

Student Name _____

OHIO GRADUATION TESTS



Science

Spring 2007

This test was originally administered to students in March 2007. This publicly released material is appropriate for use by Ohio teachers in instructional settings. This test is aligned with Ohio's Academic Content Standards.

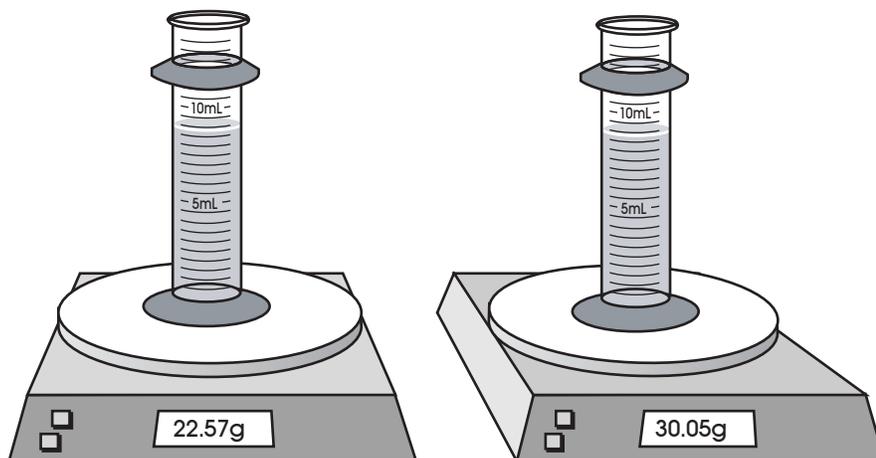
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SCIENCE TEST

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. Two identical flasks containing different liquids are placed on identical balances.



Based only on what you can observe from the picture, what property differs between the two liquids?

- A. density
- B. volume
- C. alkalinity
- D. conductivity

Use the information to answer questions 2 - 5.

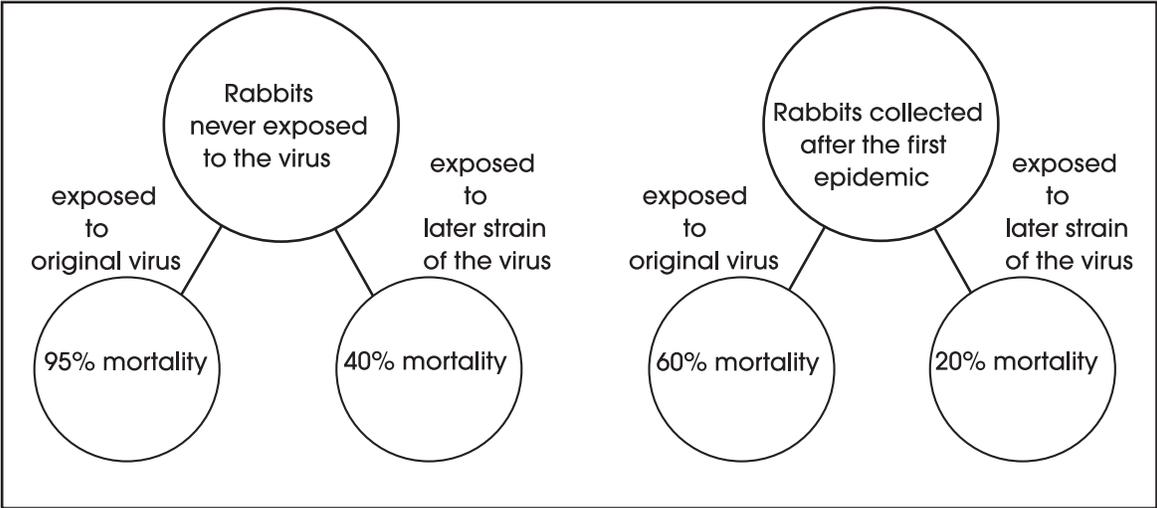
In 1859, European rabbits were introduced into Australia. The rabbits ate agricultural crops and native plants. The wild rabbit population expanded rapidly, numbering in the hundreds of millions. To control the rabbit population, the Australian government introduced the myxoma virus. Transmitted by a mosquito, this virus caused disease in the European rabbits. Each exposure to the virus led to an epidemic, and the following mortality rates were observed in the wild rabbit population.

Chart 1

Epidemic	Wild Rabbit Mortality Rate
1st	99.8%
2nd	90%
3rd	40 - 60%

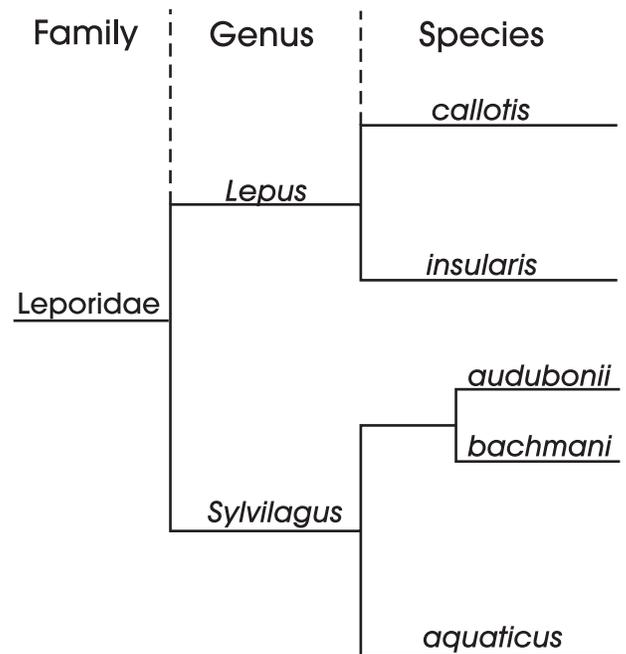
Australian scientists kept laboratory populations of the original virus and rabbits that were never exposed to the virus. They also maintained populations of rabbits and strains of the virus collected from the wild at different times after the original introduction of the virus. The scientists then exposed each group of rabbits to a different strain of the virus. The diagram below summarizes their data.

Diagram 1



2. What characteristic of the European rabbit allowed it to become a major pest in Australia so quickly?
- A. high reproductive rate
 - B. limited diet preferences
 - C. relatively short life span
 - D. narrow range of habitat
3. Which action may increase the impact of the myxoma virus on the rabbit population today?
- A. spraying to kill mosquitoes
 - B. releasing different strains of the virus
 - C. introducing sterile rabbits into the population
 - D. releasing the virus where the rabbit population is low
4. Surviving rabbits had traits that became more common in the rabbit population because rabbits with these traits
- A. changed habitats.
 - B. ate differently.
 - C. produced offspring.
 - D. developed parasites.

5. This classification system shows genetic relationships between five species of rabbits.



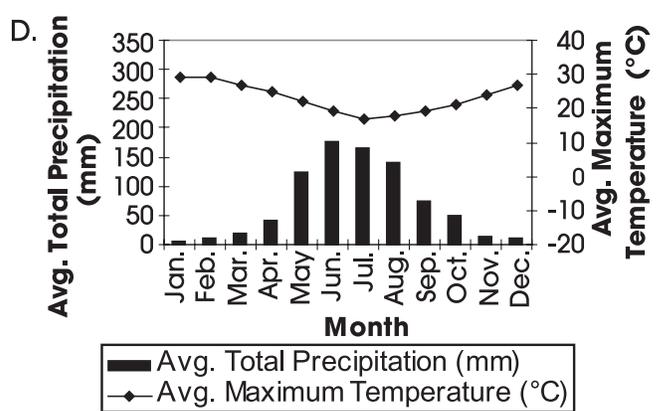
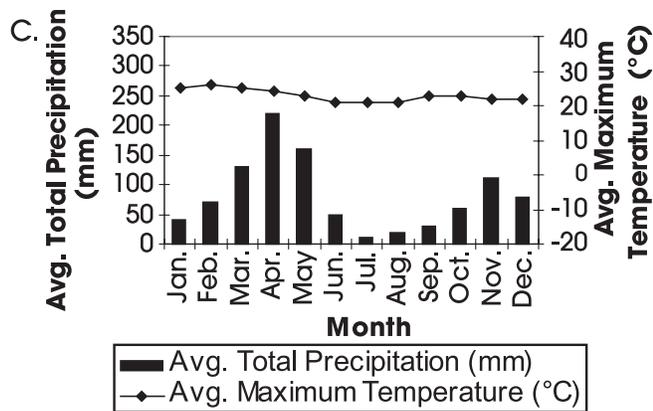
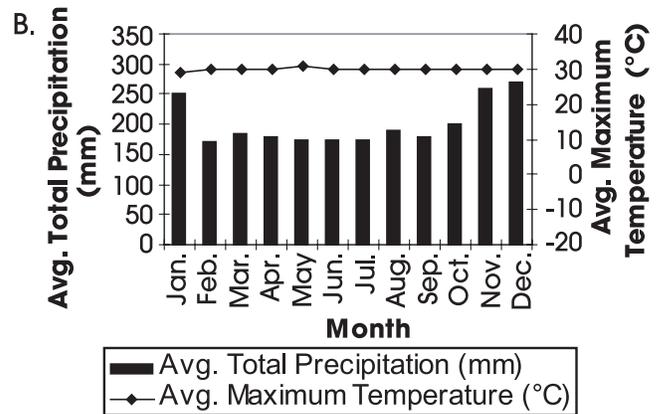
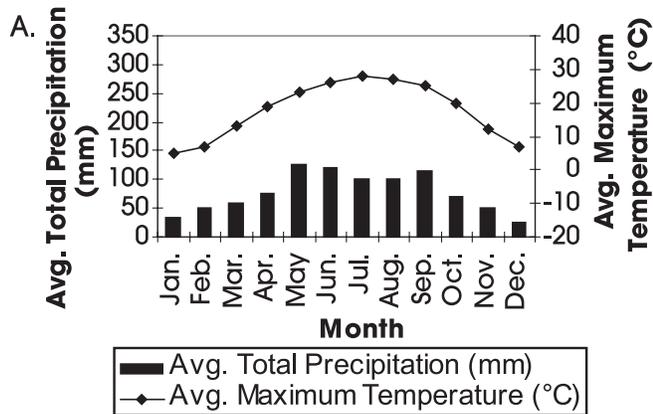
Which species likely harbors the virus infecting *Sylvilagus bachmani*?

- A. *Lepus callotis*
- B. *Lepus insularis*
- C. *Sylvilagus aquaticus*
- D. *Sylvilagus audubonii*

Science

6. Climatographs are often used to represent a location's temperature and precipitation patterns. (Precipitation is represented by the bar graph because it is cumulative.)

Which climatograph most likely represents a tropical rainforest?



Use the partial periodic table to answer question 7.

6	— Atomic number
C	— Symbol
Carbon	— Name
12.0107	— Average Atomic Mass

Partial Periodic Table of the Elements

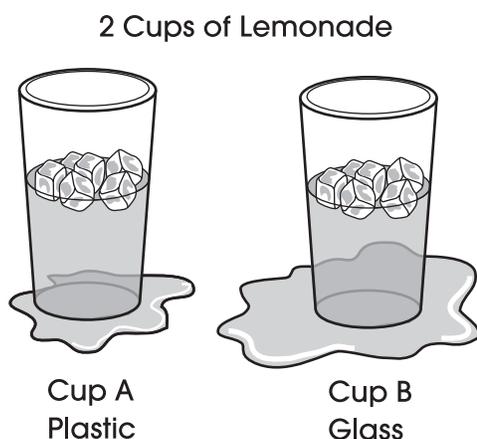
IA 1	IIA 2A	IIIA 13	IVA 14	VA 15	VIA 16	VIIA 17	VIIIA 18
1 H Hydrogen 1.00794	4 Be Beryllium 9.0122	5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	2 He Helium 4.0026
2 3 Li Lithium 6.941	12 Mg Magnesium 24.3050	13 Al Aluminum 26.98154	14 Si Silicon 28.0855	15 P Phosphorus 30.9738	16 S Sulfur 32.065	10 Ne Neon 20.1797	18 Ar Argon 39.948
3 11 Na Sodium 22.9898	20 Ca Calcium 40.078						
4 19 K Potassium 39.0983							

7. In terms of electrons, describe the difference between the formation of the covalent bond in Cl₂ and the ionic bond in NaCl. Respond in the space provided in your **Answer Document**. (2 points)

Use the information to answer questions 8 and 9.

Lemonade

On a humid summer day, Franklin put six ice cubes into each of two cups and then poured the same amount of lemonade into each cup. Cup A was made of plastic, and Cup B was made of glass. He left the cups for about 20 minutes and then came back. He found a small puddle of water around Cup A and a larger puddle around Cup B. Franklin determined that the cups were not leaking.



8. Which is the best explanation for the small puddle around Cup A and the larger puddle around Cup B?
- A. Cup A contained more ice than Cup B.
 - B. Cup A was a better insulator than Cup B.
 - C. Cup A had a greater volume of lemonade than Cup B.
 - D. The contents of Cup A were initially colder than the contents of Cup B.

9. Suppose Franklin had a third cup, made of Styrofoam[®], to which he added the same number of ice cubes and the same amount of lemonade. What would Franklin expect to observe after 20 minutes?
- A. The Styrofoam cup would have a smaller puddle than either the glass or plastic cup.
 - B. The Styrofoam cup would have a larger puddle than either the glass or plastic cup.
 - C. The Styrofoam cup would have a puddle exactly the same size as the plastic cup.
 - D. The Styrofoam cup would have a larger puddle than the plastic cup but a smaller puddle than the glass cup.
-
10. Antoine Lavoisier developed a model of an acid from which he concluded that acids were oxygen-containing binary compounds. Later, Davy and Gay-Lussac demonstrated that hydrogen was the essential element in acids. This example from history shows that Lavoisier's model
- A. did not take into account the correct charge on hydrogen ions.
 - B. was a failure, since bases, not acids, are able to contain oxygen.
 - C. was rejected as more information was collected.
 - D. was a mere hypothesis with no data to support it.

**On the March 2007 Ohio Graduation Science Test,
questions 11–16 are field test questions that are not released.**

17. A medical research group placed the following advertisement in a newspaper:

**Seeking Volunteers for
Medical Research Study**

Volunteers are needed to participate in a 12-week research study to test a new drug for type 2 diabetes. Participants must be between the ages of 18 and 80 and must not be taking more than one oral medication for diabetes. The following will be provided to participants at no cost:

- Medical evaluations (physical exam)
- Diagnostic testing (blood & urine tests)
- Experimental study medication
- Compensation for time and travel expenses

If you are interested in participating, please contact Rudy at 1-808-555-5000.

In order for potential participants to make a medically sound decision, what is the research group's ethical obligation?

- A. Pay all participants' health insurance costs during the entire course of the study.
- B. Inform participants of the exact amount of compensation they will be receiving.
- C. Provide participants with a list of additional studies that may be relevant to their condition.
- D. Disclose all medical procedures and provide information on risks and potential side effects.

18. Astronomers have formulated many models of the solar system over time. Ptolemy's early geocentric model gave way to Copernicus' heliocentric model on which the modern solar system model is based.

Which statement best describes why models of the early Ptolemy solar system were replaced by the Copernican model?

- A. Computers are better able to develop scientific models than humans are.
- B. A more precise age has been established for the formation of the solar system.
- C. More direct observations have enabled scientists to change solar system models.
- D. Scientists established that a different set of laws govern the motion of our solar system than govern the motion of other solar systems.

19. A study is planned to investigate the potential environmental impact of storing animal wastes in large, open lagoons on commercially owned farms. These lagoons sometimes rupture or overflow, spilling their contents into lakes and waterways.

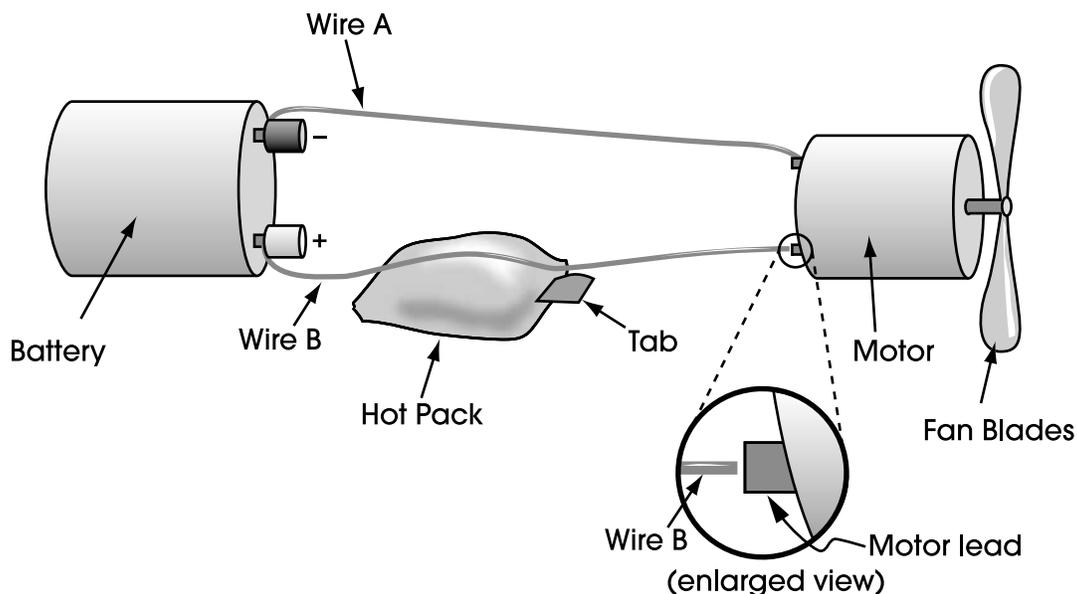
Identify one negative consequence of increased animal waste in lakes and waterways and describe how the increased animal waste results in this consequence.

Then identify a second negative consequence of increased animal waste in lakes and waterways and describe how the increased animal waste results in this consequence. Respond in the space provided in your **Answer Document**. (4 points)

Go to next page

Use the information to answer questions 20 – 23.

For a science fair project, a student has built the following apparatus to demonstrate energy transformations.



The battery is made from a zinc-containing paste which releases electrons and a mercury compound which accepts electrons. Because these substances are separated, electron flow occurs only when the battery is part of a complete circuit.

The hot pack is a sealed plastic bag. Water and calcium chloride (CaCl_2) are stored separately inside the bag. When the tab is pulled, the CaCl_2 mixes with the water and dissolves. This dissolving process is highly exothermic.

Wire B is in physical contact with the outside of the hot pack. Wire B is very close to the motor lead, but does not quite touch it (open gap seen in enlarged view).

Before the student pulls the hot pack tab, the motor is inactive. Once the tab is pulled, the temperature of the hot pack increases and thermal energy is transferred to wire B. The wire expands, making contact with the motor lead (closes the gap seen in enlarged view). The motor becomes active and the fan begins to rotate, creating a breeze.

20. What changes in the hot pack over the course of the demonstration?
- A. total mass
 - B. number of protons
 - C. number of atomic nuclei
 - D. amount of thermal energy
21. The energy conducted through the circuit will cease at some time after
- A. hot pack stops conducting electricity.
 - B. chemical reaction in the hot pack ends.
 - C. fan blades are disconnected from the motor.
 - D. mercury in the battery begins releasing electrons.
22. Electrons in the wire cannot flow into the hot pack because
- A. only positive charges flow through wire B.
 - B. hot pack atoms have higher kinetic energies.
 - C. the plastic bag has low electrical conductivity.
 - D. the hot pack does not contain an electrolyte solution.
23. Assume that the electric circuit remains complete. Which change in the system would cause a slower rotation within the motor?
- A. reducing friction in the motor
 - B. decreasing the length of wire B
 - C. increasing the size of the fan blades
 - D. reversing the direction of current flow in the circuit
-
24. The Arctic tundra has an annual temperature range of -34°C to 12°C . Annual precipitation ranges from 15 cm to 25 cm.
- Based on these conditions, what characteristic does the Arctic tundra exhibit?
- A. high nutrients
 - B. low biodiversity
 - C. long growing season
 - D. small population changes

Use the information to answer questions 25 – 27.

Phytoplankton and Productivity

Phytoplankton are microscopic aquatic algae capable of photosynthesis.

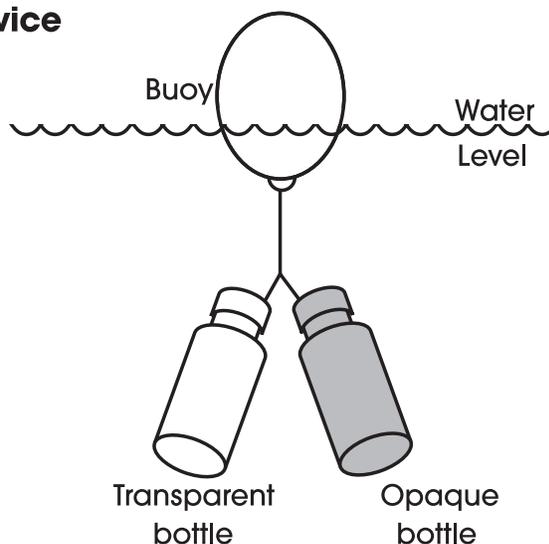
The rate at which light energy is converted to organic compounds by the photosynthetic organisms of an ecosystem is called productivity. Scientists have developed a method to determine the productivity of phytoplankton in an aquatic habitat using the following steps.

Method to Determine Productivity

1. Two bottles, one transparent and one opaque, are filled with equal volumes of water containing phytoplankton from the same depth of a lake.
2. Initial measurements of the concentrations of various dissolved gases for each bottle are determined from a separate water sample taken from the same depth.
3. The two filled bottles are sealed and suspended in the water for 24 hours.
4. After 24 hours, the concentrations of various dissolved gases in each bottle are measured and compared to the initial measurements of dissolved gases.

The diagram below shows the device used in the “Method to Determine Productivity.”

Floating Device



25. A scientist applies the method described in the passage to examine phytoplankton productivity in two ponds of similar size and depth. He observes that the final oxygen concentration values for pond 1 are lower than those for pond 2.

Identify a condition within pond 1 that could account for the lower oxygen concentration values. Explain why this condition affects the oxygen concentration values. Respond in the space provided in your **Answer Document**. (2 points)

26. During the process of photosynthesis, phytoplankton convert the sun's radiant energy into which form of energy?

- A. kinetic
- B. chemical
- C. electrical
- D. mechanical

27. Which process will decrease the amount of dissolved oxygen measured?

- A. mitosis
- B. osmosis
- C. respiration
- D. photosynthesis

28. Scientists have written computer programs to model populations of organisms within ecosystems. By changing initial numbers of individuals and survival rates, these programs can simulate what will happen to members of the ecosystem over time.

Explain how computer modeling could be valuable to an ecologist studying a forest ecosystem. Speculate on why this type of data can only be gained by using a computer program. Respond in the space provided in your **Answer Document**. (2 points)

Use the information and tables to answer questions 29 – 31.

Peppered Moths

The British peppered moth, *Biston betularia*, occurs in two colorations: light (mixed black and white) and black. Black coloration was first seen in 18th-century moth collections as a rare, highly prized mutant. Black coloration is controlled primarily by a single, dominant gene.

Before 1850, the overwhelming majority of peppered moths in northern England were light. As the Industrial Revolution swept through northern England, however, light moth populations dwindled as black moth populations grew. Overall, the total peppered moth numbers remained steady.

Peppered Moths in England

Year	Black Moths (%)	Light Moths (%)
1850	10	90
1900	90	10
1996	Fewer than 10	90+

In the same time period, the less industrialized rural England saw no such changes in moth populations. The only predators observed to prey on the moths were local birds. No migratory or population changes of birds occurred during that time.

British naturalist H.B.D. Kettlewell captured, marked and released known numbers of black and light-peppered moths in an unpolluted woodland and two similar groups in a polluted woodland. He later recaptured as many moths as possible. The following are some of Kettlewell’s mark-and-recapture data.

**Dorset, England
(Unpolluted Woodland)**

	Black Moths	Light Moths
Marked and Released	473	496
Recaptured	30	62
Percentage Recaptured	6.3%	12.5%

**Birmingham, England
(Soot-blackened Woodland)**

	Black Moths	Light Moths
Marked and Released	447	137
Recaptured	123	18
Percentage Recaptured	27.5%	13.1%

29. What 20th-century event most likely had the greatest impact on the recovery of light moth populations?
- A. higher taxes imposed on oil imports
 - B. invention of the silicon solar cell in 1941
 - C. clean air legislation passed in the 1950s
 - D. reduced fuel efficiency in new automobiles
30. Kettlewell's results indicated that black moths in industrialized areas
- A. had greater genetic variation than light moths.
 - B. could out-compete light moths for food and habitat.
 - C. had a higher survival rate than light moths in the same area.
 - D. could change their phenotype when environmental conditions changed.
31. The change in population numbers of black and light moths from 1850 and 1900 is most likely a result of the increased use of
- A. fossil fuels.
 - B. solar energy.
 - C. geothermal energy.
 - D. pollution control technologies.
-
32. Methane (CH₄) from Ohio's Rose Valley coal mine has successfully been used to power fuel cells.
- Since the fuel used in these cells is not burned, using methane from the mine will help to
- A. increase the concentration of atmospheric ozone.
 - B. reduce public demand for alternative fuel sources.
 - C. increase public awareness of global warming issues.
 - D. reduce pollutants commonly associated with fossil fuel combustion.

33. A university student wants to perform an experiment using mice as test subjects. The procedure would require the mice to be injected with a specific bacterial infection and then treated with an antibiotic. Their response to the treatment would be observed and recorded. Provide two questions that an ethics review board would raise regarding the proposed work. For each question, explain why it is important that the question be answered prior to granting permission for the experiment. Respond in the space provided in your **Answer Document**. (4 points)

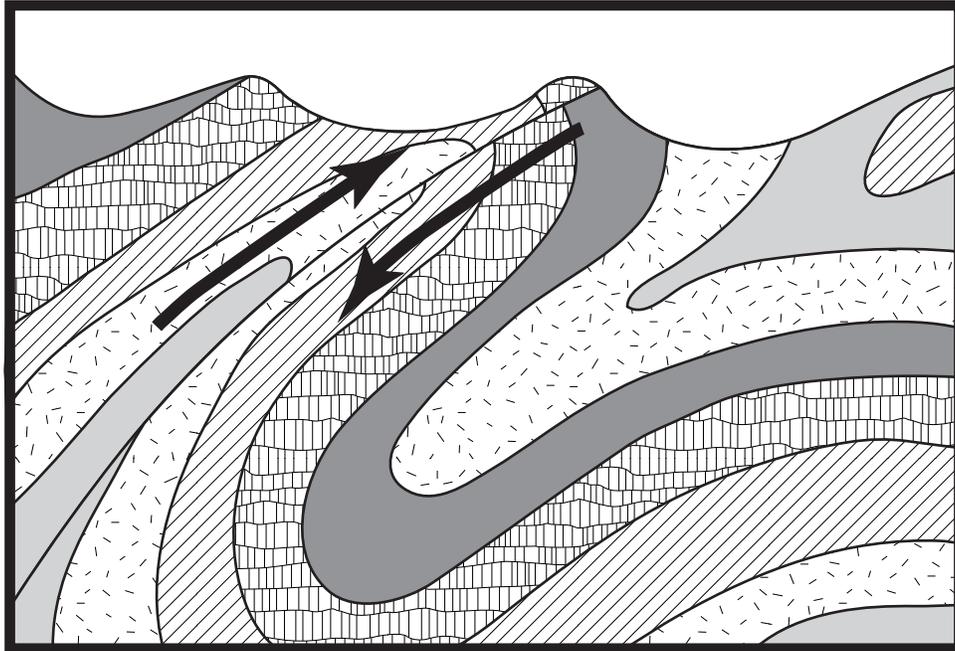
34. *Bacillus thuringiensis* (Bt) is a bacterium that contains a gene that results in the production of a natural pesticide that kills insects. Genetic engineers have successfully inserted this Bt gene into the DNA of some corn varieties, allowing the corn to produce its own pesticide.

What negative consequence could result from this technology?

- A. Only corn that is resistant to the Bt gene will survive.
- B. Individual insects that eat the genetically modified corn will develop resistance to Bt.
- C. The genetically modified crops will insert this Bt gene into the DNA of humans that eat the corn.
- D. Only Bt resistant insects will survive to reproduce, eventually producing a population of entirely resistant individuals.

35. The cross-section below shows the orientation of rock layers in a given area.

Geologic Cross-section

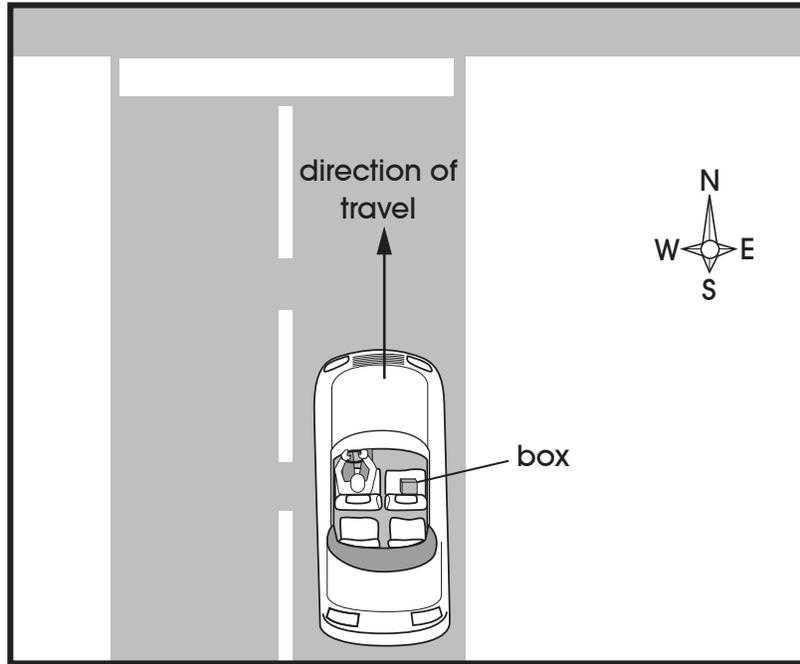


What geologic event most likely caused the folding and faulting of these layers?

- A. tectonic activity
- B. glacial advance
- C. magnetic reversal
- D. seafloor spreading

Science

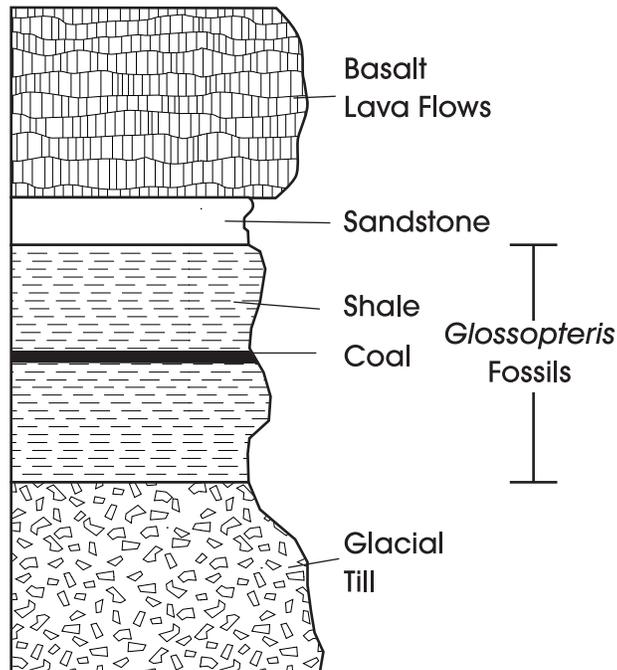
36. A driver is headed north at 50 km/hr. A box is sitting on the seat next to him.



What action by the driver would most likely cause him to observe the box appear to slide to the west?

- A. applying the brakes
 - B. speeding up to 60 km/hr
 - C. making a turn to the east
 - D. making a turn to the west
37. Some strains of laboratory mice have been inbred for many generations, resulting in large numbers of mice with nearly identical genetic makeup. Explain an advantage of using these mice in designing an experiment to test the effects of a new drug. Compare this to a test using mice with varied genetic makeup. Respond in the space provided in your **Answer Document**. (2 points)

38. The cross-section below shows a series of rock layers that have been found in all of these landmasses: South America, Africa, India, Australia, and Antarctica.



Alfred Wegener's analysis of the similarities in these layers led to the conclusion that

- A. continental plates float on top of a molten mantle.
- B. in undisturbed rock sequences, the oldest fossils will be on the bottom.
- C. these five landmasses were once joined together in a single landmass.
- D. magnetic anomalies are preserved in rocks formed at mid-oceanic spreading centers.

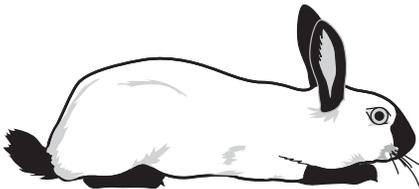
Use the information to answer questions 39 – 41.

Himalayan Rabbits

Himalayan rabbits are native to the Himalayan Mountains, where a great deal of snow falls annually. These rabbits have white fur over most of their bodies, with black fur on the ears, noses, feet and tails. This color pattern results from temperature differences in different parts of the rabbits' bodies. Areas where the body temperature is below 33°C the fur grows in black.

To demonstrate this color change, a scientist shaved a small area of fur on the backs of adult Himalayan rabbits. Ice packs were kept on the shaved areas long enough for the rabbits' fur to begin growing back. When the ice packs were removed, the fur growing beneath them was black.

Before Experiment



After Experiment



39. Suppose the same scientist wanted a Himalayan rabbit with white feet. Which procedure would most likely generate these results?
- A. place ice packs on the rabbit's feet
 - B. place the rabbit outside on a sunny day
 - C. place the rabbit outside when it is snowing
 - D. place the rabbit in a cage with a heated floor

40. During the winter months, the body temperature of Himalayan rabbits is several degrees lower than it is during the summer months. This causes the rabbits' fur to grow in black.

This color change in the winter could negatively affect the rabbits because black fur

- A. is thinner than the white color fur.
- B. makes them easier for predators to see.
- C. reduces their chances of finding a mate.
- D. does not absorb as much heat as white color fur.

41. The black fur on Himalayan rabbits helps provide additional warmth for the ears, noses, feet and tails.

Why does the fur color affect warmth for these areas?

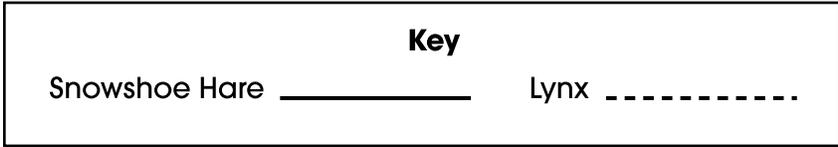
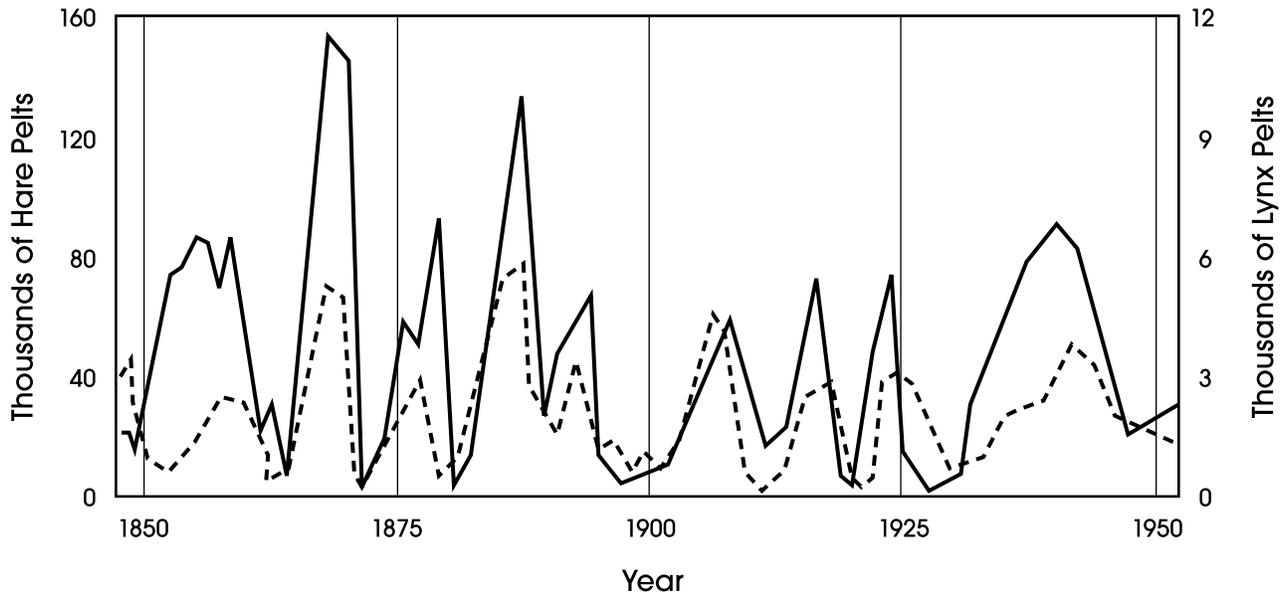
- A. Black fur generates more heat energy than white fur.
- B. Black fur insulates the rabbit from cold better than white fur.
- C. Black fur reflects more heat energy from sunlight than white fur.
- D. Black fur absorbs more heat energy from sunlight than white fur.

Use the information to answer questions 42 - 44.

Hare and Lynx Populations

In a classic study of predator-prey interactions, the numbers of snowshoe hare pelts and lynx pelts sold to a trading company by trappers were recorded over a period of 100 years. Both lynx and hare populations appear to oscillate in a regular pattern over a period of about ten years. One explanation for this pattern is that heavy predation reduces the snowshoe hare population, which in turn reduces the lynx population. More recently, scientists have proposed that the hare population oscillates due to diseases caused by overcrowding or by the effects of its own feeding activities on vegetation.

Population Levels



42. Based on the information in the passage, the snowshoe hares are
- A. carnivores.
 - B. decomposers.
 - C. herbivores.
 - D. producers.
43. One assumption about the data used in this study is that
- A. oscillations in population size occur every ten years.
 - B. the number of pelts reflects the size of the populations.
 - C. snowshoe hares have an impact on their food supply.
 - D. hares and lynx were trapped over a period of 100 years.
44. What would prevent the lynx population from declining along with the hare population?
- A. an extremely harsh winter
 - B. an influx of other hare predators
 - C. an abundant alternate food source
 - D. an outbreak of disease among hares

S