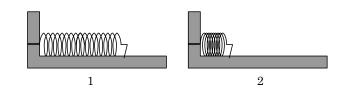
B. Explain your answer using your knowledge of magnets.

JUNOF (\mathbf{v})

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Types, Sources and Conversions	Conceptual Understanding

Stored energy in two springs

Spring 1 and Spring 2 were the same. Then, Spring 1 was pushed together a little and clamped in place. Spring 2 was pushed together a lot and clamped.



Which spring has more stored energy?

- (A) Spring 1
- (B) Spring 2
- (C) Both springs have the same energy.
- (D) You cannot tell unless you know what the springs are made of.

В

Item Number: S012002

Correct Response:

Singapore	84	
England	84	
Korea, Republic of	84	
United States	83	
New Zealand	83	
Japan Natharlanda	81	
Netherlands	79 70	
Australia	78	A
Scotland	78	
Estonia	77	
Hungary	75	
Italy	75	
Norway	74	
Lithuania	74	
Russian Federation	73	
Belgium (Flemish)	71	
Sweden	71	
Israel	70	
Hong Kong, SAR	69	
Slovenia	68	
Malaysia	67	
Latvia	64	0
Chinese Taipei	64	0
Lebanon	63	0
	05	0
lordan	63	0
Jordan	63	0
International average	62	
International average Bulgaria	62 61	0
International average Bulgaria Armenia	62 61 60	0
International average Bulgaria Armenia Chile	62 61 60 59	0 0 0
International average Bulgaria Armenia Chile Cyprus	62 61 60 59 58	0 0 0 0
International average Bulgaria Armenia Chile Cyprus Indonesia	62 61 60 59 58 57	0 0 0 0
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of	62 61 60 59 58 57 56	0 0 0 0 0
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of	62 61 60 59 58 57 56 56	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro	62 61 59 58 57 56 56 55	0 0 0 ♥ ♥
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana	62 61 60 59 58 57 56 56 55 52	0 0 0 ♥ ♥
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth.	62 61 60 59 58 57 56 56 55 55 52 50	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines	62 61 60 59 58 57 56 55 56 55 52 50 48	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic	62 61 60 59 58 57 56 56 55 55 52 50	0 0 0 ♥ ♥
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines	62 61 60 59 58 57 56 55 56 55 52 50 48	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic	62 61 60 59 58 57 56 56 55 52 50 48 47	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco	62 61 60 59 58 57 56 55 52 50 48 47 46	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania	62 61 60 59 58 57 56 55 52 50 48 47 46 39	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa Egypt	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39 39	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa Egypt Moldova, Rep. of	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39 39 38 37	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa Egypt Moldova, Rep. of Saudi Arabia Ghana	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39 39 39 38 37 36	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa Egypt Moldova, Rep. of Saudi Arabia	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39 39 38 37 36 35	
International average Bulgaria Armenia Chile Cyprus Indonesia Iran, Islamic Republic of Macedonia, Republic of Serbia and Montenegro Botswana Palestinian Nat'l Auth. Philippines Slovak Republic Morocco Romania South Africa Egypt Moldova, Rep. of Saudi Arabia Ghana Bahrain	62 61 60 59 58 57 56 55 52 50 48 47 46 39 39 39 39 38 37 36	

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Types, Sources and Conversions	Conceptual Understanding

Nail pulled out of a wooden board

When a nail is pulled out of a wooden board, the nail becomes warm. Explain why.

Item Number: S032131

SCORING

Correct Response

- Explanation refers to friction (implicitly or explicitly). Examples: Because it is rubbed against the wood.
 - Nail resists when you pull it out.
 - Because of the force on the nail to pull it out. Because of friction.
 - There is friction between the nail and the wooden board.
- Explanation refers to energy change. Examples: There is more energy in the nail after the transition. Because energy is used to get it out.
 - Kinetic energy changes to heat energy when you pull it out.
- Other correct.

Incorrect Response

• Explanation refers only to the nail or the action taken with inadequate connection to friction or energy.

Examples: It is hard to get it out. You must pull hard. Because it was in the wood for too long.

· Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Chinese Taipei	84	
Hungary	84	
Slovak Republic	78	
England	75	
Hong Kong, SAR	74	
Japan	74	
United States	73	
Russian Federation	72	
Lithuania	72	
Netherlands	71	
Australia	71	
Korea, Republic of	70	
Latvia	68	
Singapore	67	
Estonia	66	
Scotland	66	
Armenia	66	
Belgium (Flemish)	64	
Romania	64	
Malaysia	63	
Moldova, Rep. of	62	
Bulgaria	61	
New Zealand	57	0
Slovenia	54	0
International average	52	
Iran, Islamic Republic of	52	0
Iran, Islamic Republic of Sweden	52 51	0
Iran, Islamic Republic of Sweden Israel	52 51 48	0
Iran, Islamic Republic of Sweden Israel Norway	52 51 48 47	0
Iran, Islamic Republic of Sweden Israel Norway Jordan	52 51 48 47 44	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus	52 51 48 47 44 44	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro	52 51 48 47 44 44 44	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of	52 51 48 47 44 44 44 44	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth.	52 51 48 47 44 44 44 41 40	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy	52 51 48 47 44 44 44 41 40 40	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile	52 51 48 47 44 44 41 40 40 40	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia	52 51 48 47 44 44 41 40 40 40 39	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain	52 51 48 47 44 44 41 40 40 40 39 33	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco	52 51 48 47 44 44 41 40 40 40 39 33 27	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia	52 51 48 47 44 44 41 40 40 40 39 33 27 27	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia	52 51 48 47 44 44 41 40 40 40 39 33 27 27 26	
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines	52 51 48 47 44 44 41 40 40 40 39 33 27 27 26 24	
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines Lebanon	52 51 48 47 44 44 41 40 40 40 39 33 27 27 26 24 22	
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines Lebanon Egypt	52 51 48 47 44 44 41 40 40 40 40 39 33 27 27 26 24 22 20	
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines Lebanon Egypt Botswana	52 51 48 47 44 41 40 40 40 40 40 39 33 27 27 26 24 22 20 11	
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines Lebanon Egypt Botswana South Africa	52 51 48 47 44 41 40 40 40 40 40 39 33 27 27 26 24 22 20 11 11	0
Iran, Islamic Republic of Sweden Israel Norway Jordan Cyprus Serbia and Montenegro Macedonia, Republic of Palestinian Nat'l Auth. Italy Chile Indonesia Bahrain Morocco Tunisia Saudi Arabia Philippines Lebanon Egypt Botswana	52 51 48 47 44 41 40 40 40 40 40 39 33 27 27 26 24 22 20 11	

Country average vs. International average:		
Higher		
Not different	0	
Lower	•	

Nail pulled out of a wooden board (continued) Item Number: S032131

Student Responses

Correct Response:

When a nail is pulled out of a wooden board, the nail becomes warm. Explain why.

The nail becomes warm because of the energy that was in it as it was pulled out.

Incorrect Response:

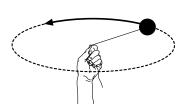
When a nail is pulled out of a wooden board, the nail becomes warm. Explain why.

Because the inside of the board is warmer than it is on the outside

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Conceptual Understanding

Path of ball released from orbit

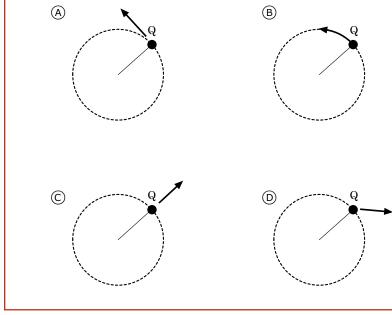
The diagram on the left shows a ball on the end of a string being whirled in a circle. The diagram on the right shows the whirling ball as viewed from above.





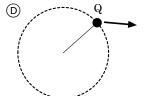
(View from above)

After several whirls, the string is released when the ball is at Q. Which of these diagrams shows the direction in which the ball will fly the instant the string is released?



Item Number: S022040

Correct Response: Α



Korea, Republic of	87	
Netherlands	82	
Estonia	80	
Singapore	79	
Australia	77	
Japan	77	
Hungary	77	
Scotland	77	
New Zealand	77	
Belgium (Flemish)	76	
United States	76	
Lithuania	75	
Malaysia	75	
Sweden	74	
England	74	
Russian Federation	74	
Slovak Republic	72	
Norway	72	
Latvia	71	
Slovenia	70	
Hong Kong, SAR	69	
Chinese Taipei	68	
Italy	61	0
Bulgaria	60	0
Daigana	00	<u> </u>
Serbia and Montenegro	60	0
Serbia and Montenegro	60 60	0
International average	60	
International average Cyprus	60 59	0
International average Cyprus Israel	60	0
International average Cyprus Israel Romania	60 59 58 58	0 0 0
International average Cyprus Israel Romania Chile	60 59 58 58 58	0 0 0 0
International average Cyprus Israel Romania Chile Armenia	60 59 58 58 58 58 58	0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of	60 59 58 58 58 58 58 58 54	0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of	60 59 58 58 58 58 58 58 54 52	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of	60 59 58 58 58 58 58 54 52 48	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan	60 59 58 58 58 58 58 54 52 48 47	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia	60 59 58 58 58 58 58 54 52 48 47 47	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain	 60 59 58 58 58 58 54 52 48 47 47 44 	0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines	 60 59 58 58 58 54 52 48 47 47 44 42 	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia	 60 59 58 58 58 54 52 48 47 47 44 42 38 	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth.	 60 59 58 58 58 54 52 48 47 47 44 42 38 36 	0 0 0 0 0 0
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco	 60 59 58 58 58 54 52 48 47 47 44 42 38 36 33 	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia	60 59 58 58 58 54 52 48 47 47 44 42 38 36 33 31	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia Egypt	60 59 58 58 58 54 52 48 47 47 47 44 42 38 36 33 31 30	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia Egypt Lebanon	60 59 58 58 58 54 52 48 47 47 44 42 38 36 33 31 30 30	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia Egypt Lebanon Botswana	60 59 58 58 58 54 52 48 47 47 47 44 42 38 36 33 31 30 30 30 30	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia Egypt Lebanon Botswana South Africa	60 59 58 58 58 54 52 48 47 47 47 44 42 38 36 33 31 30 30 30 22	
International average Cyprus Israel Romania Chile Armenia Macedonia, Republic of Moldova, Rep. of Iran, Islamic Republic of Jordan Indonesia Bahrain Philippines Saudi Arabia Palestinian Nat'l Auth. Morocco Tunisia Egypt Lebanon Botswana	60 59 58 58 58 54 52 48 47 47 47 44 42 38 36 33 31 30 30 30 30	

Country average vs. International average:	
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Domai	n
PHYSICS	Forces and Motion	Conceptual Understa	ndin
ny helium balloon moves upwa	rd	Overall Percent (Corre
A balloon filled with helium gas is set f Which of the following best explains wh A The density of helium is less than B The air resistance lifts the balloon C There is no gravity acting on heliu D The wind blows the balloon upwar The wind blows the balloon upwar	free and starts to move upward. ny the helium balloon moves upward? the density of air. up. um balloons.	Korea, Republic of Hungary Slovak Republic Chinese Taipei Estonia Singapore Slovenia Sweden Russian Federation Japan United States Hong Kong, SAR Malaysia Lithuania Norway Scotland Latvia New Zealand England Australia Serbia and Montenegro Romania Italy Bulgaria International average Netherlands Jordan Moldova, Rep. of Armenia Israel Chile Macedonia, Republic of Palestinian Nat'l Auth. Philippines Belgium (Flemish) Lebanon Egypt Bahrain	89 88 86 83 87 77 75 74 72 71 69 69 69 69 69 69 69 69 69 67 66 65 65 61 60 58 56 56 56 56 56 56 56 52 52 50 49 49 47 45 43
		Iran, Islamic Republic of Cyprus Saudi Arabia Indonesia Ghana Botswana South Africa Tunisia	38 35 33 22 28 25 21 21

Country average vs. International average:	
Higher	
Not different	0
Lower	V

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Conceptual Understanding

Metal crown: why scientists repeated measurement

The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

Volume of Crown (cm ³)	Density of Crown (g/cm ³)
202	11.88
200	12.00
201	11.94
198	12.12
199	12.06
	202 200 201 198

A. Why did the scientists measure the volume five times?

B. The scientists reported to the king that the density of the crown was 12.0 g/cm^3 . Show how the scientists used their results to obtain this value for the density.

Item Number: S032712A

Chinese Taipei	76	
Korea, Republic of	67	
Estonia	60	
Singapore	58	
Hong Kong, SAR	56	
Japan	53	
Malaysia	53	
Lithuania	53	
Belgium (Flemish)	47	
United States	47	
Australia	44	
Jordan	44	
Slovenia	44	
Sweden	42 42	
Scotland	42 41	
Scotland New Zealand		
	40	
Palestinian Nat'l Auth.	38	
Slovak Republic	34	0
England	34	0
Netherlands	33	0
Israel	33	0
International average	30	
Moldova, Rep. of	30	0
Latvia	29	0
Egypt	29	0
Russian Federation	26	
571	26 23	
Russian Federation	26 23 22	
Russian Federation Serbia and Montenegro	26 23 22 22	
Russian Federation Serbia and Montenegro Norway	26 23 22	
Russian Federation Serbia and Montenegro Norway Hungary	26 23 22 22	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus	26 23 22 22 21	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco	26 23 22 22 21 21	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia	26 23 22 22 21 21 21 19	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of	26 23 22 21 21 21 19 18	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain	26 23 22 21 21 19 18 17	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of	26 23 22 21 21 19 18 17 15	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of Indonesia	26 23 22 21 21 19 18 17 15 15	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of Indonesia Italy	26 23 22 21 21 19 18 17 15 15 15	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of Indonesia Italy Romania	26 23 22 21 21 19 18 17 15 15 15 14	
Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of Indonesia Italy Romania Bulgaria	26 23 22 21 21 19 18 17 15 15 15 14 13	$\begin{array}{c} \bullet \\ \bullet $
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Russian Federation Serbia and Montenegro Norway Hungary Cyprus Morocco Tunisia Iran, Islamic Republic of Bahrain Macedonia, Republic of Indonesia Italy Romania Bulgaria Armenia Botswana	26 23 22 21 21 19 18 17 15 15 15 14 13 11 10	$\begin{array}{c} \bullet \\ \bullet $
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Country average vs. International average:	
Higher	
Not different	0
Lower	V

Metal crown: why scientists repeated measurement (continued)

Item Number: S032712A

SCORING

Why Scientists Repeat Measurements

Correct Response

- Refers to accuracy, precision, reliability, experimental uncertainty, estimation of measurement error (or similar).
- Examples: Because there is experimental error. So measuring it 5 times you can calculate the average to know how much error there is.
 - Each time they measure the volume it is close but not exactly the same. So, it's better to measure it a few times to be sure.
 - They want a more exact answer.
 - To get an accurate measure of the volume.
 - It's more reliable.
- Refers only to computing an average or mean value (or median or range).
 Examples: To find the average volume. To work out the mean.
- Other correct.

Incorrect Response

- Refers only to 'mistakes' or changes in the measurements (or similar); no explicit mention of accuracy, precision, experimental uncertainty, etc.
- Examples: In case mistakes happen.
 - To make sure it wasn't changing.
 - To make sure the answer was right and he did not make a mistake.
 - To make sure they did it right.
 - To check if it was correct.
- · Refers only to a 'fair test' or similar; no explicit mention of computation of average, accuracy,
- precision, experimental uncertainty, etc.
- Examples: To make sure it was a fair test.
 - To ensure a fair test.
- · Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Metal crown: why scientists repeated measurement (continued) Item Number: S032712A

Student Responses

Correct Response:

The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

Trial	Volume of Crown (cm ³)	Density of Crown (g/cm ³)
1	202	11.88
2	200	12.00
3	201	11.94
4	198	12.12
5	199	12.06

A. Why did the scientists measure the volume five times?

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To test more than once to see if their
answers are close to the other answers
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Incorrect Response:

The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

Trial	Volume of Crown (cm ³)	Density of Crown (g/cm ³)
1	202	11.88
2	200	12.00
3	201	11.94
4	198	12.12
5	199	12.06

A. Why did the scientists measure the volume five times?

To see if they got a different answer, or they might of used 5 different object to measure,

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Conceptual Understanding

Metal crown: determination of average/median value

The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

Trial	Volume of Crown (cm ³)	Density of Crown (g/cm ³)
1	202	11.88
2	200	12.00
3	201	11.94
4	198	12.12
5	199	12.06

A. Why did the scientists measure the volume five times?

B. The scientists reported to the king that the density of the crown was 12.0 g/cm^3 . Show how the scientists used their results to obtain this value for the density.

Item Number: S032712B

SCORING

Correct Response

- Shows (or describes) a correct method for computing the average (mean) value.
 - Examples: (11.88+12.00+11.94+12.12+12.06) = 60. 60/5=12.0 (202+200+201+198+199)/5 = 200. 2400/200=12.0
 - They added together all of the densities and then divided by 5 to get the average.
- Shows (or describes) a correct method for determining the median value.
- Examples: 202, 201, 200, 198, 199. 200 is the median volume, so 2400/200 is the median density (12).
 - 12 is the middle value when placed in order (12.12, 12.06, 12.00, 11.94, 11.88).
- Other correct

Incorrect Response

- States that it is the average, mean or median value with no or incorrect work shown.
- Shows a computation of density (mass/volume). [No determination of average or median included.] *Examples: They did mass divided by volume.*
 - 2400g/200cc = 12 g/cc
- Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	47	
Japan	44	
Estonia	36	
Lithuania	31	
United States	29	
Netherlands	29	
Chinese Taipei	28	
Scotland	26	
Sweden	24	
Hong Kong, SAR	24	
Australia	23	
England	22	
Latvia	22	
New Zealand	21	
Malaysia	20	
Belgium (Flemish)	20	
Korea, Republic of	15	0
Norway	14	0
Slovenia	14	0
International average	14	
Israel	13	0
Moldova, Rep. of	13	0
Hungary	12	▼
Serbia and Montenegro	11	
Slovak Republic	10	▼
Russian Federation	10	0
Cyprus	9	▼
Bulgaria	9	▼
Romania	7	▼
Jordan	7	
Macedonia, Republic of	7	
Armenia	6	
Italy	6	
Lebanon	6	
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Country average vs. International average:	
Higher	
Not different	0
Lower	•

Metal crown: determination of average/median value (continued) Item Number: S032712B

Student Responses

Correct Response:

The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

Trial	Volume of Crown (cm ³)	Density of Crown (g/cm ³)
1	202	11.88
2	200	12.00
3	201	11.94
4	198	12.12
5	199	12.06

B. The scientists reported to the king that the density of the crown was 12.0 g/cm³. Show how the scientists used their results to obtain this value for the density.

5 60

Metal crown: determination of average/median value (continued) Item Number: S032712B

Student Responses

Incorrect Response:

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The scientists measured the volume of the crown five times. They computed the density for each volume measurement. Their results are shown in the table below.

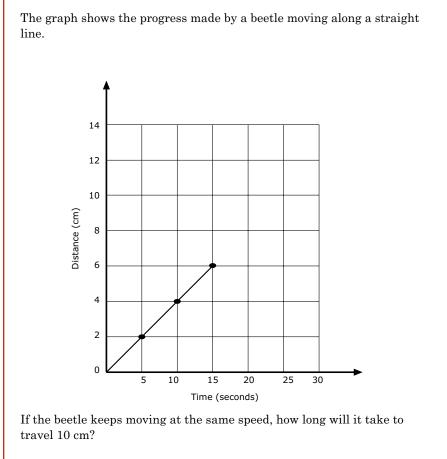
Trial	Volume of Crown (cm ³)	Density of Crown (g/cm ³)
1	202	11.88
2	200	12.00
3	201	11.94
4	198	12.12
5	199	12.06

B. The scientists reported to the king that the density of the crown was 12.0 g/cm³. Show how the scientists used their results to obtain this value for the density.

He took the average and used that.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Reasoning and Analysis

Extrapolation of distance/time graph



 \bigcirc 4 seconds

- B 6 seconds
- \bigcirc 20 seconds
- \bigcirc 25 seconds

Item Number: S022041

Correct Response:

D

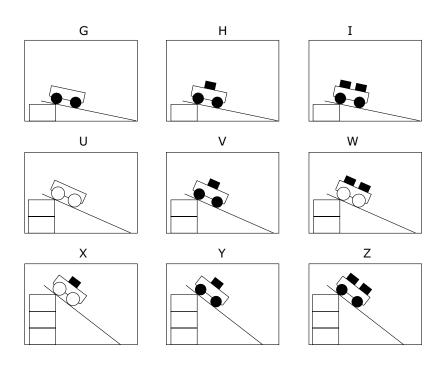
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	Bulgaria International average Lebanon Cyprus Slovak Republic Romania Botswana Macedonia, Republic of Morocco Indonesia Bahrain Iran, Islamic Republic of Armenia Serbia and Montenegro Tunisia Jordan Philippines Egypt Palestinian Nat'l Auth.	71 70 68 67 64 64 61 61 58 56 55 55 55 55 52 51 44	
	Bulgaria International average Lebanon Cyprus Slovak Republic Romania Botswana Macedonia, Republic of Morocco Indonesia Bahrain Iran, Islamic Republic of Armenia Serbia and Montenegro Tunisia Jordan Philippines Egypt Palestinian Nat'l Auth. Saudi Arabia	71 70 68 67 64 64 61 61 58 56 55 55 55 54 52 51 44 40	
	Bulgaria International average Lebanon Cyprus Slovak Republic Romania Botswana Macedonia, Republic of Morocco Indonesia Bahrain Iran, Islamic Republic of Armenia Serbia and Montenegro Tunisia Jordan Philippines Egypt Palestinian Nat'l Auth. Saudi Arabia South Africa	71 70 68 67 64 64 61 61 58 56 55 55 55 55 54 52 51 44 40 35	

Country average International av		
Higher		
Not different	0	
Lower	•	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Reasoning and Analysis

Controlled experiment with cart

The diagrams show nine different trials Michael carried out using carts with wheels of two different sizes and different numbers of blocks of equal mass. He used the same ramp for all trials, starting the carts from different heights.



He wants to test this idea: The higher the ramp is placed, the faster the cart will travel at the bottom of the ramp. Which three trials should he compare?

- (A) G, H and I
- B $\,$ I, W and Z $\,$
- © I, V and X
- (D) U, W and X
- (E) H, V and Y

Item Number: S022222

Correct Response: E

Singapore	79	
Japan	78	
Korea, Republic of	75	
Hong Kong, SAR	66	
England	65	
Chinese Taipei	63	
Netherlands	59	
Malaysia	58	
Australia	58	
Scotland	58	
United States	57	
Hungary	56	
Lithuania	54	
New Zealand	54	
Estonia	51	
Sweden	48	
Belgium (Flemish)	48	
Russian Federation	47	0
Slovenia	45	0
Armenia	45	0
Italy	44	0
International average	43	
Slovak Republic	43	0
Latvia	42	0
Norway	41	0
Norway Israel	41 41	0
,		-
Israel	41	0
Israel Serbia and Montenegro	41 39	0
Israel Serbia and Montenegro Bahrain	41 39 37	0
Israel Serbia and Montenegro Bahrain Romania	41 39 37 36	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria	41 39 37 36 36	0 • • •
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan	41 39 37 36 36 35	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus	41 39 37 36 36 35 34	0 • • •
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile	41 39 37 36 36 35 34 33	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia	41 39 37 36 36 35 34 33 32	0 • • •
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of	41 39 37 36 36 35 34 33 32 31	0 V V V V
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon	41 39 37 36 36 35 34 33 32 31 31	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of	41 39 37 36 36 35 34 33 32 31 31 31	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of	41 39 37 36 35 34 33 32 31 31 31 30	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia	41 39 37 36 35 34 33 32 31 31 31 30 30	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth.	41 39 37 36 35 34 33 31 31 30 30 25 25 23	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia	41 39 37 36 36 35 34 33 31 31 30 30 25 25	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia Egypt	41 39 37 36 35 34 33 31 31 30 30 25 25 23	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia Egypt Botswana Tunisia Morocco	41 39 37 36 35 34 33 32 31 31 30 30 25 25 23 23	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia Egypt Botswana Tunisia Morocco South Africa	41 39 37 36 35 34 33 32 31 31 30 25 25 23 23 23 23	0 * * *
Israel Serbia and Montenegro Bahrain Romania Bulgaria Jordan Cyprus Chile Saudi Arabia Macedonia, Republic of Lebanon Iran, Islamic Republic of Moldova, Rep. of Philippines Palestinian Nat'l Auth. Indonesia Egypt Botswana Tunisia Morocco	41 39 37 36 35 34 33 32 31 31 30 30 25 25 23 23 23 22	0 * * *

Country average International av	•
Higher	
Not different	0
Lower	•

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Reasoning and Analysis

Data trend of masses on spring

The table below shows the results of an experiment to investigate how the length of a spring changes as different masses are hung from it.

Mass (grams)	Length of Spring (cm)
0	5
10	7
20	9
30	11
40	12
50	13
60	13

Describe how the length of the spring changed as different masses were hung from it.

Item Number: S022286

Singapore75AHungary73ASlovak Republic71AKorea, Republic of68AChinese Taipei67AEstonia66ANew Zealand65AArmenia65AChile62AItaly60AJapan56ANorway56AAustralia55ASerbia and Montenegro53ASweden50ASlovenia49ALatvia47OIran, Islamic Republic of46ANetherlands45OBulgaria42OInternational average42OJordan37TMacedonia, Republic of36TJordan37TMalaysia33TScotland34TMalaysia33TEgypt33TSaudi Arabia20TMorocco17TMorocco17TBahrain13T			
Slovak Republic71AKorea, Republic of68AChinese Taipei67AEstonia66ANew Zealand65AArmenia65AChile62AItaly60AJapan56ANorway56AAustralia55AHong Kong, SAR55ASerbia and Montenegro53ASweden50ASlovenia49ALatvia470Iran, Islamic Republic of46AUnited States450Netherlands450Russian Federation430Belgium (Flemish)390Jordan37TMacedonia, Republic of36TMalaysia33TEgypt33TScotland34TMalaysia29TIndonesia27TIndonesia17TMorocco17TBahrain13T	Singapore	75	
Slovak Republic71AKorea, Republic of68AChinese Taipei67AEstonia66ANew Zealand65AArmenia65AChile62AItaly60AJapan56ANorway56AAustralia55AHong Kong, SAR55ASerbia and Montenegro53ASweden50ASlovenia49ALatvia470Iran, Islamic Republic of46AUnited States450Netherlands450Russian Federation430Belgium (Flemish)390Jordan37TMacedonia, Republic of36TMalaysia33TEgypt33TScotland34TMalaysia29TSaudi Arabia27TLebanon20TIndonesia17TMorocco17TBahrain13T	Hungary	73	
Chinese Taipei67AEstonia66ANew Zealand65AArmenia65AChile62AItaly60AJapan56ANorway56AAustralia55AHong Kong, SAR55ASerbia and Montenegro53ASweden50ASlovenia49ALatvia470Iran, Islamic Republic of46AUnited States450Russian Federation430Bulgaria420Israel410Moldova, Rep. of400Belgium (Flemish)390Jordan37TMacedonia, Republic of36TRomania36TPalestinian Nat'l Auth.35TScotland34TMalaysia33TEgypt33TSaudi Arabia27TLebanon20TIndonesia17TBahrain13T	Slovak Republic	71	
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New Zealand65AArmenia65AChile62AItaly60AJapan56ANorway56AAustralia55AHong Kong, SAR55ASerbia and Montenegro53ASweden50ASlovenia49ALatvia470Iran, Islamic Republic of46AUnited States450Russian Federation430Bulgaria420International average420Israel410Moldova, Rep. of400Belgium (Flemish)390Jordan37₹Romania36₹Scotland34₹Malaysia33₹Egypt33₹Egypt33₹Saudi Arabia27₹Lebanon20₹Indonesia17₹Bahrain13₹	Chinese Taipei	67	
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Israel41OMoldova, Rep. of40OBelgium (Flemish)39OJordan37VMacedonia, Republic of36VRomania36VPalestinian Nat'l Auth.35VScotland34VMalaysia33VEgypt33VSaudi Arabia27VCyprus26VLebanon20VIndonesia17VBahrain13V			
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Palestinian Nat'l Auth.35▼Scotland34▼Malaysia33▼Egypt33▼England30▼Philippines29▼Saudi Arabia27▼Cyprus26▼Lebanon20▼Indonesia17▼Morocco17▼Bahrain13▼	Israel Moldova, Rep. of Belgium (Flemish) Jordan	41 40 39 37	0
Scotland34YMalaysia33YEgypt33YEngland30YPhilippines29YSaudi Arabia27YCyprus26YLebanon20YIndonesia17YMorocco17YBahrain13Y	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of	41 40 39 37 36	0
Malaysia33TEgypt33TEngland30TPhilippines29TSaudi Arabia27TCyprus26TLebanon20TIndonesia17TMorocco17TBahrain13T	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania	41 40 39 37 36 36	0 0 • •
Cyprus26VLebanon20VIndonesia17VMorocco17VBahrain13V	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth.	41 40 39 37 36 36 35	0 0 • •
Cyprus26VLebanon20VIndonesia17VMorocco17VBahrain13V	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland	41 40 39 37 36 36 35 34	0 0 * * *
Cyprus26VLebanon20VIndonesia17VMorocco17VBahrain13V	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia	41 40 39 37 36 36 35 34 33	0 0 * * *
Cyprus26VLebanon20VIndonesia17VMorocco17VBahrain13V	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt	41 40 39 37 36 36 35 34 33 33	0 0 * * *
Cyprus26VLebanon20VIndonesia17VMorocco17VBahrain13V	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England	41 40 39 37 36 36 35 34 33 33 30	0 0 * * *
Lebanon20▼Indonesia17▼Morocco17▼Bahrain13▼	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines	41 40 39 37 36 36 35 34 33 33 30 29	0 0 * * *
Indonesia 17 ▼ Morocco 17 ▼ Bahrain 13 ▼	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia	41 40 39 37 36 35 34 33 33 30 29 27	0 0 * * *
Morocco 17 ▼ Bahrain 13 ▼	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus	41 40 39 37 36 35 34 33 33 30 29 27 26	0 0 * * *
Bahrain 13 🔻	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon	41 40 39 37 36 35 34 33 33 30 29 27 26 20	0 0 * * *
	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia	41 40 39 37 36 35 34 33 30 29 27 26 20 17	0 0 * * *
	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia Morocco	41 40 39 37 36 35 34 33 30 29 27 26 20 17 17	0 0 * * *
Botswana 7	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia Morocco	41 40 39 37 36 35 34 33 30 29 27 26 20 17 17	0 0 * * *
South Africa 6	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia Morocco Bahrain Tunisia	41 40 39 37 36 35 34 33 30 29 27 26 20 17 17 13 12	0 0 * * *
	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia Morocco Bahrain Tunisia Botswana	41 40 39 37 36 35 34 33 30 29 27 26 20 17 17 13 12 7	0 0 * * *
	Israel Moldova, Rep. of Belgium (Flemish) Jordan Macedonia, Republic of Romania Palestinian Nat'l Auth. Scotland Malaysia Egypt England Philippines Saudi Arabia Cyprus Lebanon Indonesia Morocco Bahrain Tunisia Botswana	41 40 39 37 36 35 34 33 30 29 27 26 20 17 17 13 12 7 6	0 0 * * *

	Country average vs. International average:	
Higher		
Not different	0	
Lower	•	

Data trend of masses on spring (continued)

Item Number: S022286

SCORING

Note: To receive credit, responses must address two basic regions in the table to describe the trend in spring length as a function of the mass added:

(i) initially, the spring increases in length (at a constant rate) as more mass is added.

(ii) after a point (40 grams), the spring length starts to level off and then remains constant as more mass is added.

Responses may be quantitative or qualitative in nature. [No credit is lost for using wrong or no units in describing length or mass.]

Correct Response

- Response includes both regions (i) and (ii).
- Examples: At low mass, it grew 2 for every 10 grams. Then it changed by 1 at 40g. Then at 50g, it did not grow any more.
 - It increases by 2's until 30, increases by 1's until 50, and increases by 0 at 60. The length increased steadily up to 40g, and then it increased just a little bit more until it was 13cm at 50 and 60 grams.
 - At first it got longer every time you added a mass, but then after a while, it did not get any longer.
- · Other correct.

Incorrect Response

- Includes only region (i). Response references only an increase in length as more mass is added but discussion of leveling off is inadequate or missing.
 - Examples: The length increased as more mass was added.
 - The spring length got 2cm longer with each mass.
 - It increased by 2cm each time until 40 grams.
- Refers only to leveling off of spring length or decreasing increments at higher masses. [Description of change in region (i) is inadequate or missing.]

Examples: It stretches but only up to 13 cm. After 50 grams it did not change.

- It stretches less at higher masses.
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Data trend of masses on spring (continued)

Item Number: S022286

Student Responses

Correct Response:

The table below shows the results of an experiment to investigate how the length of a spring changes as different masses are hung from it.

Mass (grams)	Length of Spring (cm)
0	5
10	7
20	9
30	11
40	12
50	13
60	13

Describe how the length of the spring changed as different masses were hung

". The length increased by 2 until it reached a mass of 30 grams it than increased by 1 and than sustained after a mass of 50. from it.

Data trend of masses on spring (continued)

Item Number: S022286

Student Responses (continued)

Incorrect Response:

The table below shows the results of an experiment to investigate how the length of a spring changes as different masses are hung from it.

Mass (grams)	Length of Spring (cm)
0	.5
10	7
20	9
30	11
40	12
50	13
60	13

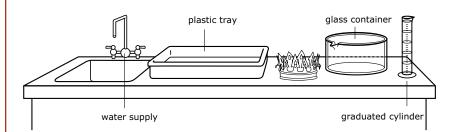
Describe how the length of the spring changed as different masses were hung

heavier thimps from it. from it.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Reasoning and Analysis

Metal crown: procedure to find volume of crown

The scientists then needed to find the volume of the crown in order to determine its density. The following equipment and materials were available for them to use.



Describe a procedure that the scientists could use to find the volume of the crown using some or all of the equipment and materials shown above. You may use diagrams to help explain your procedure.

Item Number: S032711

Singapore	38	
Japan	36	
Hong Kong, SAR	33	
Korea, Republic of	33	
Chinese Taipei	32	
Jordan	27	
Russian Federation	25	
Estonia	21	
Lithuania	20	
Slovak Republic	20	
Sweden	19	
Slovenia	19	
United States	17	
Belgium (Flemish)	16	
New Zealand	16	0
Hungary	15	0
Israel	15	0
Australia	14	0
International average	13	<u> </u>
Romania	13	0
Latvia	13	0
Netherlands	13	0
Italy	12	0
Malaysia	11	0
Cyprus	11	0
Bulgaria	11	0
Serbia and Montenegro	10	▼
Norway	9	•
Saudi Arabia	9	V
Scotland	8	•
Macedonia, Republic of	8	V
England	8	V
Bahrain	8	
Palestinian Nat'l Auth.	7	* * * *
Egypt	5	.
Armenia	5	.
Indonesia	5	.
Lebanon	5	.
Iran, Islamic Republic of	4	.
Botswana	4	.
Philippines	3	÷
South Africa	2	.
Chile	2	-
Ghana	2	-
Tunisia	2 1	-
Morocco	0	* * * *
Moldova, Rep. of	0	-
woluova, nep. 01	0	•

Country average vs. International average:		
Higher		
Not different	0	
Lower	V	

Metal crown: procedure to find volume of crown (continued)

Item Number: S032711

SCORING

Note: For full credit, responses must describe or diagram a procedure based on displacement and clearly identify how the volume of the crown is determined. Partial credit is given for procedures or diagrams that demonstrate knowledge of displacement without a complete description of the steps/ measurements to be made. Responses may also implicitly refer to other materials not indicated in the diagram (e.g., ruler, marker, etc.). Because it is not totally clear from the diagram what the relative size of the crown, beaker, and tray are, credit is given for procedures that use any of these materials for displacement even if the actual procedure might not be completely successful.

Correct Response

- Describes or diagrams a procedure based on displacement of water using measured water level differences:
- i) Adding water to the beaker (sink or tray) and marking the water level.
- ii) Placing the crown in the beaker (sink or tray) and marking the new water level.
- iii) Measuring the volume difference before/after adding the crown using the graduated cylinder
- Describes or diagrams a procedure based on displacement of water using measured overflow: i) Filling the beaker (or tray) with water.
- ii) Placing the crown in the beaker (or tray) and collecting the overflow.
- iii) Measuring the volume of the overflow using the graduated cylinder
- Other fully correct.

Partially Correct Response

- Describes or diagrams a partial procedure that includes displacement of water but with inadequate or no description of the steps/measurements to determine the volume.
 - Examples: Put some water in the beaker and add the crown. Measure how much the level of water went up.
 - Add the crown to the beaker filled with water. See how much overflowed.

Other partially correct.

Incorrect Response

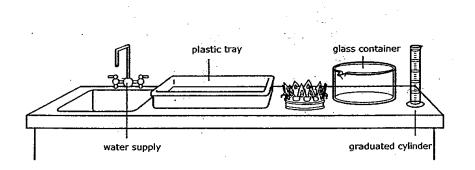
- Mentions putting the crown in the beaker (sink or tray) of water with no explicit mention that the
 water level will rise/overflow and no or incorrect procedure given for measuring the volume.
 Examples: Fill the beaker to the top with water and add the crown. You can get the volume that way.
- Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Metal crown: procedure to find volume of crown (continued) Item Number: S032711

Student Responses

Correct Response:

The scientists then needed to find the volume of the crown in order to determine its density. The following equipment and materials were available for them to use.



Describe a procedure that the scientists could use to find the volume of the crown using some or all of the equipment and materials shown above. You may use diagrams to help explain your procedure.

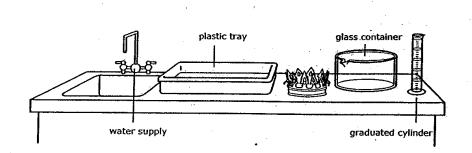
@ F? 11 glass container to the very P.m allith eventer @ Place graduated civilinder under the sport Place the crown carefully into the gloss container
Place the crown carefully into the gloss container
Measure how much water for into the cylinder.
However much water spilled into the cylinder is the volume of the crown, 6 convert mL into cm3

Metal crown: procedure to find volume of crown (continued) Item Number: S032711

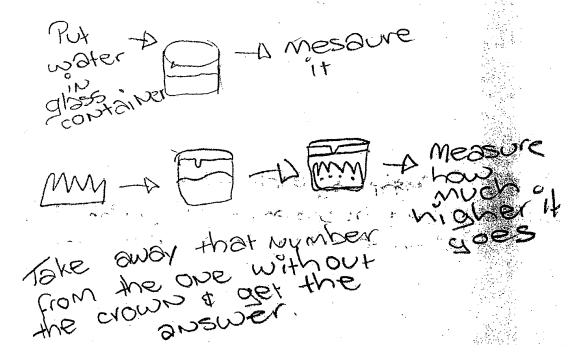
Student Responses (continued)

Partially Correct Response:

The scientists then needed to find the volume of the crown in order to determine its density. The following equipment and materials were available for them to use.



Describe a procedure that the scientists could use to find the volume of the crown using some or all of the equipment and materials shown above. You may use diagrams to help explain your procedure: $\mathcal{F} = \sum_{i=1}^{n}$

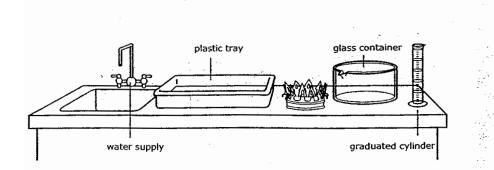


Metal crown: procedure to find volume of crown (continued) Item Number: S032711

Student Responses (continued)

Incorrect Response:

The scientists then needed to find the volume of the crown in order to determine its density. The following equipment and materials were available for them to use.



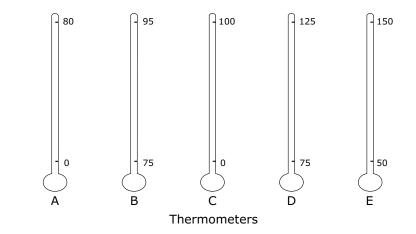
Describe a procedure that the scientists could use to find the volume of the crown using some or all of the equipment and materials shown above. You may use diagrams to help explain your procedure.

put the crown into the plastic they weigh it.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Heat and Temperature	Reasoning and Analysis

Thermometer scale for boiling water

At different altitudes, the boiling point of water ranges from about 80° C to 100° C. Which of the Celsius thermometers shown below would give the most accurate measurement of the boiling point of water at different altitudes?



- (A) Thermometer A
- (B) Thermometer B
- (C) Thermometer C
- D Thermometer D
- (E) Thermometer E

Item Number: S022225

Correct Response: D

Hong Kong, SAR	38	
Korea, Republic of	33	
Netherlands	33	
Slovak Republic	33	
Estonia	31	
Chinese Taipei	30	
Japan	29	
Belgium (Flemish)	27	
Israel	27	
Lithuania	26	
United States	20	
Singapore	25	
51	23	
Hungary Russian Federation	24 23	
Sweden	25 22	
Slovenia	22	0
New Zealand	22	-
		0
Australia	22	0
Latvia	22	0
Palestinian Nat'l Auth.	21	0
Egypt	21	0
Jordan	20	0
England	20	0
International average	20	
Bulgaria	20	0
Bulgaria Scotland	20 19	0
Bulgaria Scotland Cyprus	20 19 17	0
Bulgaria Scotland Cyprus Romania	20 19 17 16	0 0 V
Bulgaria Scotland Cyprus Romania Italy	20 19 17 16 16	0 0 V
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro	20 19 17 16 16 16	0 0 • •
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain	20 19 17 16 16 16 16	0 0 * *
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Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of	20 19 17 16 16 16 16 15	0 0 V V V V
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Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of	20 19 17 16 16 16 16 15 14 13 13	0 0 V V V V
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Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia	20 19 17 16 16 16 16 15 14 13 13 13	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon	20 19 17 16 16 16 16 15 14 13 13 13 12 11 10	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia	20 19 17 16 16 16 16 15 14 13 13 13 13 12 11 10 9	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia Chile	20 19 17 16 16 16 16 15 14 13 13 13 12 11 10	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia	20 19 17 16 16 16 16 15 14 13 13 13 13 12 11 10 9	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia Chile	20 19 17 16 16 16 16 15 14 13 13 13 12 11 10 9 9	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia Chile Ghana	20 19 17 16 16 16 16 15 14 13 13 13 12 11 10 9 9 8	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia Chile Ghana Botswana	20 19 17 16 16 16 16 15 14 13 13 12 11 10 9 8 8 8	
Bulgaria Scotland Cyprus Romania Italy Serbia and Montenegro Bahrain Norway Macedonia, Republic of South Africa Tunisia Moldova, Rep. of Philippines Lebanon Indonesia Iran, Islamic Republic of Armenia Chile Ghana Botswana Malaysia	20 19 17 16 16 16 16 15 14 13 13 12 11 10 9 8 8 8 8 6	

Country average vs. International average:	
Higher	
Not different	0
Lower 🔻	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Conceptual Understanding

Seeing person in a dark room

A person in a dark room looking through a window can clearly see a person outside in the daylight. But a person outside cannot see the person inside. Why does this happen?

- There is not enough light being reflected off the person in the room. (A)
- (B) Light rays cannot pass through a window twice.
- (C) Outside light does not pass through windows.
- (D) Sunlight is not as intense as other sources of light.

Item Number: S012004

Correct Response:

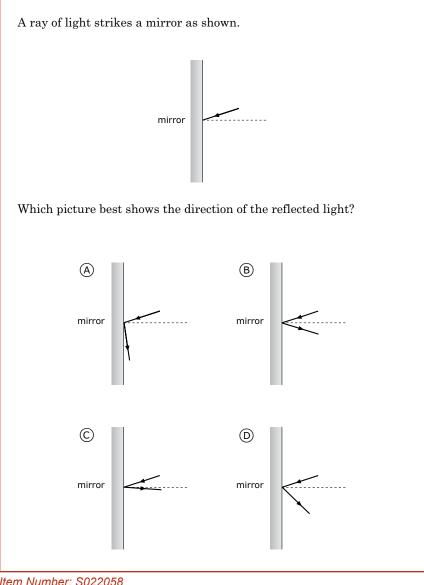
Α

Singapore	87	
England	83	
Scotland	81	
New Zealand	81	
Sweden	80	
United States	79	
Lithuania	79	
Chinese Taipei	79	
Netherlands	79	
Korea, Republic of	78	
Australia	76	
Estonia	76 76	
Norway	75	
Israel	75	
Hong Kong, SAR	73	
Latvia	72	
Belgium (Flemish)	71	
Slovenia	70	
Romania	69	0
Hungary	69	0
Serbia and Montenegro	69	0
Indonesia	68	0
Italy	68	0
Moldova, Rep. of	68	0
Iran, Islamic Republic of	66	0
Iran, Islamic Republic of Bahrain	66 66	0
Bahrain	66	
Bahrain International average	66 66	0
Bahrain International average Philippines	66 66 66	0
Bahrain International average Philippines Jordan	66 66 65	0
Bahrain International average Philippines Jordan Cyprus	66 66 65 62	0
Bahrain International average Philippines Jordan Cyprus Chile	66 66 65 62 61	0
Bahrain International average Philippines Jordan Cyprus Chile Japan	66 66 65 62 61 61	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia	66 66 65 62 61 61 61 60	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of	66 66 65 62 61 61 60 60	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia	66 66 65 62 61 61 60 60 59	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic	66 66 65 62 61 61 60 60 59 59 59 58	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco	66 66 65 62 61 61 60 60 59 59 58 57	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth.	66 66 65 62 61 61 61 60 60 59 59 59 58 57 57	0
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation	66 66 65 62 61 61 60 60 59 59 59 58 57 57 52	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria	66 66 65 62 61 61 60 60 59 59 58 57 57 57 52 50	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt	66 66 65 62 61 61 60 60 59 59 59 58 57 57 57 57 52 50 50	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt Malaysia	66 66 65 62 61 61 60 60 59 59 59 59 58 57 57 57 57 52 50 50 47	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt Malaysia Ghana	66 66 65 62 61 61 60 60 59 59 59 59 58 57 57 57 57 52 50 50 47 44	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt Malaysia Ghana Armenia	66 66 65 62 61 61 60 60 59 59 59 59 59 59 59 57 57 57 57 52 50 50 47 44 42	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt Malaysia Ghana Armenia South Africa	66 66 65 62 61 61 60 60 59 59 59 59 59 59 59 57 57 57 57 52 50 50 47 44 42 42	
Bahrain International average Philippines Jordan Cyprus Chile Japan Saudi Arabia Tunisia Macedonia, Republic of Slovak Republic Botswana Morocco Palestinian Nat'l Auth. Russian Federation Bulgaria Egypt Malaysia Ghana Armenia	66 66 65 62 61 61 60 60 59 59 59 59 59 59 59 57 57 57 57 52 50 50 47 44 42	0

Country average vs. International average:	
Higher	
Not different	0
Lower 🔻	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Conceptual Understanding

Angle of reflected light ray



Item Number: S022058

Correct Response:

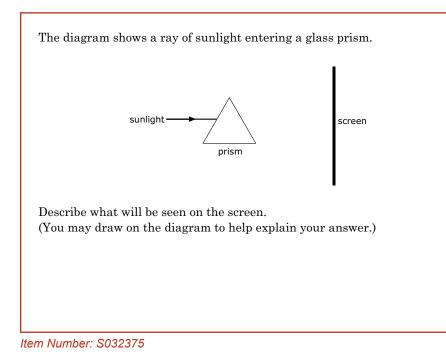
В

Estonia	83	
England	83	
Korea, Republic of	81	
Netherlands	81	
Japan	80	
	80 79	
Singapore Armenia	79 76	
New Zealand	76	
Chinese Taipei	75	A
Latvia	74	
Malaysia	72	
Cyprus	72	
Sweden	71	
Lithuania	71	
Hong Kong, SAR	68	
Belgium (Flemish)	67	
Scotland	67	0
Australia	66	0
Bulgaria	66	0
Hungary	66	0
International average	63	
Slovenia	63	0
Serbia and Montenegro	62	0
Iran, Islamic Republic of	62	0
Slovak Republic	62	0
Israel	61	0
Russian Federation	61	0
Macedonia, Republic of	61	0
Indonesia	61	0
Palestinian Nat'l Auth.	60	0
Romania	59	0
United States		
	59	•
Jordan	59	•
Moldova, Rep. of	58	
Lebanon	57	
Norway	57	
Italy	57	* * * *
Egypt	54	
Bahrain	54	
Morocco	51	
Philippines	51	▼
Saudi Arabia	49	▼
Chile	45	▼
Tunisia	44	▼
Ghana	41	\bullet
Botswana	38	▼
South Africa	33	▼

Country average vs. International average:	
Higher	
Not different	0
Lower 🔻	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Conceptual Understanding

Sunlight through a glass prism



SCORING

Note: For full credit, responses must explicitly indicate that different colors are seen on the screen, either by textual description or by drawing on the diagram. A completely correct or complete sequence of colors is not required for full credit. Partial credit will be given for responses that show or describe refraction even if the appearance of the light beams on the screen is not fully described.

Correct Response

- Describes or draws the visible color spectrum. Examples: A spectrum of seven colors which is red, orange, yellow, green, blue, indigo, violet.
- Refers to a spectrum, rainbow, colors, etc. (no color spectrum shown)
- Examples: I will see many colors on it like the rainbow.
 - All the colors of the color spectrum.
 - There will be seven colors.
- · Other fully correct.

Partially Correct Response

- Describes or draws multiple refracted rays but with no explicit connection to color.
 Examples: There will be a lot of rays coming out the other side of the prism.
 The light will spread out across that side of the prism and be seen on most of the screen.
- Describes or draws only the refraction (bending) of light beam (no mention of color dispersion). *Examples: The light inside the prism will bend.*
 - The sunlight would go through at an angle.
- Other partially correct.

Incorrect Response

- Describes or draws a shadow or image of the prism (or similar). Examples: The prism will make a shadow on the screen.
- Refers only to seeing sunlight or light on the screen. [No mention of color dispersion or refraction.] *Examples: Sunlight hitting the screen.*

The screen will be bright because there is light falling on it.

Other incorrect (including crossed out/erased, stray marks, illegible or off task).

Korea, Republic of		
	74	
Singapore	65	
Malaysia	53	
Hong Kong, SAR	49	
United States	49	
England	47	
Netherlands	45	
New Zealand	43	
Chinese Taipei	38	
Jordan	36	
Bahrain	34	
Armenia	33	
Palestinian Nat'l Auth.	33	
Lithuania	32	
Iran, Islamic Republic of	31	
Scotland	28	0
Sweden	25	0
Egypt	24	0
Hungary	24	0
Italy	24	0
International average	23	
Australia	22	0
Estonia	20	0
Romania	18	▼
Israel	17	▼
Latvia	17	▼
Belgium (Flemish)	15	▼
Norway	15	
Slovenia	15	
Saudi Arabia	14	▼
Chile	11	▼
Russian Federation	11	▼
	10	▼
Philippines		
Philippines Japan	10	
	10 9	▼ ▼
Japan	9 7	• • •
Japan Indonesia	9 7 7	• • •
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Japan Indonesia Lebanon Bulgaria	9 7 7	• • • •
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Japan Indonesia Lebanon Bulgaria Macedonia, Republic of Slovak Republic Botswana Cyprus South Africa Moldova, Rep. of Serbia and Montenegro	9 7 7 6 5 4 3 2 2	▼ ▼ ▼
Japan Indonesia Lebanon Bulgaria Macedonia, Republic of Slovak Republic Botswana Cyprus South Africa Moldova, Rep. of Serbia and Montenegro Ghana	9 7 7 7 6 5 4 3 2 2 1	▼ ▼ ▼
Japan Indonesia Lebanon Bulgaria Macedonia, Republic of Slovak Republic Botswana Cyprus South Africa Moldova, Rep. of Serbia and Montenegro Ghana Morocco	9 7 7 6 5 4 3 2 2 1 1	$\mathbf{\cdot}$
Japan Indonesia Lebanon Bulgaria Macedonia, Republic of Slovak Republic Botswana Cyprus South Africa Moldova, Rep. of Serbia and Montenegro Ghana	9 7 7 7 6 5 4 3 2 2 1	▼ ▼ ▼

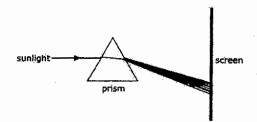
Country average vs. International average:	
Higher	
Not different	0
Lower 🔻	

Sunlight through a glass prism (continued) *Item Number:* S032375

Student Responses

Correct Response:

The diagram shows a ray of sunlight entering a glass prism.

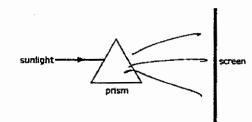


Describe what will be seen on the screen. (You may draw on the diagram to help explain your answer.)

```
Seven different colours namely red, orange, yellow, green
blue, indigo rand violet will be seen.
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Partially Correct Response:

The diagram shows a ray of sunlight entering a glass prism.



Describe what will be seen on the screen. (You may draw on the diagram to help explain your answer.)

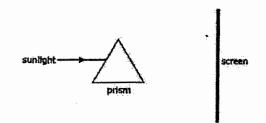
You will see many different light rays

Sunlight through a glass prism (continued) *Item Number: S032375*

Student Responses (continued)

Incorrect Response:

The diagram shows a ray of sunlight entering a glass prism.



Describe what will be seen on the screen. (You may draw on the diagram to help explain your answer.)

DE O. There will reflection of one side of the prism

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Conceptual Understanding

Lightning seen before thunder heard

Mary was looking out her window on a stormy night. She saw lightning and then heard thunder a few seconds later.

Explain why she saw lightning before she heard thunder.

Item Number: S032626

SCORING

Correct Response

- Refers to light traveling faster than sound (or similar).
 Examples: Speed of light is faster than speed of sound. Light travels quicker than sound.
 - It takes more time for sound to reach her than light.
- · Other correct.

Incorrect Response

- Refers only to lightning being closer or thunder being further away (explicitly or implicitly).
 Examples: Thunder has a longer way to go. Thunder is striking from kilometers away.
- Refers to lightning occurring first, causing thunder, or similar. [No explicit mention of the relative speed of light/sound to travel.] *Examples: Lightning is so quick, thunder only happens afterward. The noise occurs later. Thunder occurs from lightning. Thunder is the echo of lightning.*

• Other incorrect (including crossed out/erased, stray marks, illegible, or off task).

Singapore	88	
England	74	
Chinese Taipei	70	
Japan	65	
Hong Kong, SAR	62	
Lithuania	61	
Sweden	59	
Botswana	54	
Hungary	54	
Norway	54	
Estonia	53	
Latvia	52	
Netherlands	52	
Australia	51	
Korea, Republic of	47	
Malaysia	47	
Israel	46	0
United States	46	
Bahrain	45	0
Saudi Arabia	45	0
Romania	44	0
Slovenia	44	0
Bulgaria	43	0
New Zealand	43	0
Scotland	43	0
Jeonana		
Belgium (Flemish)	42	
Belgium (Flemish)	42 42	0
International average	42 42 41	0
International average Italy	42	
International average Italy Slovak Republic	42 41	0
International average Italy Slovak Republic Macedonia, Republic of	42 41 41	0
International average Italy Slovak Republic	42 41 41 41	0
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan	42 41 41 41 40	
International average Italy Slovak Republic Macedonia, Republic of Egypt	42 41 41 41 40 39	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation	42 41 41 40 39 37	
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International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile	42 41 41 40 39 37 36 35 35 32 31 26 19	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia	42 41 41 40 39 37 36 35 35 32 31 26 19 19	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of	42 41 41 40 39 37 36 35 35 32 31 26 19 19 15	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of Philippines	42 41 41 40 39 37 36 35 35 32 31 26 19 19 15 13	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of Philippines Morocco	42 41 41 40 39 37 36 35 35 32 31 26 19 19 15	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of Philippines Morocco Tunisia	42 41 41 40 39 37 36 35 35 32 31 26 19 19 15 13 12	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of Philippines Morocco	42 41 41 40 39 37 36 35 35 35 32 31 26 19 19 15 13 12 8	
International average Italy Slovak Republic Macedonia, Republic of Egypt Jordan Serbia and Montenegro Russian Federation Cyprus Moldova, Rep. of Lebanon Palestinian Nat'l Auth. Armenia Chile Indonesia Iran, Islamic Republic of Philippines Morocco Tunisia South Africa	42 41 41 40 39 37 36 35 35 32 31 26 19 15 13 12 8 4	

Country average International av	
Higher	
Not different	0
Lower	

Lightning seen before thunder heard (continued)

Item Number: S032626

Student Responses

Correct Response:

Mary was looking out her window on a stormy night. She saw lightning and then heard thunder a few seconds later.

Explain why she saw lightning before she heard thunder.

it travels raster than sour lightning was moving f ve thurder ever though th \mathcal{P} U of the same thing

Incorrect Response:

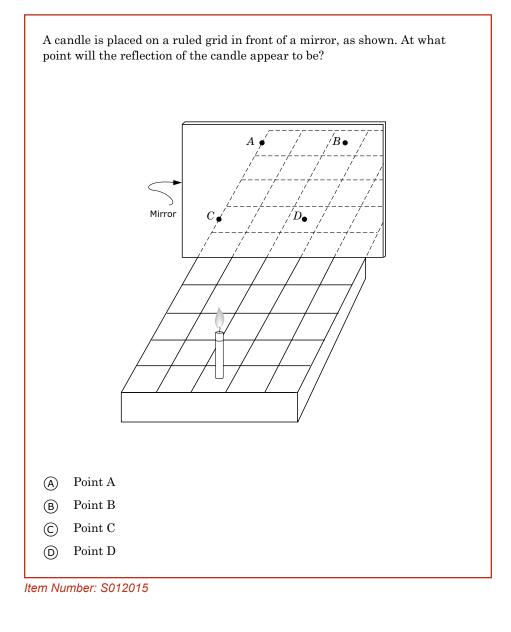
Mary was looking out her window on a stormy night. She saw lightning and then heard thunder a few seconds later.

Explain why she saw lightning before she heard thunder.

first because the Sh $), \Omega q$ ടെഡ IS

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Reasoning and Analysis

Candle position reflected on grid



Correct Response:

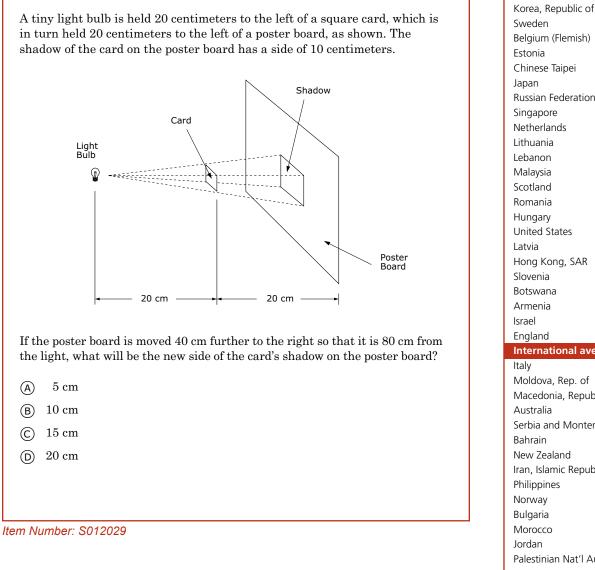
В

Belgium (Flemish)	89	
Singapore	88	
Netherlands	87	
New Zealand	86	
England	86	
Scotland	83	
Hungary	80	
Hong Kong, SAR	80	
Estonia	80	
Australia	80	
Slovak Republic	77	
Korea, Republic of	77	
Chinese Taipei	77	
Japan	75	
Bahrain	74	
Malaysia	73	
United States	73	
Slovenia	72	
Russian Federation	71	
Norway	70	
Latvia	69	
Lithuania	68	
Cyprus	65	0
Armenia	65	0
International average	64	
International average Italy	64 64	0
		0
Italy	64	-
Italy Israel	64 63	0
Italy Israel Chile	64 63 63	0 0 V
Italy Israel Chile Indonesia	64 63 63 60	0 0 V
Italy Israel Chile Indonesia Sweden	64 63 63 60 60	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro	64 63 63 60 60 59	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of	64 63 60 60 59 56	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth.	64 63 60 60 59 56 55	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria	64 63 60 60 59 56 55 54	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania	64 63 60 60 59 56 55 54 53	0 0 V V
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Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt	64 63 60 60 59 56 55 54 53 53 53	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of	64 63 60 59 56 55 54 53 53 53 52	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon	64 63 60 59 56 55 54 53 53 53 52 51	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia	64 63 60 59 56 55 54 53 53 53 52 51 48	
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco	64 63 60 59 56 55 54 53 53 53 52 51 48 46	
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco Jordan	64 63 60 59 56 55 54 53 53 53 53 52 51 48 46 45	
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco Jordan Tunisia	64 63 60 59 56 55 54 53 53 53 53 52 51 48 46 45 43	
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco Jordan Tunisia Botswana	64 63 60 59 56 55 54 53 53 53 53 52 51 48 46 45 43 42	0 0 V V
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco Jordan Tunisia Botswana Philippines	64 63 60 59 56 55 54 53 53 53 52 51 48 46 45 43 42 41	
Italy Israel Chile Indonesia Sweden Serbia and Montenegro Moldova, Rep. of Palestinian Nat'l Auth. Bulgaria Romania Macedonia, Republic of Egypt Iran, Islamic Republic of Lebanon Saudi Arabia Morocco Jordan Tunisia Botswana Philippines Ghana	64 63 60 59 56 55 54 53 53 53 53 52 51 48 46 45 43 42 41 28	

	Country average vs. International average:
Higher	
Not different	0
Lower	▼

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Reasoning and Analysis

Shadow size from distance diagram



Correct Response: D

Overall Percent Correct

79

69

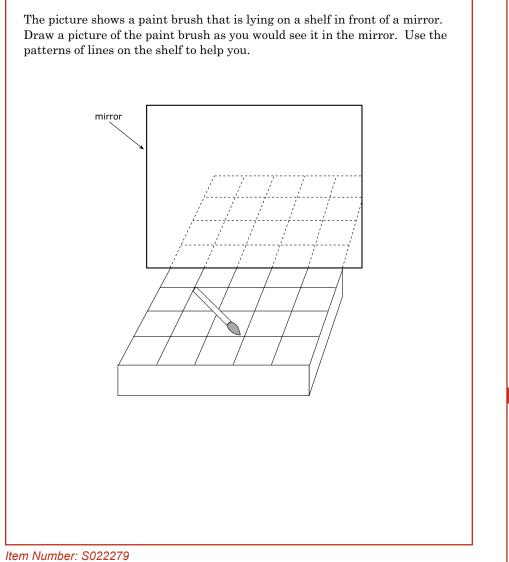
69

68

	00	
Chinese Taipei	68	
Japan	67	
Russian Federation	67	
Singapore	66	
Netherlands	64	
Lithuania	63	0
Lebanon	63	0
Malaysia	63	
Scotland	63	0
Romania	62	0
Hungary	61	0
United States	61	0
Latvia	61	0
Hong Kong, SAR	61	0
Slovenia	61	0
Botswana	60	0
Armenia	60	0
Israel	60	0
England	60	0
International average	59	
Italy	59	0
Moldova, Rep. of	59	0
Macedonia, Republic of	58	0
Australia	58	0
Serbia and Montenegro	58	0
Bahrain	58	0
New Zealand	57	0
Iran, Islamic Republic of	57	0
Philippines	57	0
Norway	57	0
NOTWAY		
Bulgaria	56	0
	56 56	0 0
Bulgaria		
Bulgaria Morocco	56	0 0
Bulgaria Morocco Jordan	56 56	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth.	56 56 56	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus	56 56 56 55	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia	56 56 56 55 53	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic	56 56 55 53 53	0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa	56 56 55 53 53 53 51	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia	56 56 55 53 53 51 50	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia Saudi Arabia	56 56 55 53 53 51 50 49	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia Saudi Arabia Egypt	56 56 55 53 53 51 50 49 48	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia Saudi Arabia Egypt Chile	56 56 55 53 53 51 50 49 48 47	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia Saudi Arabia Egypt Chile	56 56 55 53 53 51 50 49 48 47 47 47	0 0
Bulgaria Morocco Jordan Palestinian Nat'l Auth. Cyprus Tunisia Slovak Republic South Africa Indonesia Saudi Arabia Egypt Chile Ghana Country average	56 56 55 53 53 51 50 49 48 47 47 47	0 0

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light	Reasoning and Analysis

Brush reflected in mirror at angle



New Zealand	75	
Netherlands	72	
Belgium (Flemish)	71	
England	71	
Scotland	70	
Estonia	67	
Japan	66	
Australia	61	
Hungary	61	
Hong Kong, SAR	60	
	59	
Singapore Latvia	59 59	
Lithuania	59 58	
Russian Federation	58 56	
	50 54	
Armenia		
Norway	53	
Slovenia	53	
Slovak Republic	52	
Chinese Taipei	52	
Sweden	51	
Malaysia	51	
Moldova, Rep. of	51	
United States	51	
Korea, Republic of	46	0
		0
Serbia and Montenegro	45	0
Bahrain	44	0
Bahrain International average	44 44	0
Bahrain International average Italy	44 44 42	0
Bahrain International average Italy Romania	44 44 42 41	0
Bahrain International average Italy Romania Bulgaria	44 42 41 37	0
Bahrain International average Italy Romania Bulgaria Israel	44 42 41 37 36	0
Bahrain International average Italy Romania Bulgaria Israel Chile	44 42 41 37 36 35	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia	44 42 41 37 36	0
Bahrain International average Italy Romania Bulgaria Israel Chile	44 42 41 37 36 35	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia	44 42 41 37 36 35 35	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of	44 42 41 37 36 35 35 35	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of	44 42 41 37 36 35 35 35 32	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Cyprus	44 42 41 37 36 35 35 35 35 32 31	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Cyprus Tunisia	44 42 41 37 36 35 35 35 32 31 26	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines	44 42 41 37 36 35 35 35 35 32 31 26 24	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco	44 42 41 37 36 35 35 35 32 31 26 24 23	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt	44 42 41 37 36 35 35 35 32 31 26 24 23 22	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth.	44 42 41 37 36 35 35 35 32 31 26 24 23 22 22	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth. Saudi Arabia	44 42 41 37 36 35 35 35 32 31 26 24 23 22 22 21	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth. Saudi Arabia Lebanon	44 42 41 37 36 35 35 35 32 31 26 24 23 22 22 21 21 21	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth. Saudi Arabia Lebanon Jordan	44 42 41 37 36 35 35 35 32 31 26 24 23 22 22 21 21 21 20	0
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth. Saudi Arabia Lebanon Jordan Botswana	44 42 41 37 36 35 35 35 32 31 26 24 23 22 21 21 21 20 17	
Bahrain International average Italy Romania Bulgaria Israel Chile Indonesia Macedonia, Republic of Iran, Islamic Republic of Iran, Islamic Republic of Cyprus Tunisia Philippines Morocco Egypt Palestinian Nat'l Auth. Saudi Arabia Lebanon Jordan Botswana South Africa	44 42 41 37 36 35 35 35 32 31 26 24 23 22 21 21 20 17 8	

International average:	
Higher	▲
Not different	0
Lower	▼

Brush reflected in mirror at angle (continued)

Item Number: S022279

SCORING

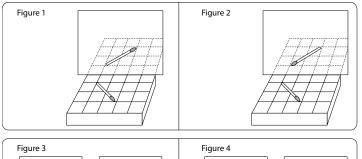
Note: A brush on the borderline of the correct squares should be accepted as correct. Credit is given for a brush in the correct squares even if the hairs are not clearly shown. Only if the hairs are clearly shown in the wrong direction is the answer incorrect.

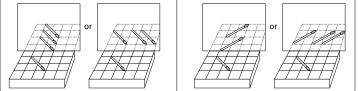
Correct Response

• Correct placement: angle, grid position, and direction (hairs to the right). (See Figure 1.)

Incorrect Response

- Correct angle and placement, but image flipped with hairs clearly turned to the left. (See Figure 2.)
- Image parallel to original (hairs to the right or left). (See Figure 3; other rows/columns are possible).
- Correct angle but image translated (hairs to the right or left). (See Figure 4; other rows/columns are possible).
- · Other incorrect (including crossed out/erased, stray marks, illegible, or off task).





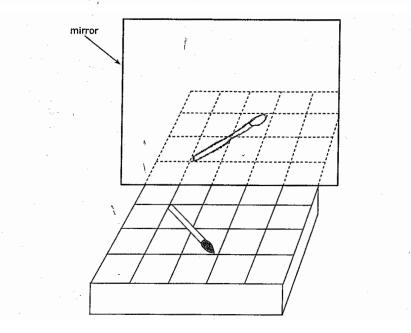
Brush reflected in mirror at angle (continued)

Item Number: S022279

Student Responses

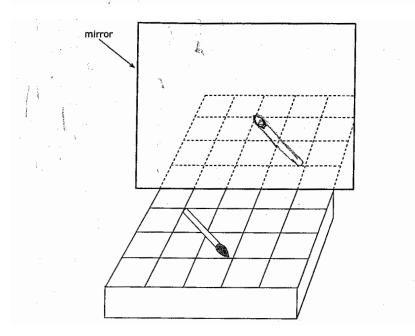
Correct Response:

The picture shows a paint brush that is lying on a shelf in front of a mirror. Draw a picture of the paint brush as you would see it in the mirror. Use the patterns of lines on the shelf to help you.



Incorrect Response:

The picture shows a paint brush that is lying on a shelf in front of a mirror. Draw a picture of the paint brush as you would see it in the mirror. Use the patterns of lines on the shelf to help you.



TIMSS 2003 8th-Grade Science Concepts and Science Ite				
Content Domain	Main Topic	Cognitive Domain		
PHYSICS	Physical States and Changes in Matter	Factual Knowledge		
let towel dries in the sun		Overall Percent	Corr	ect
		Chinese Taipei	98	
A wet towel will dry when it is left in this happen?	the Sun. Which process occurs to make	Singapore Hungary	95 95	
		Estonia	94	
(A) melting		Slovak Republic	94	
B boiling		Hong Kong, SAR	94	
e		Japan	94	
© condensation		Russian Federation	94	
(D) evaporation		Korea, Republic of	93	
		Tunisia	91 01	
		Lithuania Slovenia	91 90	
		England	89	
		Moldova, Rep. of	89	
		New Zealand	88	
		Australia	88	
		Latvia	88	
		Netherlands	88	
		Malaysia	87	
		Bulgaria	87	
		Scotland	87	0
		Jordan	86	0
		Romania	86 86	0
		Armenia Belgium (Flemish)	86 85	0
		United States	85	0
		Israel	85	0
		Serbia and Montenegro	85	0
		Bahrain	84	0
		Norway	84	0
		International average	83	
		Iran, Islamic Republic of	83	0
		Morocco	83	0
		Sweden	82	C
		Saudi Arabia	82	C
m Number: S032055		Italy Palestinian Nat'l Auth.	81 78	0
		Macedonia, Republic of	78	,
		Cyprus	77	Ţ
		Indonesia	77	V
		Chile	76	
		Lebanon	76	V
		Philippines	69	V
		Botswana	67	V
		Egypt	59	▼
		South Africa	51	▼
Correct Response: D		Ghana	39	

Country average International av	
Higher	
Not different	0
Lower	•

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Content Domain

Earth Science

B01	Layers of Earth
B05	Elevation diagram of wind/temperature
D03	Contour map showing river
F05	Oxygen equipment on mountain tops
H03	Why moon shines
H04	Diagram of soil layers
J01	Earth's plates over millions of years
J06	Factor explaining seasons on Earth
J09	Life on other planets
R04	Atmospheric conditions in jets
Z02	Diagram of rain from sea

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