PISA USA

SCIENCE ITEMS

Guide to the Content and Layout of This Section

The *Science Items* section contains, in a ready-to-use form, the eight science assessment items that appeared in Section 5.3, *Science Concepts and Science Items*. Each item is presented on a separate page to facilitate photocopying.

The two sections are designed to be used in tandem. The *Science Items* section is designed to facilitate the construction of sets of items tailored to the purpose of the user—most likely a classroom teacher. Users can select items for their own purpose based on their reading of *Science Concepts and Science Items* section, photocopy these and administer them to students. Student responses can be scored using the scoring instructions presented in the *Science Concepts and Science Items* section, and may be compared to the international benchmarks presented there.

To assist in the recording and scoring of items Scoring Worksheets can be generated by photocopying the master copy included in this section.

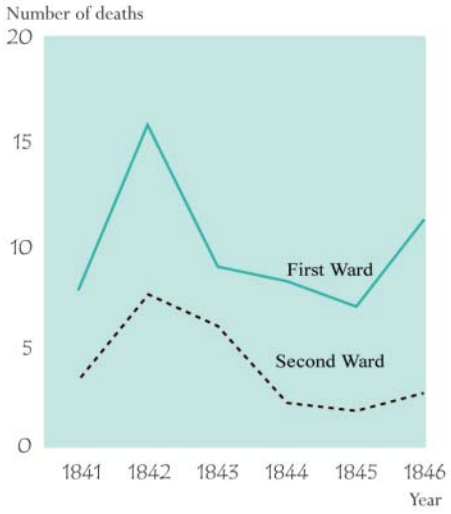
5.4

Semmelweis

Semmelweis' diary text 1

'July 1846. Next week I will take up a position as "Herr Doktor" at the First Ward of the maternity clinic of the Vienna General Hospital. I was frightened when I heard about the percentage of patients who die in this clinic. This month not less than 36 of the 208 mothers died there, all from puerperal fever. Giving birth to a child is as dangerous as first-degree pneumonia.'

Number of deaths per 100 deliveries from puerperal fever



These lines from the diary of Ignaz Semmelweis (1818-1865) illustrate the devastating effects of puerperal fever, a contagious disease that killed many women after childbirth. Semmelweis collected data about the number of deaths from puerperal fever in both the First and the Second Wards (see diagram).

Physicians, among them Semmelweis, were completely in the dark about the cause of puerperal fever. Semmelweis' diary again:

> *'December 1846. Why do so many women die from this fever after giving birth without any problems? For centuries science has told us that it is an invisible epidemic that kills mothers. Causes may be changes in the air or some extraterrestrial influence or a movement of the earth itself, an earthquake.'*

Nowadays not many people would consider extraterrestrial influence or an earthquake as possible causes of fever. We now know it has to do with hygienic conditions. But in the time Semmelweis lived, many people, even scientists, did! However, Semmelweis knew that it was unlikely that fever could be caused by extraterrestrial influence or an earthquake. He pointed at the data he collected (see diagram) and used this to try to persuade his colleagues.

Question 1: SEMMELWEIS' DIARY

Suppose you were Semmelweis. Give a reason (based on the data Semmelweis collected) why puerperal fever is unlikely to be caused by earthquakes.

Question 2: SEMMELWEIS' DIARY

Semmelweis' diary text 2

Part of the research in the hospital was dissection. The body of a deceased person was cut open to find a cause of death. Semmelweis recorded that the students working on the First Ward usually took part in dissections on women who died the previous day, before they examined women who had just given birth. They did not pay much attention to cleaning themselves after the dissections. Some were even proud of the fact that you could tell by their smell that they had been working in the mortuary, as this showed how industrious they were!

One of Semmelweis' friends died after having cut himself during such a dissection. Dissection of his body showed he had the same symptoms as mothers who died from puerperal fever. This gave Semmelweis a new idea.

Semmelweis' new idea had to do with the high percentage of women dying in the maternity wards and the students' behavior.

What was this idea?

A Having students clean themselves after dissections should lead to a decrease of puerperal fever.

B Students should not take part in dissections because they may cut themselves.

C Students smell because they do not clean themselves after a dissection.

D Students want to show that they are industrious, which makes them careless when they examine the women.

Question 3: SEMMELWEIS' DIARY

Semmelweis succeeded in his attempts to reduce the number of deaths due to puerperal fever. But puerperal fever even today remains a disease that is difficult to eliminate.

Fevers that are difficult to cure are still a problem in hospitals. Many routine measures serve to control this problem. Among those measures are washing sheets at high temperatures.

Explain why high temperature (while washing sheets) helps to reduce the risk that patients will contract a fever.

Question 4: SEMMELWEIS' DIARY

Many diseases may be cured by using antibiotics. However, the success of some antibiotics against puerperal fever has diminished in recent years.

What is the reason for this?

A Once produced, antibiotics gradually lose their activity.

B Bacteria become resistant to antibiotics.

C These antibiotics only help against puerperal fever, but not against other diseases.

D The need for these antibiotics has been reduced because public health conditions have improved considerably in recent years.

Scientific Unit 2

Ozone

Read the following section of an article about the ozone layer.

The atmosphere is an ocean of air and a precious natural resource for sustaining life on the Earth. Unfortunately, human activities based on national/personal interests are causing harm to this common resource, notably by depleting the fragile ozone layer, which acts as a protective shield for life on the Earth.

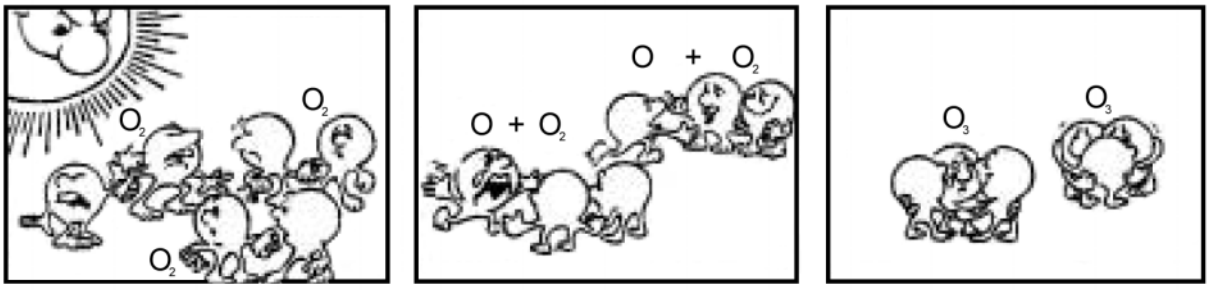
Ozone molecules consist of three oxygen atoms, as opposed to oxygen molecules which consist of two oxygen atoms. Ozone molecules are exceedingly rare: fewer than ten in every million molecules of air. However, for nearly a billion years, their presence in the atmosphere has played a vital role in safeguarding life on Earth. Depending on where it is located, ozone can either protect or harm life on Earth. The ozone in the troposphere (up to 10 kilometers above the Earth's surface) is "bad" ozone which can damage lung tissues and plants. But about 90 percent of ozone found in the stratosphere (between 10 and 40 kilometers above the Earth's surface) is "good" ozone which plays a beneficial role by absorbing dangerous ultraviolet (UV-B) radiation from the Sun.

Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun. In the last decades the amount of ozone has decreased. In 1974 it was hypothesized that chlorofluorocarbons (CFCs) could be a cause for this. Until 1987, scientific assessment of the cause-effect relationship was not convincing enough to implicate CFCs. However, in September 1987, diplomats from around the world met in Montreal (Canada) and agreed to set sharp limits to the use of CFCs.

Source: Connect, UNESCO International Science, Technology & Environmental Education Newsletter, section from an article entitled "The Chemistry of Atmospheric policy", Vol., XXII No. 2, 1997 (spelling adapted).

Question 1: OZONE

In the text above nothing is mentioned about the way ozone is formed in the atmosphere. In fact each day some ozone is formed and some other ozone disappears. The way ozone is formed is illustrated in the following comic strip.



Source: Deilig er den Himme, Temahefte 1, Institute for Physics, University of Oslo, August 1997.

Suppose you have an uncle who tries to understand the meaning of this strip. However, he did not get any science education at school and he doesn't understand what the author of the strip is explaining. He knows that there are no little fellows in the atmosphere but he wonders what those little fellows in the strip stand for, what those strange notations O, O_2 and O_3 mean and which processes the strip represents. He asks you to explain the strip. Assume that your uncle knows:

- **that O is the symbol for oxygen;**
- **what atoms and molecules are.**

Write an explanation of the comic strip for your uncle. In your explanation, use the words atoms and molecules in the way they are used in lines 5 and 6.

Question 2: OZONE

Ozone is also formed during thunderstorms. It causes the typical smell after such a storm. In lines 10-12 the author of the text distinguishes between "bad ozone" and "good ozone".

In terms of the article, is the ozone that is formed during thunderstorms "bad ozone" or "good ozone"?

Choose the answer and the explanation that is supported by the text.

	Bad ozone or good ozone?	Explanation
A	Bad	It is formed during bad weather.
B	Bad	It is formed in the troposphere.
C	Good	It is formed in the stratosphere.
D	Good	It smells good.

Question 3: OZONE

Lines 14 and 15 state: "Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun."

Name one of these specific diseases.

Question 4: OZONE

At the end of the text, an international meeting in Montreal is mentioned. At that meeting lots of questions in relation to the possible depletion of the ozone layer were discussed. Two of those questions are given in the table below.

Which of the questions below can be answered by scientific research?

Circle Yes or No for each.

Question:	Answerable by scientific research?
Should the scientific uncertainties about the influence of CFCs on the ozone layer be a reason for governments to take no action?	Yes / No
What would the concentration of CFCs be in the atmosphere in the year 2002 if the release of CFCs into the atmosphere takes place at the same rate as it does now?	Yes / No

TEST ITEM ANALYSIS WORKSHEET

Date ____________ Test Description ______________________________

Student Name Last	First	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Number Correct	Percent Correct
Number Correct																																	
Percent Correct																																	

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