

Student Name _____

OHIO GRADUATION TESTS



Science

Spring 2008

This test was originally administered to students in March 2008. This publicly released material is appropriate for use by Ohio teachers in instructional settings. This test is aligned with Ohio's Academic Content Standards.

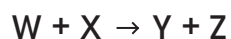
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SCIENCE TEST

Directions: For multiple-choice questions, choose the correct answer and then mark the corresponding circle in the Answer Document. If you change an answer, be sure to erase the first mark completely.

For written response questions a gridded area is provided. Using the grid may or may not be necessary to answer the question; however, your response should be written in the gridded area. Be sure to answer the question completely and show all your work in the Answer Document.

1. W reacts with X in the equation below.



According to the law of conservation of mass, how many grams of W must react completely with 225 grams of X to result in 375 grams of product?

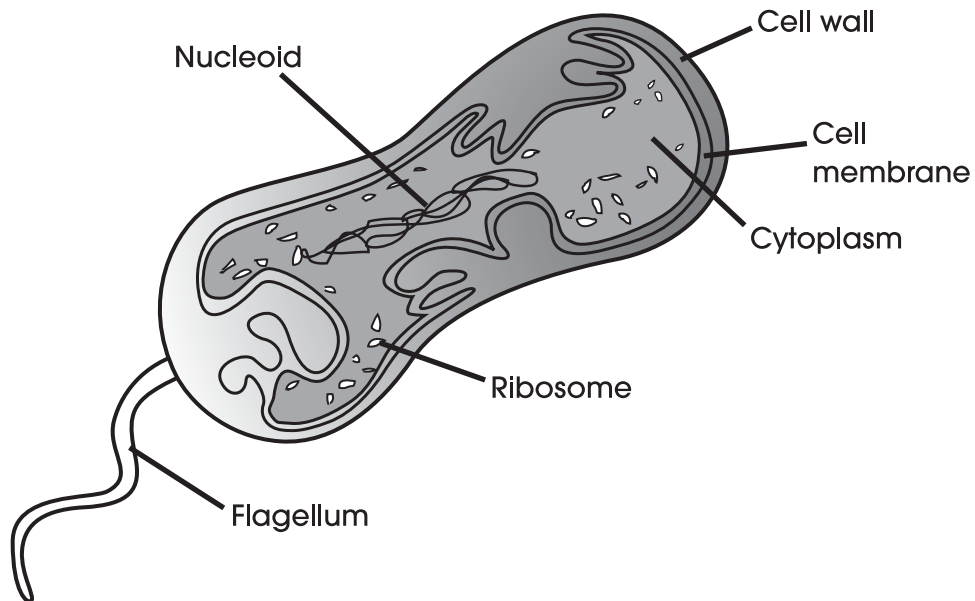
- A. 150 grams
- B. 225 grams
- C. 375 grams
- D. 600 grams

2. When submitting research proposals to funding agencies, investigators must follow ethical guidelines.

What information in a research proposal would be considered bogus and lead to rejection of the proposal?

- A. plan for monitoring safety
- B. estimates of the number of participants required for the study
- C. data from experiments that have not been performed
- D. projected budget for equipment and laboratory personnel

3. The picture below shows some of the structures in a single-celled organism.



The presence of which structure provides evidence that this organism is capable of locomotion?

- A. cell wall
- B. ribosome
- C. flagellum
- D. cytoplasm

4. James Hutton (1726 - 1797) is often referred to as the father of modern geology. His detailed observations and theories about Earth processes opposed the accepted theories of his time. One of his contributions was the development of what he called "the great geological cycle". Hutton theorized that most rocks were igneous in origin. The igneous rocks could then change into sedimentary or metamorphic rocks. The chart below shows locations of several rock types and the minerals they contain.

Location	Rock Type	Rock Name	Minerals Present
England	Sedimentary	Dirty Sandstone	Muscovite Mica, Quartz, Biotite Mica
Germany	Igneous	Granite	Quartz, Orthoclase Feldspar, Muscovite Mica, Biotite Mica
Australia	Metamorphic	Gneiss	Orthoclase Feldspar, Muscovite Mica, Biotite Mica, Quartz
North America	Sedimentary	Conglomerate	Muscovite Mica, Quartz, Biotite Mica

What evidence from the chart could be used to support Hutton's theory that most rocks are igneous in origin?

- A. Igneous rocks are only found in Germany.
- B. Sedimentary rocks are found in both North America and England.
- C. The rocks found in the table are made up of many of the same minerals.
- D. The rocks found in the table are different types of rocks from different locations.

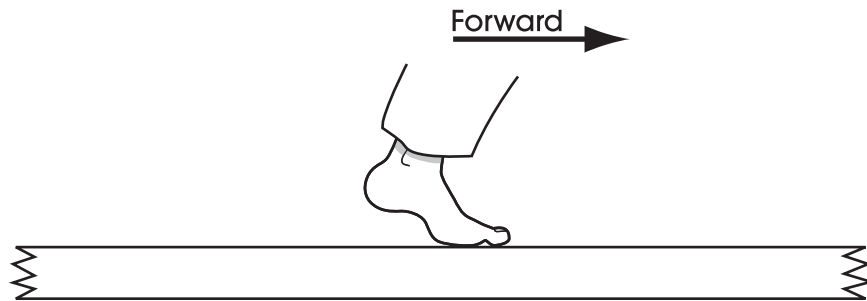
Science

5. Energy produced by cellular processes is stored as
- A. CO₂.
 - B. ATP.
 - C. DNA.
 - D. RNA.

6. Thousands of acres of tropical rainforests are cut down each year, primarily for farming and wood products. Identify two negative environmental consequences of rainforest destruction. Explain the negative impact of each consequence.

Respond in the space provided in your **Answer Document**. (4 points)

Use the picture to answer question 7.



7. Which statement accurately describes the interaction between the foot and sidewalk as a person moves forward along the sidewalk in the direction of the arrow?
- A. The foot pushes forward on the sidewalk; the sidewalk does not push forward on the foot.
 - B. The foot pushes forward on the sidewalk; the sidewalk pushes forward on the foot.
 - C. The foot pushes backward on the sidewalk; the sidewalk pushes forward on the foot.
 - D. The foot pushes backward on the sidewalk; the sidewalk pushes backward on the foot.

8. The pesticide DDT was at one time referred to as a “miracle” pesticide. Its widespread use in the United States peaked in 1959, but then usage steadily declined until its ban in late 1972. Reasons for declining usage included increased insect resistance and public concern over potentially harmful environmental effects.

How did this concern affect the field of agricultural science?

- A. It led to the development of equally harmful herbicides.
- B. It encouraged farmers to violate the ban and increase the use of DDT.
- C. It led to the development of more effective, alternative pesticides.
- D. It encouraged farmers to reduce the number of crops grown in their fields.

Use the information below to answer questions 9 - 12.

A group of students designs an experiment to test how an herbicide affects pepper plants and weeds. Eight plots are tested, each of which holds 25 pepper plants and a variety of weeds. Plots 1 and 2 are not treated; plots 3 - 8 are treated with varying amounts of weed-killing herbicide. The weeds are counted in each plot during week 1. The herbicide is applied during week 2, and the weeds are counted again in week 3. The data are shown in the table below.

Effects of Herbicide on Plant Growth				
Plot	Herbicide dose	Number of pepper plants that die before producing fruit	Week 1 number of weeds	Week 3 number of weeds
1	No herbicide application	3	30	33
2	No herbicide application	5	35	40
3	50% of recommended dose	3	42	24
4	50% of recommended dose	3	43	14
5	100% of recommended dose	4	47	7
6	100% of recommended dose	6	42	3
7	150% of recommended dose	12	43	2
8	150% of recommended dose	15	45	5

9. A student takes a herbicide-resistant weed from plot 3 and a herbicide-resistant weed from plot 4. He determines that both plants have dominant mutations in the gene that is responsible for herbicide resistance (H). The genotype of each plant is indicated below.

Weed from plot 3
Hh

Weed from plot 4
HH

In a cross between these two weeds, what percentage of the offspring would be resistant to the herbicide?

- A. 0%
- B. 25%
- C. 50%
- D. 100%

10. A student is concerned that the experiments could cause widespread damage to the local ecosystem. A relevant concern may be
- A. increasing the genetic diversity in the weed population.
 - B. runoff or absorption of the herbicide into local water sources.
 - C. the use of atmospheric carbon dioxide gas for photosynthesis.
 - D. the effect of the herbicide on pepper production in the treated plots.
11. What factor most likely accounts for the pepper plants that died in plots 1 and 2 prior to producing peppers?
- A. increased consumption of weeds by insects
 - B. competition between weeds and pepper plants
 - C. a lack of nutrients in the soil resulting from herbicide application
 - D. a reduction in the amount of sunlight received by weeds growing under pepper plants

12. In a follow-up study, a student allows weeds to grow in a previously cleared plot for several weeks. The student counts the number of weeds and then treats the plot with the recommended dose of herbicide. The student observes that several weeds survive and their offspring soon replace the weeds that were killed by the initial application of the herbicide.

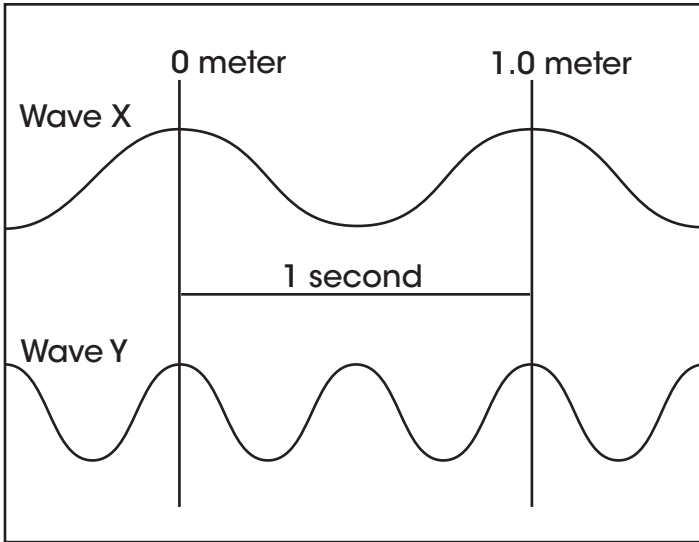
Propose a hypothesis to explain why several of the weeds survived the herbicide application. Explain how this hypothesis could be tested.

Respond in the space provided in your **Answer Document**. (2 points)

13. Most geologists accept radiometric dating techniques as valid because
- A. radioactive elements decay at a constant and measurable rate.
 - B. all radioactive elements used for dating purposes have the same decay rate.
 - C. elements used for radiometric dating have both radioactive and non-radioactive isotopes.
 - D. non-radioactive isotopes decay at the same rate as radioactive isotopes.

14. In the diagram below, similar types of waves with the same amplitude travel in the same medium.

Wave Propagation



Compared to wave X, which statement is correct?

- A. Wave Y has greater speed.
- B. Wave Y has less energy.
- C. Wave Y has a lower frequency.
- D. Wave Y has a shorter wavelength.

15. Geologists installed tiltmeters in a tectonically active area. Tiltmeters can detect very small changes in the slope (tilt) of Earth's surface. These changes result from the upward movement of magma beneath Earth's surface.

What event could be predicted by monitoring these changes?

- A. a potential volcanic eruption
- B. reversal of Earth's magnetic field
- C. a change in the composition of Earth's crust
- D. decreased thermal energy transfer within Earth

17. A student is testing the conductivity of two solid substances. Substance A has high conductivity and substance B has low conductivity.

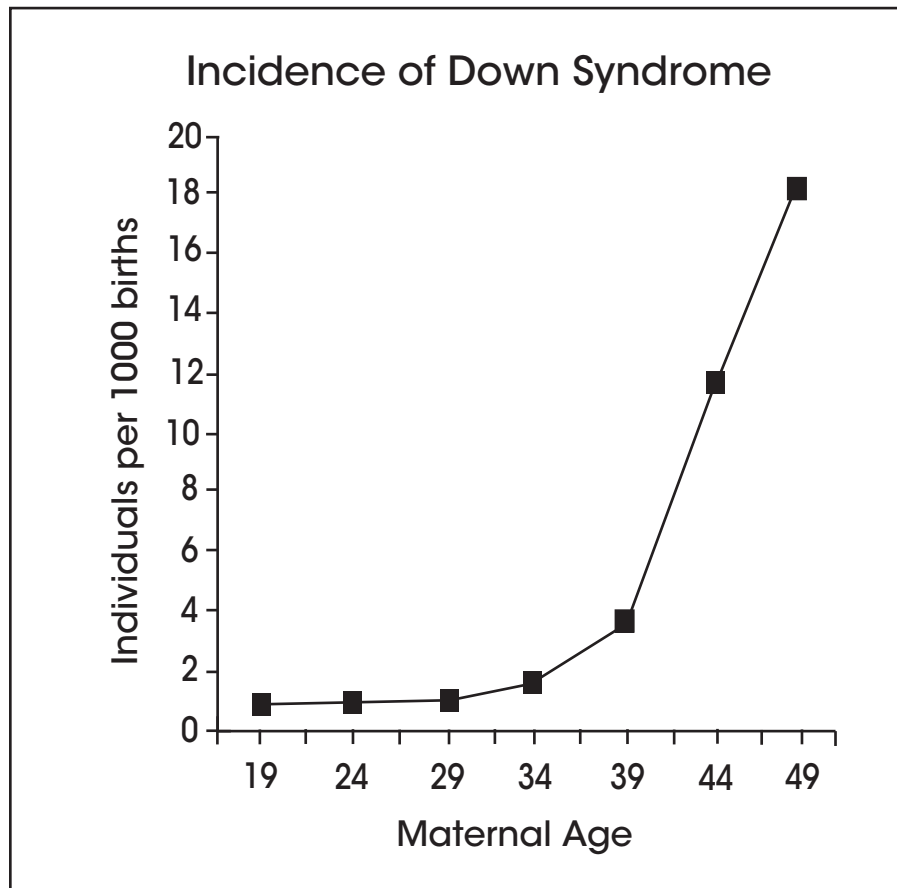
Based on this information, what must be true regarding these two substances?

- A. Electrons in substance A are able to move more easily than electrons in substance B.
- B. There is more energy stored in chemical bonds in substance A than there is in substance B.
- C. The atomic nuclei in substance A have more mass than the atomic nuclei in substance B.
- D. Substance A contains a higher percentage of radioactive atoms than does substance B.

18. Individuals suffering from debilitating and sometimes terminal diseases often advocate a more rapid development cycle for approving new drug treatments. If the development cycle is accelerated, describe one potential benefit and one potential hazard of treating a disease.

Respond in the space provided in your **Answer Document**. (2 points)

19. The graph below shows the relationship between maternal age and the incidence of children born with Down syndrome (a condition that results in an individual having an extra chromosome 21).

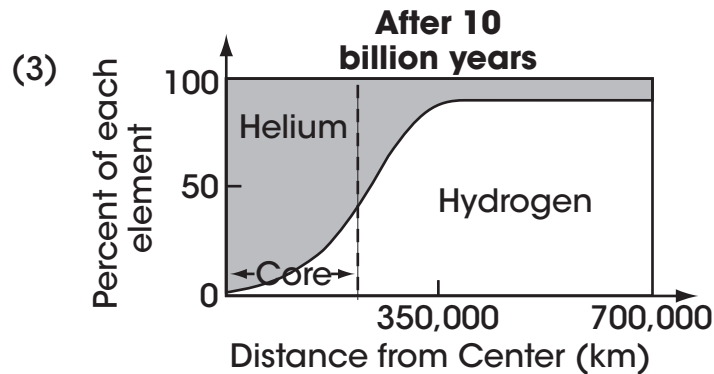
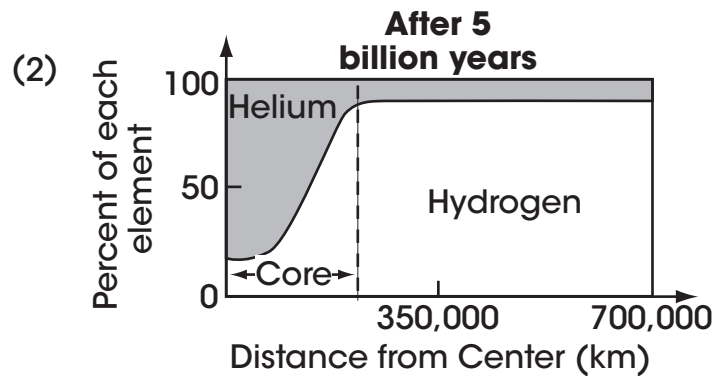
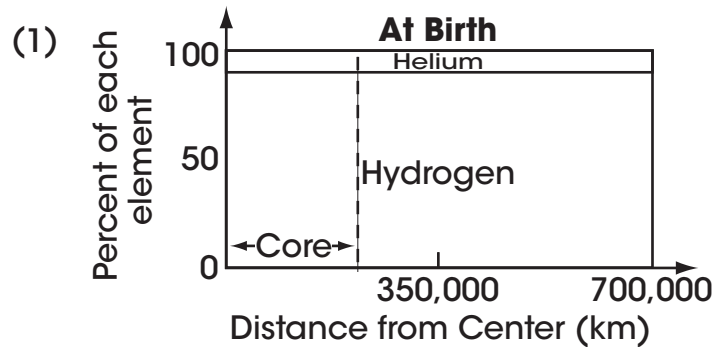


What conclusion is best supported by the data?

- A. There is no risk of Down syndrome in children born to mothers under age 34.
- B. The risk of Down syndrome increases dramatically in children born to mothers after age 34.
- C. The risk of Down syndrome doubles in children born to mothers for each year over the age of 34.
- D. There is no correlation between the number of Down syndrome births and age.

20. According to some theories, Earth's sun is approximately 5 billion years old. After about 10 billion years, this type of star runs out of fuel. The hydrogen in the core becomes depleted and cannot be fused to form helium. The graphs below illustrate the chemical changes that occur inside a star at specific times.

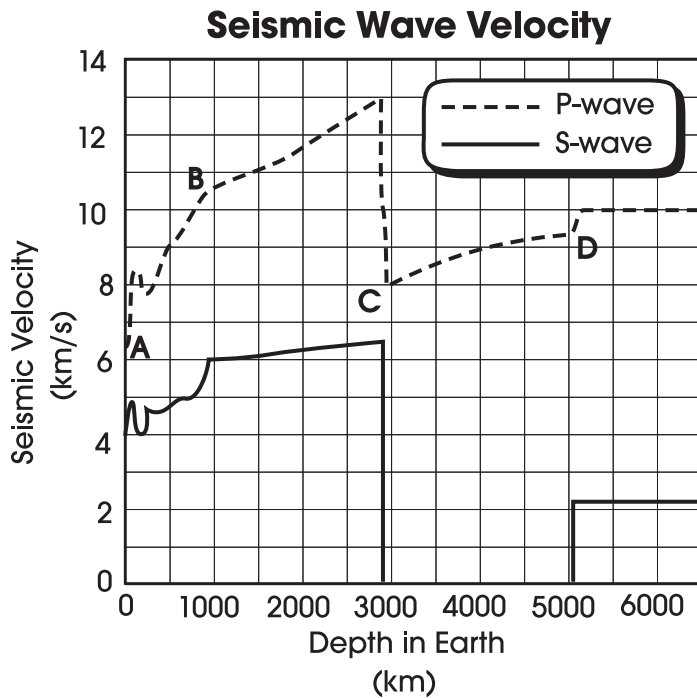
Chemical Changes in a Star



Using the information provided, what is the hydrogen/helium content inside a star that is the approximate age of our sun?

- A. The hydrogen content decreases as it reaches the outer edge of the star.
- B. The helium content is higher at the outer portion of the star than it is in the core of the star.
- C. The hydrogen content is higher at the center of the star and then decreases towards the outer edge of the star.
- D. The helium content is greatest at the center of the star and then decreases towards the outer edge of the star.

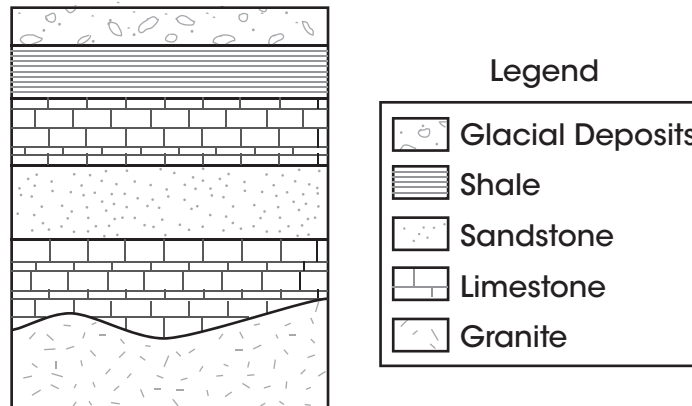
21. The graph below shows the seismic wave velocities at various depths within Earth.



Based on the graph, which point marks the beginning of Earth's liquid outer core?

- A. A
- B. B
- C. C
- D. D

22. In the 1600s, Danish scientist Nicholas Steno studied the relative positions of sedimentary rocks. He determined that sedimentary rocks typically form layer on top of layer, so if undisturbed, the bottom layer of sedimentary rock is the oldest. Today, this idea is known as the Law of Superposition. This law is one way to estimate the relative ages of sedimentary rocks. The diagram below is a geologic cross-section from Ohio.

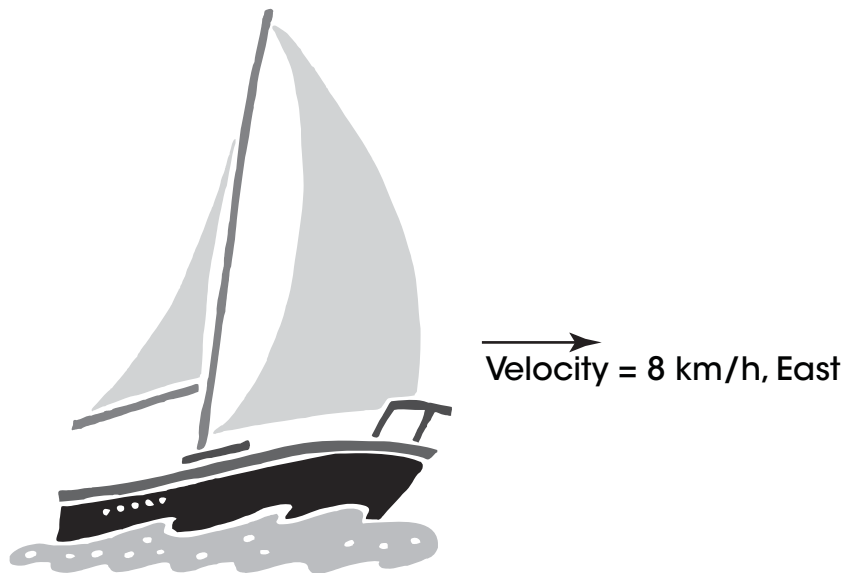


How could the Law of Superposition be applied correctly to this cross-section?

- A. The youngest sedimentary layer was deposited by glaciers.
- B. The layers in this cross-section are all igneous, so it will not work.
- C. The sedimentary layer in this cross-section is close to 5,200 years old.
- D. The youngest sedimentary layer can be found at the very bottom of the cross-section.

On the March 2008 Ohio Graduation Science Test, questions 23-28 are field test questions that are not released.

29. A sailboat is moving at a constant velocity of 8 km/h eastward as shown in the picture below.



Describe two opposing forces acting on the boat and explain how each force affects the boat.

Respond in the space provided in your **Answer Document**. (2 points)

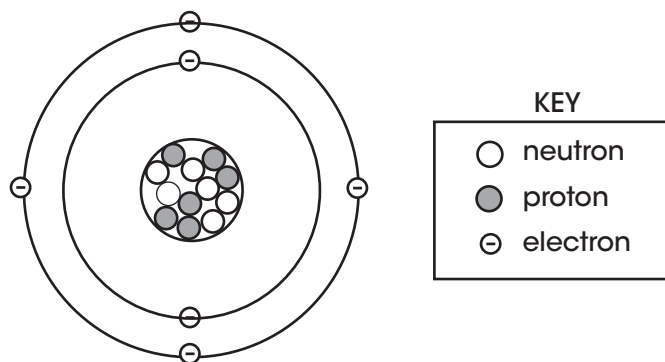
30. Many scientists hypothesize that a cloud of interstellar dust, gas and ice collapsed to form a nebula from which our Sun and planets formed.

What factor is responsible for causing most of this interstellar material to condense, forming our Sun?

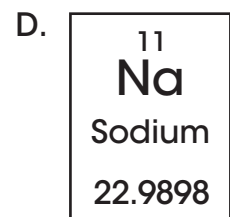
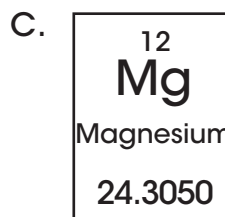
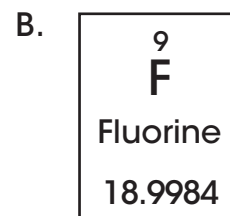
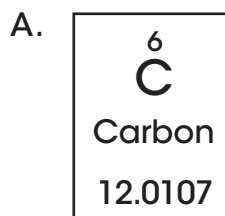
- A. magnetic attraction
- B. ultraviolet radiation
- C. dissipation of gases
- D. gravitational attraction

Use the graphic to answer question 31.

Shell Model



31. Which element does the shell model represent?

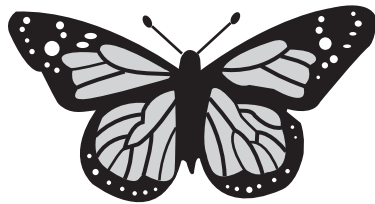


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Use the information to answer questions 32 - 34.

Butterflies

The monarch is a bright orange butterfly with black stripes. It acquires toxins from the milkweed plants it eats as a caterpillar. Adult monarchs retain these chemicals. Experiments have shown that blue jays that eat poisonous monarchs become sick within 15 to 30 minutes. The viceroy is also an orange, black-striped butterfly, which is difficult to distinguish from a monarch. Viceroy larvae consume primarily non-toxic poplar or willow tree leaves.



Monarch Butterfly



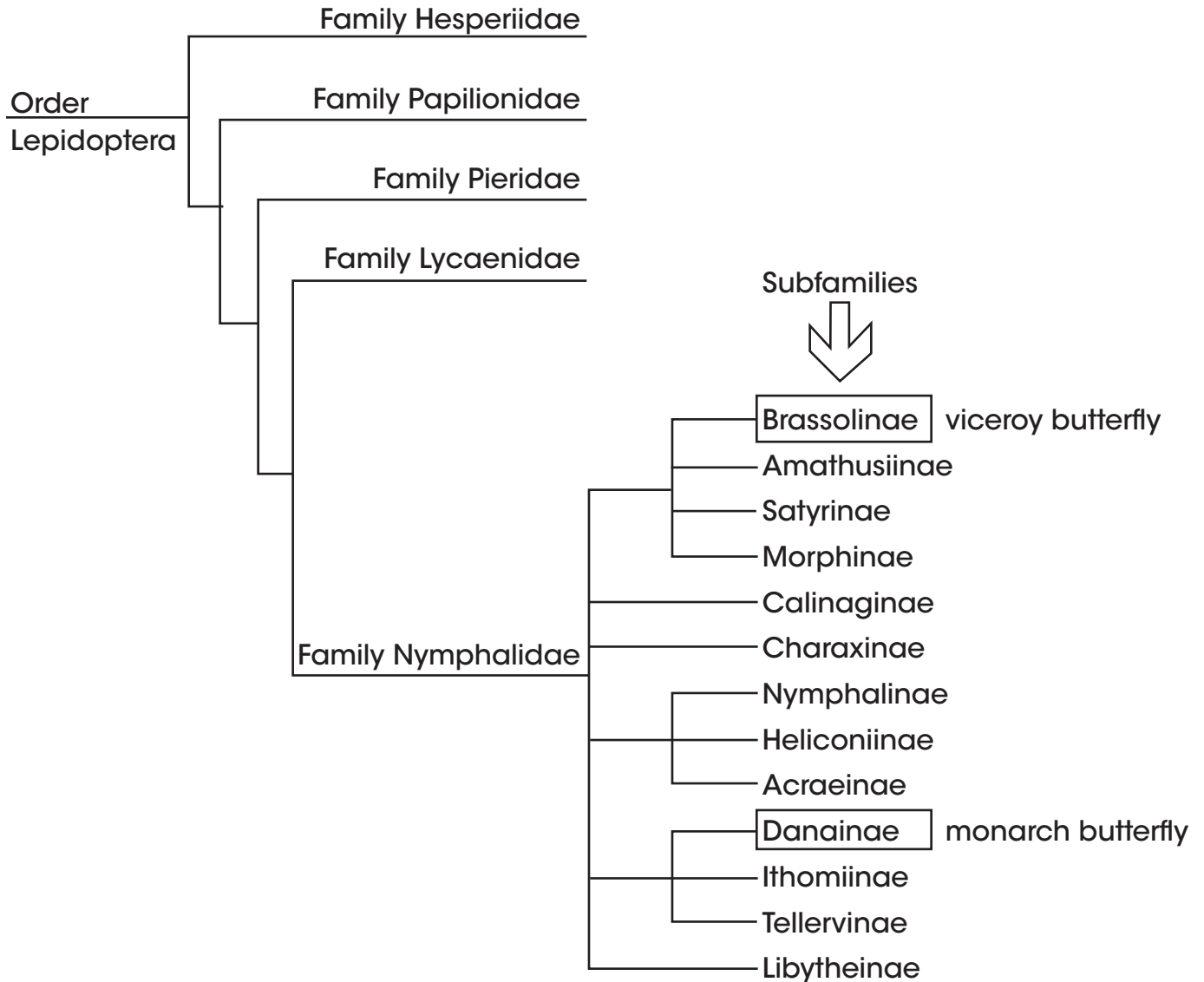
Viceroy Butterfly

Scientists have long suggested that viceroys have avoided predation by mimicking the monarch's coloration pattern. New evidence indicates that this may not be the case. Descriptions of two sets of experiments with monarchs and viceroys are given below.

Experiment 1 (1958): Blue jays that were raised in captivity were offered viceroys. The hungry jays devoured the viceroys. The same jays were offered monarchs. After eating one or two monarchs, the blue jays refused to eat monarchs or viceroys. All butterflies' wings were intact when given to the birds.

Experiment 2 (1991): Researchers fed the wingless abdomens of monarch, viceroy, queen, and non-toxic control butterflies to red-winged blackbirds and monitored the percentage of each type eaten. While 98% of control butterflies and 70% of queen butterflies were eaten, only 40% of viceroys and 40% of monarchs were eaten.

32. The diagram below shows a partial classification scheme for monarch and viceroy butterflies.



Based on this diagram, monarchs and viceroys belong to the same

- A. genus.
- B. family.
- C. species.
- D. subfamilies.

33. What statement regarding the similarities between monarchs and viceroys best agrees with Charles Darwin's theory of natural selection at the time of its publication in 1859?
- A. Monarch butterflies are an older species than viceroy butterflies.
 - B. Similarities between monarch and viceroy butterflies result from their diets.
 - C. Viceroy butterflies avoid predation due to their resemblance to monarch butterflies.
 - D. Variations in DNA sequences are responsible for the similarity between monarch and viceroy butterflies.

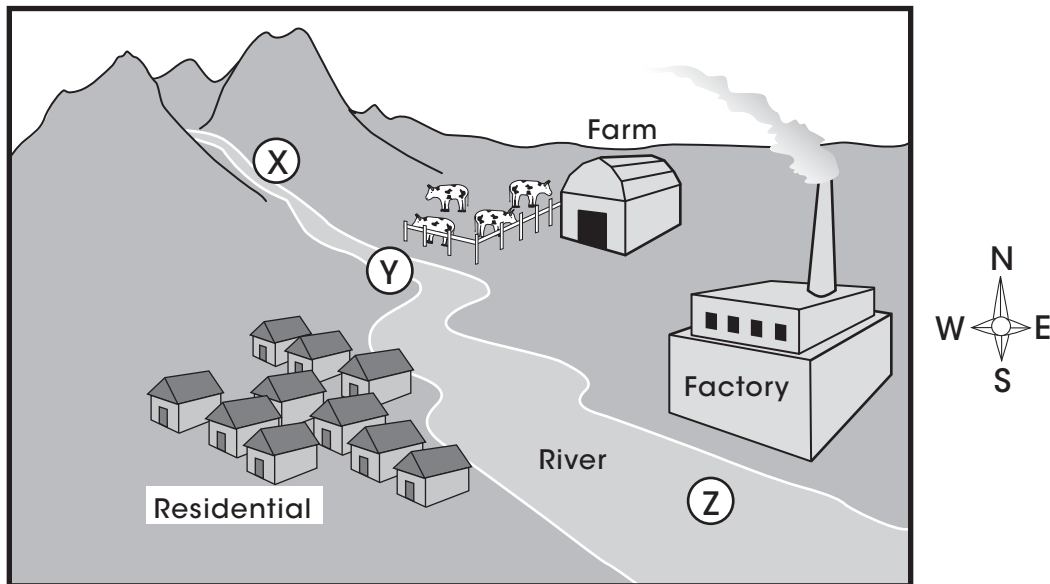
34. A scientist studying a large population of a particular species of bird concludes that monarch butterflies are toxic to that bird species. However, upon studying a second, smaller population of the same bird species, he discovers that the second population is able to eat monarchs without becoming sick.

How could the scientist best explain his findings?

- A. The larger bird population has a small gene pool.
- B. Monarchs are only toxic if eaten in large quantities.
- C. Genetic drift has occurred in the smaller population.
- D. Natural selection has increased populations of non-toxic butterflies.

35. Environmental monitoring of a lake located to the southeast of a factory has shown a consistent decrease in pH over the period of a year. A researcher investigating the pH change hypothesizes that either a factory or a farm along the river is responsible for the pH change. The river flows into the lake.

pH Sampling



The researcher collects a water sample from locations Y and Z in the diagram and runs pH analyses on each sample. He finds that the pH in sample Z is lower than the pH in sample Y and concludes that the factory is responsible for the low pH values in the lake.

Based on the diagram and the researcher's investigation, provide two reasons why this may not be a valid conclusion. Describe how each reason could invalidate the conclusion.

Respond in the space provided in your **Answer Document**. (4 points)

36. A metal that can be hammered out or rolled into thin sheets is best described as

- A. brittle.
- B. ductile.
- C. reactive.
- D. malleable.

37. In 1864, Louis Pasteur was asked to investigate diseases afflicting the wine in Arbois, France. He discovered that these diseases were caused by micro-organisms that could be killed by heating the wine to 55°C for a period of time.

What is this process called today that applies to milk?

- A. homeostasis
- B. fermentation
- C. differentiation
- D. pasteurization

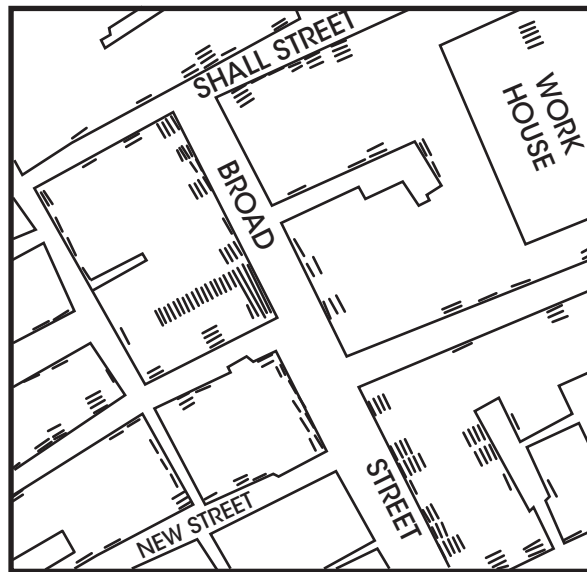
38. In some areas, magma chambers exist close to Earth's surface. Water seeping into the ground becomes heated by the rock overlying these magma chambers.

What is most likely to occur when the heated water under pressure rises back toward the surface through fractured rock?

- A. plate subduction
- B. geyser formation
- C. volcanic eruption
- D. earthquake activity

39. In 1854, a cholera epidemic spread throughout parts of London causing hundreds of deaths. Physician John Snow, in investigating the epidemic, plotted the locations of cholera-related deaths on a map of the city. Numbers of deaths are indicated by parallel lines in front of buildings where deaths occurred.

Locations of Cholera Deaths



How did the data obtained from Snow's map most likely assist city officials in stopping the cholera epidemic?

- A. It allowed them to verify the exact number of cholera-related deaths.
- B. It allowed them to determine the average age of the individuals infected.
- C. It allowed them to predict the rate at which the epidemic would continue to spread.
- D. It allowed them to pinpoint the area most affected and determine the source of infection.

40. Significant progress has been made in the development of oxygen-carrying solutions that may replace whole blood. Describe two reasons why researchers are so interested in developing artificial blood to replace the use of whole blood.

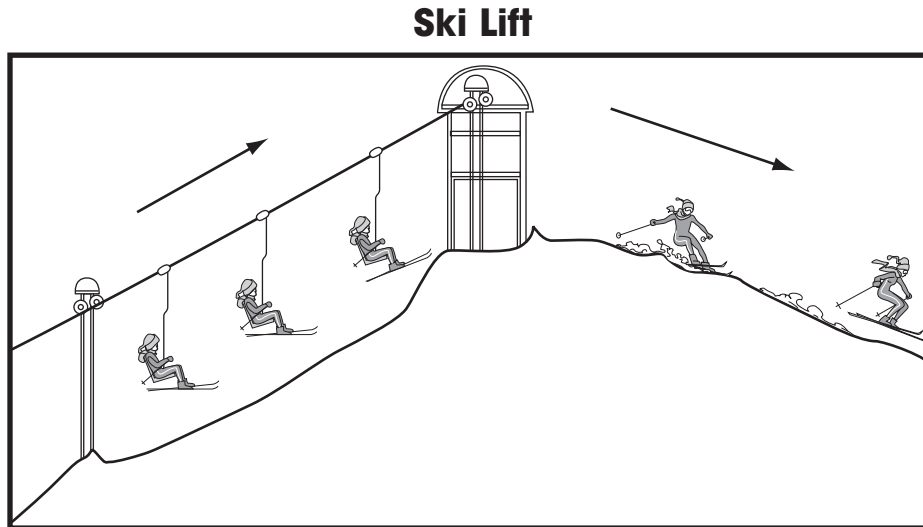
Respond in the space provided in your **Answer Document** (2 points).

41. Henri Darcy was a French engineer living in the 1800s. He observed that water flowed at different rates through different types of soil and rock. He applied his research to assist scientists in calculating groundwater flow rates, resulting in a formula called Darcy's Law.

Why do scientists use a formula to estimate groundwater flow, instead of taking direct measurements as they do in surface freshwater streams?

- A. Groundwater does not move under the ground so it has no flow rate.
- B. Scientists cannot easily reach the groundwater to determine the flow rate.
- C. Groundwater freezes easily, so it is more difficult to measure the rate of flow.
- D. There is more surface freshwater than groundwater, so it is easier to measure.

42. The picture below shows the different positions of a skier as she is lifted to the top of a slope and then skis down the other side.



Which statement best explains the change in the skier's potential energy?

- A. The skier loses potential energy as she is lifted up the slope and loses potential energy as she skis down the slope.
- B. The skier gains potential energy as she is lifted up the slope and maintains the same potential energy as she skis down the slope.
- C. The skier gains potential energy as she is lifted up the slope and loses potential energy as she skis down the slope.
- D. The skier loses potential energy as she is lifted up the slope and gains potential energy as she skis down the slope.

43. A simple food chain in a wetland is represented below.

algae → paramecium → mosquito larva → trout → blue heron

An ecologist doing population counts in the wetland observes a drop in the number of trout over an extended period of time.

What change is most likely responsible for the trout decline?

- A. migration of blue herons out of the wetland area
- B. introduction of a predator that feeds on blue heron eggs
- C. application of insecticides to wet areas where mosquitoes breed
- D. implementation of new conservation laws to protect the wetland

44. Which energy transformation below describes the conversion involved when the carbon compounds in wood are burned?
- A. Chemical energy is converted to thermal energy.
 - B. Thermal energy is converted to chemical energy.
 - C. Potential energy is converted into chemical energy.
 - D. Chemical energy is converted into potential energy.

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