

## ROUND 17

### TOSS-UP

- 1) **BIOLOGY** *Multiple Choice* Which of the following is NOT true of the Calvin-Benson Cycle:
- W) it is also sometimes called the dark reactions of photosynthesis
  - X) it is also sometimes called the light independent reactions of photosynthesis
  - Y) it converts energy trapped in the light reactions into sugar
  - Z) it does not require stores of potential energy

ANSWER: Z) IT DOES NOT REQUIRE STORES OF POTENTIAL ENERGY

### BONUS

- 1) **BIOLOGY** *Short Answer* What are the 3 tissue layers in plants that become distinct during fruit growth?

ANSWER: EXOCARP, MESOCARP, AND ENDOCARP (accept in any order)

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### TOSS-UP

- 2) **CHEMISTRY** *Multiple Choice* Which of the following is NOT an example of a voltaic cell:
- W) lead-storage battery
  - X) electrolytic cell
  - Y) dry cell
  - Z) nickel-cadmium battery

ANSWER: X) ELECTROLYTIC CELL

### BONUS

- 2) **CHEMISTRY** *Short Answer* What is the exact systematic name for the ionic compound  $\text{Cu}_2\text{S}$ ?

ANSWER: COPPER (I) SULFIDE (read as: copper ONE sulfide) (MUST BE EXACT)

### TOSS-UP

3) PHYSICS *Multiple Choice* In the creation of holograms, which of the following is LEAST likely to be true:

- W) images are formed by interference
- X) light from various points on an object interfere with light from a direct beam
- Y) a laser beam is often split into two parts by a half silvered mirror
- Z) the light source used in the hologram's creation need not be coherent

ANSWER: Z) THE LIGHT SOURCE USED IN THE HOLOGRAM'S CREATION NEED NOT BE COHERENT

### BONUS

3) PHYSICS *Short Answer* For a circuit with a current of 3 amperes, operating for 5 minutes, how much charge, in coulombs, has gone by any point in the circuit?

ANSWER: 900 C

(Solution:  $\Delta Q = I \Delta T$  ... Since coulombs is in seconds, convert 5 minutes into 300 seconds and multiply by 3 C/s = 900 C)

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### TOSS-UP

4) ASTRONOMY *Multiple Choice* Which of the following is the BEST example of gravitational lensing:

- W) the distortion of light by intervening galaxies
- X) the diffraction of light by a large mass
- Y) the obstruction of light by a large mass
- Z) the chromatic aberration of an image by an unknown source of gravity

ANSWER: W) THE DISTORTION OF LIGHT BY INTERVENING GALAXIES

### BONUS

4) ASTRONOMY *Short Answer* The largest structure discovered in the universe is a supercluster nicknamed:

ANSWER: THE GREAT WALL

**TOSS-UP**

5) MATH *Short Answer* In order, from left to right, give the binomial coefficients in the 7<sup>th</sup> row of Pascal's triangle:

ANSWER: 1, 6, 15, 20, 15, 6, 1

**BONUS**

5) MATH *Short Answer* What is the area of the region enclosed by the graph of the polar curve  $r = \frac{1}{\sin \theta + \cos \theta}$  (read as: r equals 1 over sine theta plus cosine theta) and the x axis and y axis?

ANSWER: 0.5

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**TOSS-UP**

6) EARTH SCIENCE *Multiple Choice* For the weather-watcher, a long-lasting contrail left by a passing aircraft would NOT be indicative of which of the following:

- W) the surrounding air mass contains little moisture
- X) the surrounding air mass is close to saturation
- Y) may indicate an approaching frontal system
- Z) the aircraft is flying through air temperatures well below freezing

ANSWER: W) THE SURROUNDING AIR MASS CONTAINS LITTLE MOISTURE

**BONUS**

6) EARTH SCIENCE *Multiple Choice* Geologic time can be expressed in either relative or absolute time. Which is associated with absolute time:

- W) uranium-lead dating
- X) fossil correlation
- Y) superimposition
- Z) physical feature correlation

ANSWER: W) URANIUM-LEAD DATING

### TOSS-UP

7) GENERAL SCIENCE *Multiple choice* Which of the following is the most appropriate statistical operation to evaluate whether three sets of plants, that differ only in their exposure to three different fertilizers, reacted differently:

- W) regression analysis
- X) range analysis
- Y) comparison of standard deviations
- Z) analysis of variance

ANSWER: Z) ANALYSIS OF VARIANCE

### BONUS

7) GENERAL SCIENCE *Short Answer* This fungus is the causative agent for what was known in medieval times as St. Anthony's fire, and is now used as a source for certain drugs:

ANSWER: ERGOT

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### TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* Upon booting up a computer, the message "non-system disk error" appears on the screen. What is the best way to troubleshoot this problem:

- W) restart the computer
- X) eject the floppy and restart the computer
- Y) eject the floppy and press any key
- Z) shutdown then restart the computer

ANSWER: Y) EJECT THE FLOPPY AND PRESS ANY KEY

### BONUS

8) GENERAL SCIENCE *Multiple Choice* Which of the following programming languages would be the LEAST efficient, in terms of the time required to write the program, for writing a large accounting program:

- W) C++
- X) dBASE
- Y) File Maker
- Z) Visual Basic

ANSWER: W) C++

### TOSS-UP

9) BIOLOGY *Multiple Choice* Which of the following is NOT an autoimmune disease:

- W) lupus
- X) rheumatoid arthritis
- Y) most cases of Addison's disease
- Z) post prandrial (pronounced: PRAN-dree-al) distension

ANSWER: Z) POST PRANDRIAL DISTENSION

### BONUS

9) BIOLOGY *Multiple Choice* A protein's tertiary structure is most strongly influenced by:

- W) ATP synthetase (pronounced: SIN-the-tase)
- X) imbedding in the plasma membrane
- Y) ionic and hydrogen bonds between R groups
- Z) the quaternary structure

ANSWER: Y) IONIC AND HYDROGEN BONDS BETWEEN R GROUPS

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### TOSS-UP

10) CHEMISTRY *Multiple Choice* In a paper chromatography experiment, if ether is used for the solvent and the sample is quickly carried up the paper, then the sample was:

- W) hydrophobic (pronounced: hydro-FOE-bic)
- X) hydrophilic (pronounced: hydro-FILL-ick)
- Y) polar
- Z) water soluble

ANSWER: W) HYDROPHOBIC

### BONUS

10) CHEMISTRY *Multiple Choice* A solution with a hydroxide ion concentration of  $1 \times 10^{-12}$  is:

- W) weakly acidic
- X) strongly acidic
- Y) weakly basic
- Z) strongly basic

ANSWER: X) STRONGLY ACIDIC (Solution: pH = 2)

### TOSS-UP

11) PHYSICS *Multiple Choice* From Irving Langmuir's work, it was found that a tungsten filament light bulb lasted the longest when the light bulb was filled with this gas:

- W) carbon dioxide
- X) argon
- Y) oxygen
- Z) nitrogen

ANSWER: X) ARGON

### BONUS

11) PHYSICS *Short Answer* Assuming  $g = 10$  meters per/sec<sup>2</sup>, if a pulley is used to lift a 1 Kg weight 2 meters high, how much work in SI units was expended to overcome friction if 20 newtons of effort was used?

ANSWER: 20 JOULES

(Solution: Work against gravity is 1 Kg x 10 meters/sec x 2 meters = 20 joules while total work is 20 newtons x 2 meters = 40 joules...40 - 20 = 20 joules)

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### TOSS-UP

12) ASTRONOMY *Multiple Choice* Which of the following is the most likely magnitude of quasar 3C-273:

- W) -3.0
- X) -1.0
- Y) +13.6
- Z) +6.0

ANSWER: Y) +13.6

### BONUS

12) ASTRONOMY *Short Answer* In a red giant, at about 100 million degrees, the helium nuclei will fuse to form more of this element than any other:

ANSWER: CARBON

### TOSS-UP

13) MATH *Short Answer* Considering the relationships of parts of polyhedra, if “f” is the number of faces, “e” is the number of edges, and “v” is the number of vertices, give the standard expression of Euler’s formula for polyhedra:

ANSWER:  $f - e + v = z$

### BONUS

13) MATH *Short Answer* 97 is the sum of what 2 squares?

ANSWER:  $9^2$  and  $4^2$

(Solution:  $9^2 = 81$  and  $4^2 = 16$ ;  $81+16 = 97$ )

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### TOSS-UP

14) EARTH SCIENCE *Multiple Choice* Which of the following would be the LEAST useful as an index fossil:

- W) is abundantly preserved in rocks
- X) is geographically widespread
- Y) existed as a species or genus for a relatively long time
- Z) is easily identifiable in the field

ANSWER: Y) EXISTED AS A SPECIES OR GENUS FOR A RELATIVELY LONG TIME

(Solution: ...relatively short time)

### BONUS

14) EARTH SCIENCE *Short Answer* Four of the eras of geologic time are the Proterozoic, Paleozoic, Mesozoic, and the Cenozoic. What is the fifth?

ANSWER: ARCHEAN

**TOSS-UP**

15) GENERAL SCIENCE *Short Answer* What publication of Rachael Carson ushered in a new era of environmental awareness in the USA?

ANSWER: SILENT SPRING

**BONUS**

15) GENERAL SCIENCE *Short Answer* What are the names for the International Space Station's first two segments?

ANSWER: ZARYA AND UNITY

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**TOSS-UP**

16) GENERAL SCIENCE *Multiple Choice* A computer virus that can hide in an executable program is called a:

- W) raid virus
- X) boot sector virus
- Y) exterminator
- Z) file virus

ANSWER: Z) FILE VIRUS

**BONUS**

16) GENERAL SCIENCE *Short Answer* What is the general term for a special program used to find errors in other programs, and allows the programmer to stop a program at any point and change the values of variables:

ANSWER: DEBUGGER

### TOSS-UP

17) **BIOLOGY** *Multiple Choice* A covalent bond in a protein between cysteines which are separated in the primary structural sequence by at least 20 amino acids would most likely be:

- W) a peptide bond
- X) a disulfide bond
- Y) a dative bond
- Z) a carbon-carbon bond

ANSWER: X) A DISULFIDE BOND

### BONUS

17) **BIOLOGY** *Multiple Choice* Which of the following does NOT belong to the Class Insecta:

- W) Hemiptera
- X) Crustoptera
- Y) Isoptera
- Z) Orthoptera

ANSWER: X) CRUSTOPTERA

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### TOSS-UP

18) **CHEMISTRY** *Multiple Choice* Which of the following is NOT characteristic of hydrogen as a fuel in fuel cells:

- W) it is odorless and colorless
- X) it is non-toxic
- Y) it has a high flammability limit
- Z) it disperses quickly when released

ANSWER: Y) IT HAS A HIGH FLAMMABILITY LIMIT

### BONUS

18) **CHEMISTRY** *Multiple Choice* In hydrogen fuel cells, the open-circuit voltage from a single cell operating near room temperature is approximately:

- W) 1.2 volts
- X) 7.0 volts
- Y) 12 volts
- Z) 27 volts

ANSWER: W) 1.2 VOLTS

### TOSS-UP

19) PHYSICS *Multiple Choice* Which of the following is NOT desirable in the design of a hot air engine as proposed by Carnot:

- W) there must be means of obtaining isothermal compression at a low temperature.
- X) there must be a means of obtaining isothermal expansion at a high temperature.
- Y) highest possible differences in temperature should be achieved.
- Z) there should be as much direct heat transfer between hot and cold ends as possible

ANSWER: Z) THERE SHOULD BE AS MUCH DIRECT HEAT TRANSFER BETWEEN HOT AND COLD ENDS AS POSSIBLE.

### BONUS

19) PHYSICS *Short Answer* Assuming  $g$  is  $10 \text{ m/sec}^2$ , what is the net force needed, in Newtons, to accelerate a 1000 Kg object at  $2 \text{ m/sec}^2$  in a horizontal direction:

ANSWER: 2000 NEWTONS

(Solution: ignore  $g$  for horizontal motion, and for net force.  $A \times M = F = 2 \times 1000 = 2,000$  newtons)

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### TOSS-UP

20) ASTRONOMY *Multiple Choice* The lowest temperature of bluish stars is about:

- W) 21,000 °F
- X) 25,000 °F
- Y) 36,000 °F
- Z) 45,000 °F

ANSWER: Y) 36,000 °F

### BONUS

20) ASTRONOMY *Short Answer* A red shift of  $z = 1.0$  means the original wavelength has increased by what multiple?

ANSWER: 2 TIMES

### TOSS-UP

21) MATH *Multiple Choice* For which values of  $x$  from the set of real numbers does the following inequality hold:  $8x - 6 < 2x + 6$  (read as:  $8x - 6$  is less than  $2x + 6$ )

- W)  $x < 2$  (read as:  $x$  is less than 2)
- X)  $x > 2$  (read as:  $x$  is greater than 2)
- Y)  $x < 4$  (read as:  $x$  is less than 4)
- Z)  $x > 4$  (read as:  $x$  is greater than 4)

ANSWER: W)  $x < 2$

### BONUS

21) MATH *Short Answer* The remainder obtained when  $3x^4 + 7x^3 + 8x^2 - 2x - 3$  is divided by  $x + 1$  is what?

ANSWER: 3

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### TOSS-UP

22) EARTH SCIENCE *Multiple Choice* In the Earth's atmosphere, which of the following is TRUE about the thermosphere:

- W) temperatures can reach as high as  $1500^{\circ}\text{C}$
- X) it is terminated by the mesopause
- Y) it is found 50-80 kilometers above the Earth
- Z) it is a place where ozone absorbs UV radiation coming from the sun

ANSWER: W) TEMPERATURES CAN REACH AS HIGH AS  $1500^{\circ}\text{C}$

### BONUS

22) EARTH SCIENCE *Multiple Choice* A desert weathering feature consisting of a thin, shiny, reddish-brown to blackish coating on some stones, is called:

- W) desert varnish
- X) caliche (pronounced: ka-LEE-chee)
- Y) gypsum
- Z) desert frost

ANSWER: W) DESERT VARNISH

### TOSS-UP

23) BIOLOGY *Multiple Choice* A paramount set of procedures for identifying bacterial pathogens is called:

- W) Pasteur's postulates
- X) primary response
- Y) vaccination
- Z) Koch's (pronounced: coke's) postulates

ANSWER: Z) KOCH'S POSTULATES

### BONUS

23) BIOLOGY *Multiple Choice* During replication, new bases are added to the:

- W) 3 prime phosphate
- X) 3 prime hydroxyl
- Y) 5 prime phosphate
- Z) 5 prime hydroxyl

ANSWER: X) 3 PRIME HYDROXYL

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### TOSS-UP

24) CHEMISTRY *Multiple choice* Which of the following turns blue litmus paper red?

- W)  $\text{NH}_3$
- X)  $\text{H}_2\text{SO}_4$
- Y) KOH
- Z) NaOH

ANSWER: X)  $\text{H}_2\text{SO}_4$

### BONUS

24) CHEMISTRY *Short Answer* Its value is  $6.022 \times 10^{23}$  and is the number of particles in one mole of substance. What is the symbol for this constant?

ANSWER:  $N_A$  or N

### TOSS-UP

25) PHYSICS *Multiple Choice* Assuming each of the following are traveling at the same velocity, which will have the smallest DeBroglie wavelength:

- W) alpha particle
- X) beta-minus particle
- Y) beta-plus particle
- Z) proton

ANSWER: W) ALPHA PARTICLE

(Solution: the higher the momentum, the lower the DeBroglie wavelength)

### BONUS

25) PHYSICS *Short Answer* What is the approximate speed of sound in air if the temperature of the air is 40 °C?

ANSWER: 355 METERS PER SECOND (ACCEPT: 353 TO 357)

(Solution:  $0.6 \times 40 + 331$  )