

# SCIENCE

2008 Released Items

1.

Hypothesis: When environmental conditions become unfavorable, the bacterium *E. coli* forms Protein Q.

1. Which process indicates a proper step in testing this hypothesis?
- A Establish that Protein Q is present in higher-level organisms
  - B Produce a test for the presence of Protein Q
  - C Determine that Protein Q can be artificially produced
  - D Test for the types of chemical bonds found in Protein Q

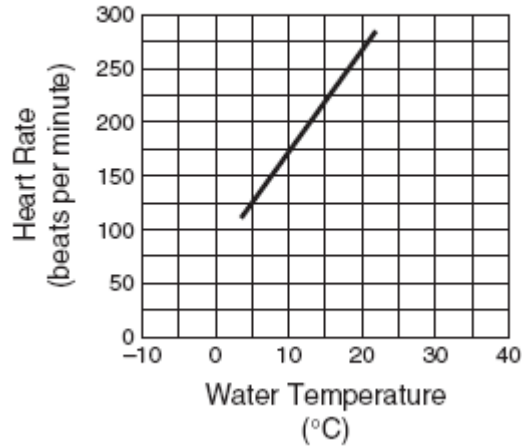
2.

Balance	Range (kg)	Precision
W	0–5	0.001
X	0–15	0.003
Y	0–25	0.005
Z	0–50	0.010

2. Four balances are available for students to use for their laboratory experiment. The table shows the range and precision of each balance. The students want to mix 0.100 kilogram of salt with 2.20 kilograms of water. Which balance would provide the greatest precision?
- A W
  - B X
  - C Y
  - D Z
3. Which of these is the best reason to not eat or drink while in the laboratory?
- A Particles of food can contaminate chemical reagents.
  - B Spilled drinks can make cleanup of chemicals difficult.
  - C Some foods produce toxic gases when mixed with acids.
  - D Chemicals spilled on hands can be transferred to food.
4. Which of the following should be used to determine whether pond water is too acidic to support plant life?
- A Motion detector
  - B pH meter
  - C Geiger counter
  - D Voltmeter

5.

Effect of Water Temperature on the Heart Rate of *Daphnia*



5. The graph shows how the heart rate of *Daphnia*, a water flea, is affected by water temperature. Which statement is best supported by these data?

- A *Daphnia* do well in freezing water.
- B *Daphnia* have healthy hearts.
- C The pulse of *Daphnia* can double.
- D The rate of mutation in *Daphnia* varies with temperature.

6.

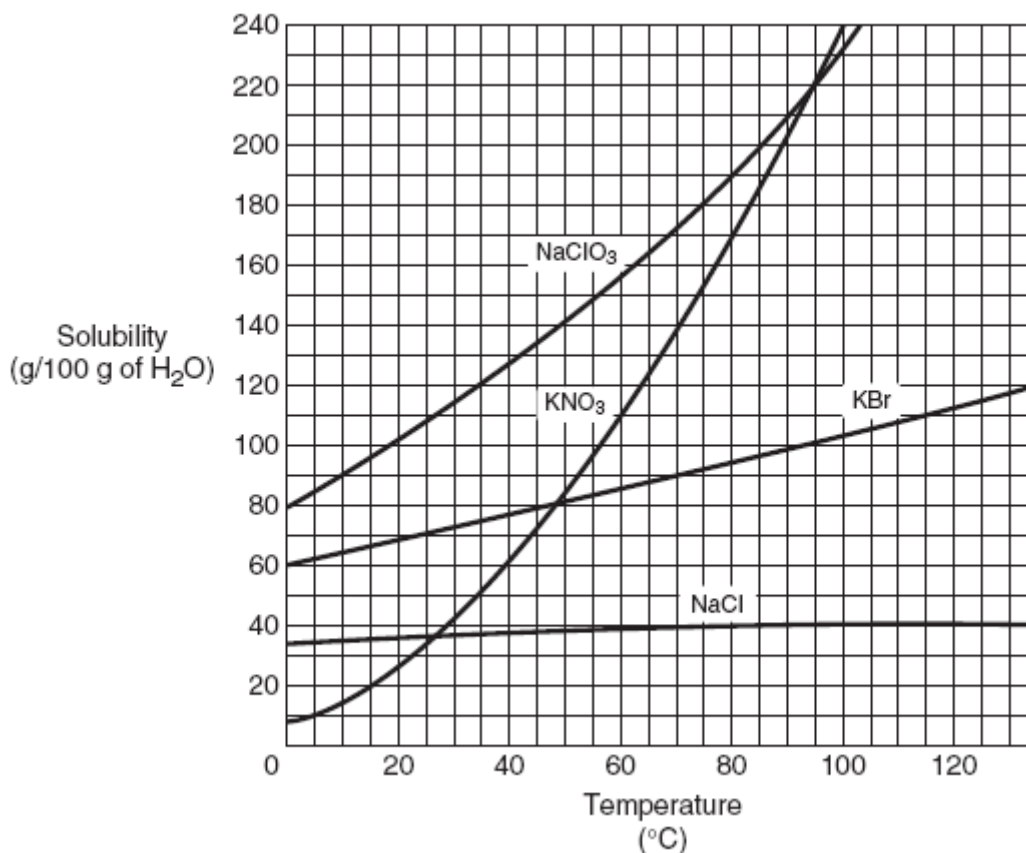
A Few Organelles and Their Functions

Organelle	Function
Lysosome	Contains enzymes used to break down organic molecules
Mitochondrion	Site of cellular respiration
Peroxisome	Produces and then breaks down hydrogen peroxide
Ribosome	Site of protein synthesis

6. The acrosome is an organelle in sperm cells that can dissolve the protective layers surrounding an egg cell. According to the chart, the acrosome is most likely a specialized —

- A lysosome
- B mitochondrion
- C peroxisome
- D ribosome

7.



7. What generalization can be made from the data in the solubility graph above?


- A** The volume of a solvent affects the solubility of a solute.
- B** The volume of a solute affects its solubility.
- C** Increasing the temperature of a solution increases the solubility of a solute.
- D** Increasing the mass of a solute decreases its solubility.

8. A student wearing goggles, gloves, and an apron begins a simple activity to determine the pH of corrosive solutions. Before the activity begins, what other safety measure should the student follow?

- A** Identify the locations of eye wash, shower, and fire equipment
- B** Check and set clocks and record the beginning time
- C** Review the proper method of fire-polishing glass tubing
- D** Arrange the equipment in the work area alphabetically

9.

A tasty way to good health.  
Get one today !



Do the following simple experiment at home and you'll agree.

1. Use JU-CER to prepare a glass of freshly squeezed vegetable juice.
2. Take a sip of the fresh juice and record your impressions of its taste.
3. Wait two minutes.
4. Open a can of vegetable juice.
5. Take a sip of the canned juice and record your impressions of its taste.
6. Repeat Steps 2 through 5 three times at intervals of one to two minutes.

Our Results:

Taste Impression	Canned Juice	JU-CER Juice
Invigorating	X X X	✓ ✓ ✓
Healthful	X X X	✓ ✓ ✓
Fresh	X X X	✓ ✓ ✓
Good	X X X	✓ ✓ ✓
Tasteless	✓ ✓ ✓	X X X
Flat	✓ ✓ ✓	X X X
Stale	✓ ✓ ✓	X X X

✓ = yes  
X = no

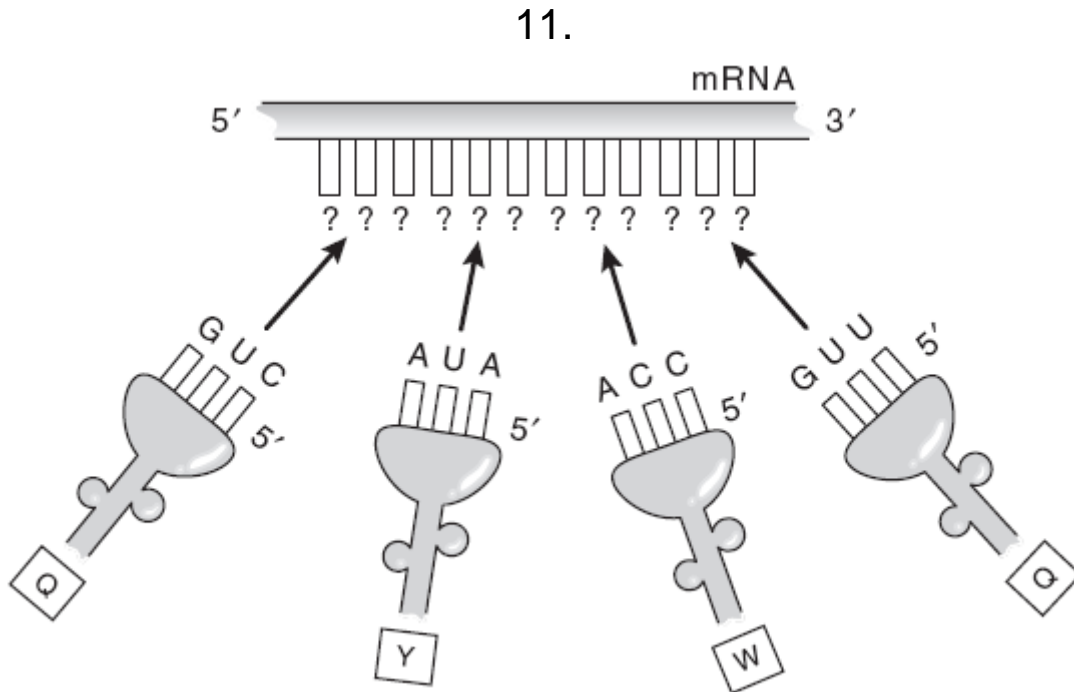
Conclusion: We agree! JU-CER juice is healthier than canned juice. You'll love its taste.

9. On the basis of scientific considerations, which is the best reason to reject the advertisement's claim that the product provides a tasty way to good health?

- A Unclear instructions
- B Poor experimental design
- C Weak hypothesis
- D Contradictory data

10. Which of the following organelles is involved in storing material in a plant cell?

- A Vacuole
- B Mitochondrion
- C Golgi body
- D Cell membrane



11. The diagram shows how a section of protein containing the amino acid sequence QYWQ is formed. What is the nucleotide sequence of the mRNA section shown?

- A 5'UCGGAUACUACU<sup>3'</sup>
- B 5'CCACCACCACCA<sup>3'</sup>
- C 5'ACUUCGGAUACU<sup>3'</sup>
- D 5'CAGUAUUGGCAA<sup>3'</sup>

12. A segment of nucleic acid is analyzed to see whether it is DNA or RNA. The nucleic acid can be identified as DNA if it contains —

- A phosphate groups
- B nucleotide bases
- C deoxyribose sugars
- D hydrogen bonds

13. The ability to roll the tongue is thought to be controlled by a dominant allele (R). What percent of offspring from two heterozygous (Rr) parents are most likely to have the tongue-rolling trait?

- A 25%
- B 50%
- C 75%
- D 100%

14.

Classification	Examples
Kingdom Animalia	Gray wolf, dog, rattlesnake, mockingbird, salamander, lobster
Phylum Chordata	Gray wolf, dog, rattlesnake, mockingbird, salamander
Genus <i>Canis</i>	Gray wolf, dog
Species <i>lupus</i>	Gray wolf

14. According to the table, the gray wolf is least related to the —

- A dog
- B rattlesnake
- C salamander
- D lobster

15. In which kingdom would a multicellular, heterotrophic, motile organism be classified?

- A Eubacteria
- B Fungi
- C Plantae
- D Animalia

16. During photosynthesis hydrogen combines with carbon dioxide to make —

- A cholesterol
- B protein
- C glucose
- D cellulose

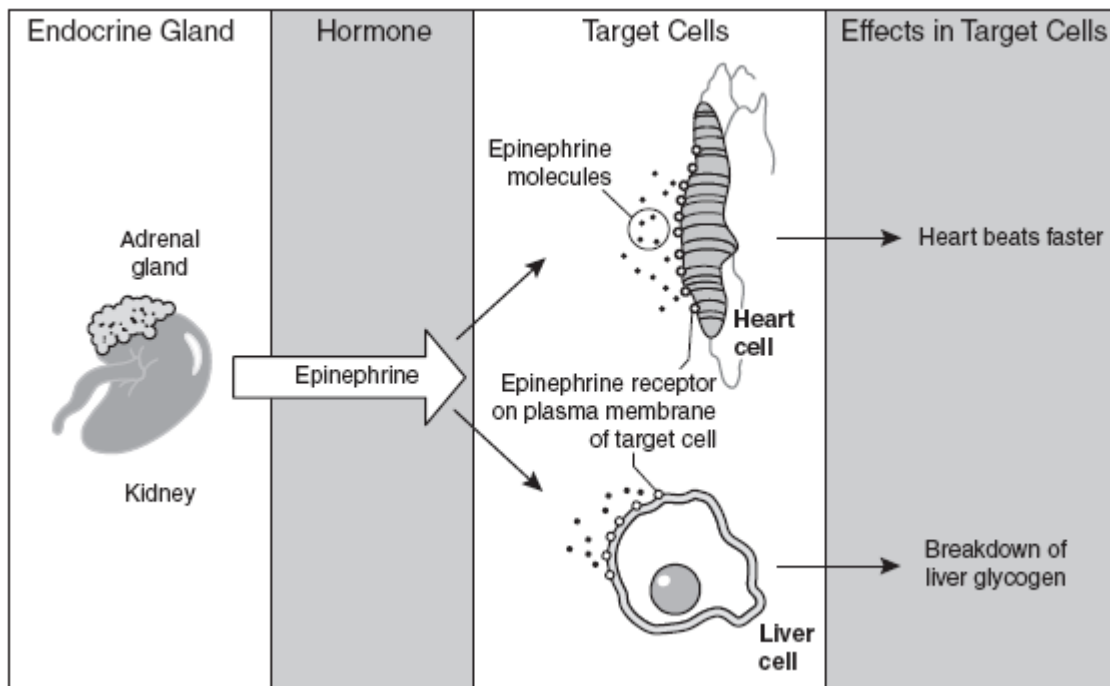
17. The nervous system directs muscles to move. The muscular system produces movements. Which of the following systems, working with the two systems mentioned, determines the types of movements a person's body can make?

- A Immune system
- B Skeletal system
- C Respiratory system
- D Endocrine system

18. Which organ system is most involved when a dog develops resistance to rabies after being vaccinated?

- A Muscular system
- B Skeletal system
- C Nervous system
- D Immune system

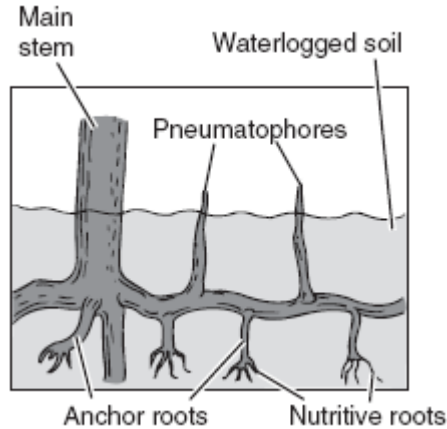
19.



19. A student produced this poster to show the interdependence of organ systems. According to the information on the poster, how does the endocrine system affect the circulatory system?

- A The endocrine system metabolizes liver glycogen.
- B The endocrine system increases the heart rate.
- C The endocrine system helps form plasma membranes.
- D The endocrine system enlarges arteries.

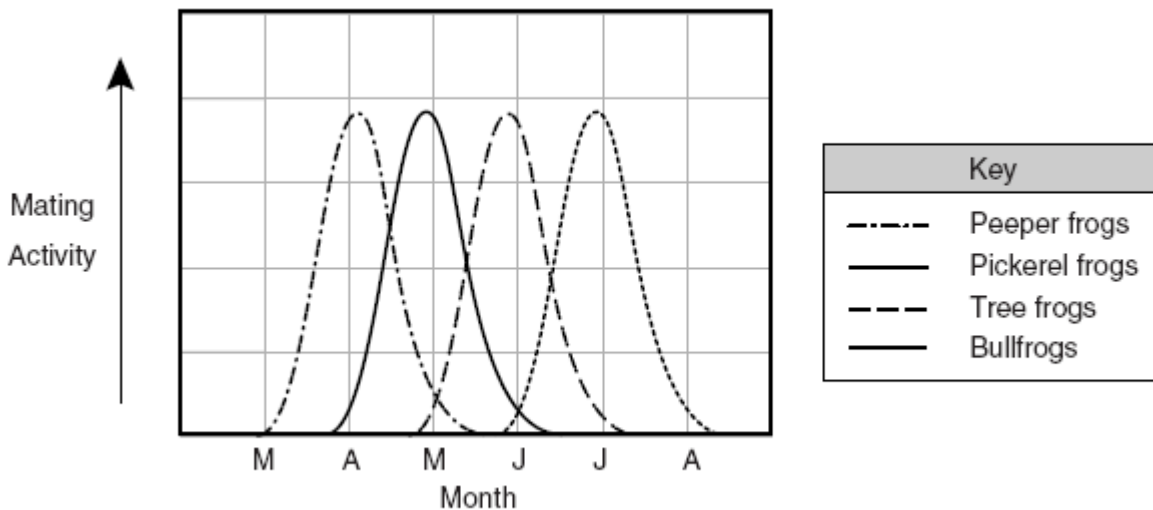
20.



20. The picture above shows pneumatophores, specialized roots that occur in some mangrove trees found in waterlogged soils. Which of the following best describes the purpose of these structures?

- A Photosynthesis
- B Reproduction
- C Water absorption
- D Oxygen absorption

21.



21. Based on the graph, the reader can conclude that the most likely reason that peeper frogs and tree frogs do not mate and produce fertile offspring is that their mating activity —

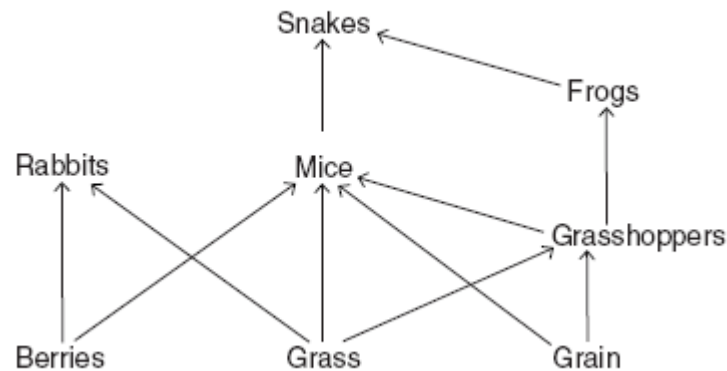
- A peaks at different times
- B fails to reach a maximum rate
- C occurs mostly in springtime
- D decreases at the same time

22. Within a certain community, crows actively eat brightly colored beetles. Which interaction is being displayed between the population of crows and the population of beetles?

- A Commensalism
- B Mutualism
- C Parasitism
- D Predation

23.

Common Food Web

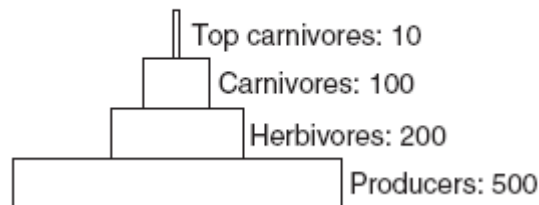


23. According to this food web, which of the following are omnivores?

- A Snakes
- B Rabbits
- C Mice
- D Grasshoppers

24.

Pyramid of Numbers



24. The diagram shows a standard pyramid of numbers that indicates the number of individual organisms in a community. Which of the following situations would form a pyramid showing more consumers than producers?

- A A small plot with 500 corn plants and 100 grasshoppers
- B One pond with 300 producers and one snake
- C An 11,000 m<sup>3</sup> lake with 75 fish and one alligator
- D One giant oak tree with 10,000 insects and 10 lizards

25. Bacteria are present in the digestive tract of some herbivores. The bacteria break down plant cellulose, making it possible for the herbivore to digest plant material. These bacteria live in a stable environment with sufficient food and water. The herbivore and the bacteria in this relationship —

- A benefit each other
- B compete for survival
- C are producers
- D are secondary consumers

26. Pollen adheres to bees as they feed on the nectar of flowers. When they move from flower to flower gathering nectar, the bees pollinate the flowers. The bees then use the nectar to make honey. The relationship between bees and flowers is an example of —

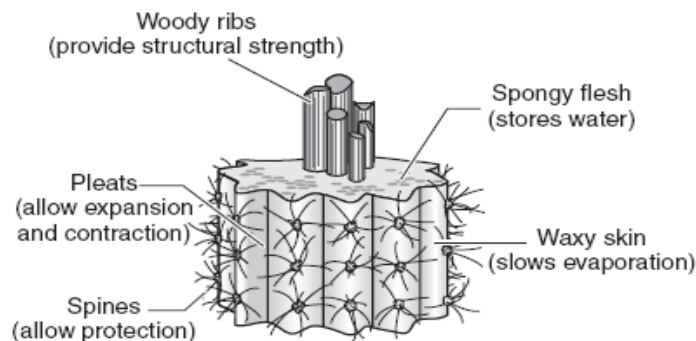
- A parasitism
- B commensalism
- C mutualism
- D neutralism

27. Which of the following describes viruses?

- A Viruses avoid antibiotics in humans.
- B Viruses exist as single cells or groups of cells.
- C Viruses require a living host in order to reproduce.
- D Viruses have plasma membranes and capsids.

28.

Cross Section of a Plant Trunk



28. The picture shows a certain plant's adaptations. In which environment would these adaptations be most beneficial?

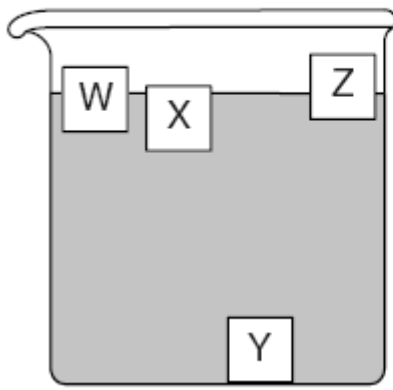
- A Tropical forest
- B Desert region
- C Northern tundra
- D Coastal area

29. Salt is added to a beaker of water and stirred until it is completely dissolved. The salt in this mixture can be separated by —

- A chromatography
- B chemical means only
- C passing the water through filter paper
- D allowing the water to evaporate slowly

30.

Buoyancy of Wood Blocks



Type of Wood	Density (g/cm <sup>3</sup> )
Balsa	0.12
Ebony	1.22
Maple	0.67
Poplar	0.42

30. According to this information, Block Z is most likely composed of —

- A balsa
- B ebony
- C maple
- D poplar

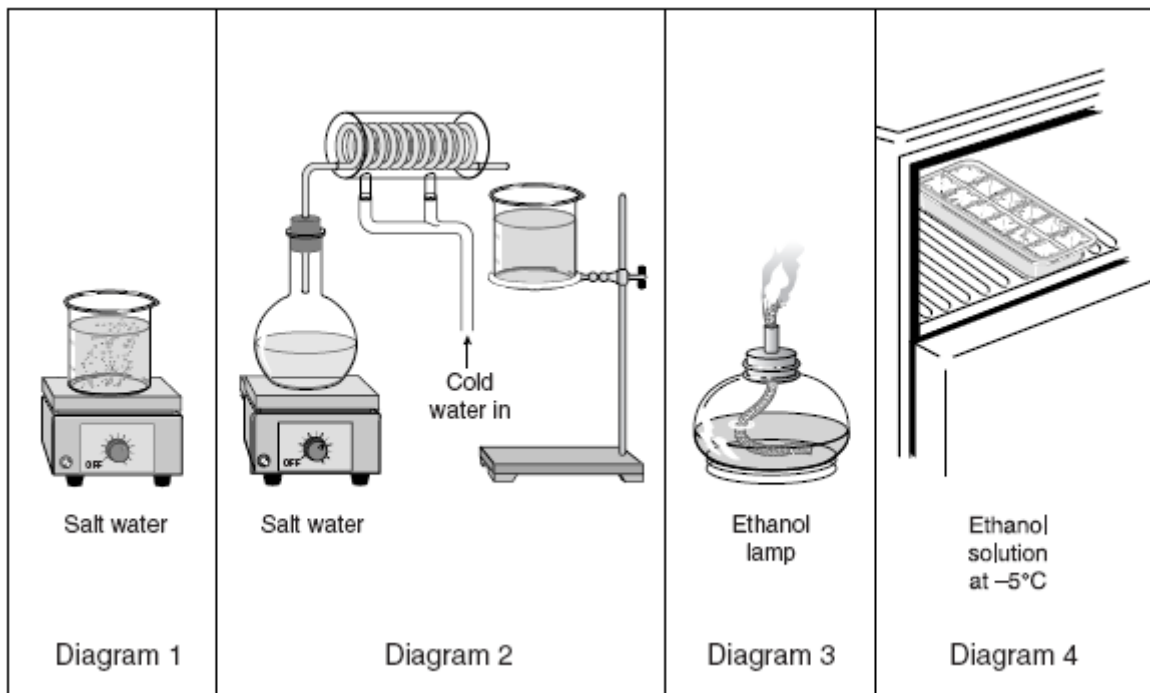
31. All of these represent a change in state of matter except —

- A melting an ice block
- B evaporating alcohol
- C sublimating dry ice
- D digesting a sugar cube

32. An element is discovered that has an atomic number of 118 and 8 valence electrons. The element is most likely —

- A a noble gas
- B an alkali metal
- C a halogen
- D a transition metal

33.



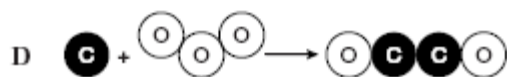
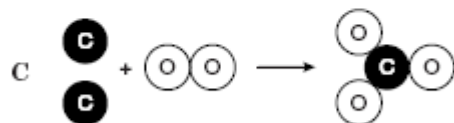
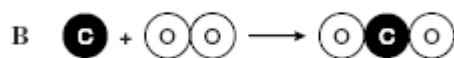
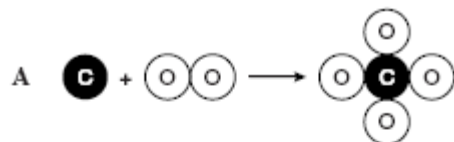
33. In which diagram is a chemical change occurring?

- A Diagram 1
- B Diagram 2
- C Diagram 3
- D Diagram 4

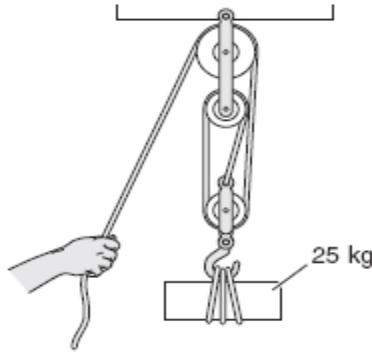
34. Hard water has a pH higher than 7 and an abundance of calcium and magnesium salts. Which of the following would be the best cleaning solution for removing hard-water residue from drinking glasses?

- A A mild acid such as vinegar
- B A strong solution such as ammonia
- C A hot solution such as baking soda in boiling water
- D A strong base such as sodium hydroxide

35. Which diagram best demonstrates the law of conservation of mass?



36.

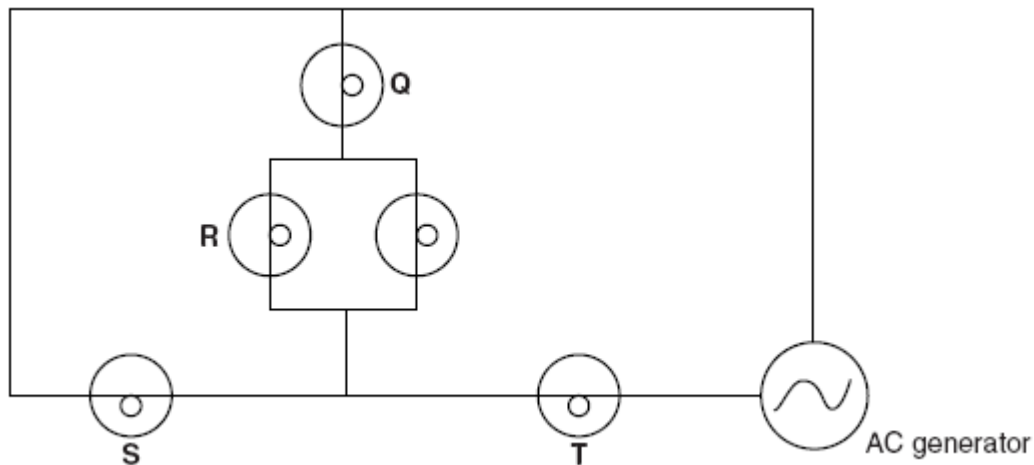


36. Which of the following explains why the machine shown above has an efficiency of less than 100%?
- A The effort force is less than the resistance force.
  - B The load must be less than the force.
  - C The load and the force act in opposite directions.
  - D The motion between the rope and the pulleys produces friction.
37. Two ice hockey players are skating directly at each other. The first has a mass of 87 kg and is skating at a constant speed of 2.6 m/s. The second skater has a mass of 78 kg. How fast must the second skater be skating in order to have a momentum similar to the first skater?
- A 2.3 m/s
  - B 2.9 m/s
  - C 3.4 m/s
  - D 5.2 m/s
38. In the event of an accident, air bags and seat belts may help reduce injury to a passenger by decreasing the force that stops the passenger's motion. The force is reduced because the seat belts or air bags decrease the —
- A mass of the passenger
  - B acceleration of the passenger
  - C reaction time of the driver
  - D speed of the vehicle
39. A surfer wishing to ride a big wave is most interested in a wave's —
- A rarefaction
  - B compression
  - C amplitude
  - D wavelength

40. Mud at the bottom of a fishpond has a temperature of  $15^{\circ}\text{C}$ . After a week of colder air temperatures, the mud temperature drops to  $12^{\circ}\text{C}$ . Which of the following methods of heat transfer is most responsible for the change in the mud temperature?

- A Water convection
- B Air conduction
- C Water reflection
- D Ground radiation

41.



41. Removal of which lightbulb will interrupt the circuit and cause all the other lightbulbs to fail to glow?

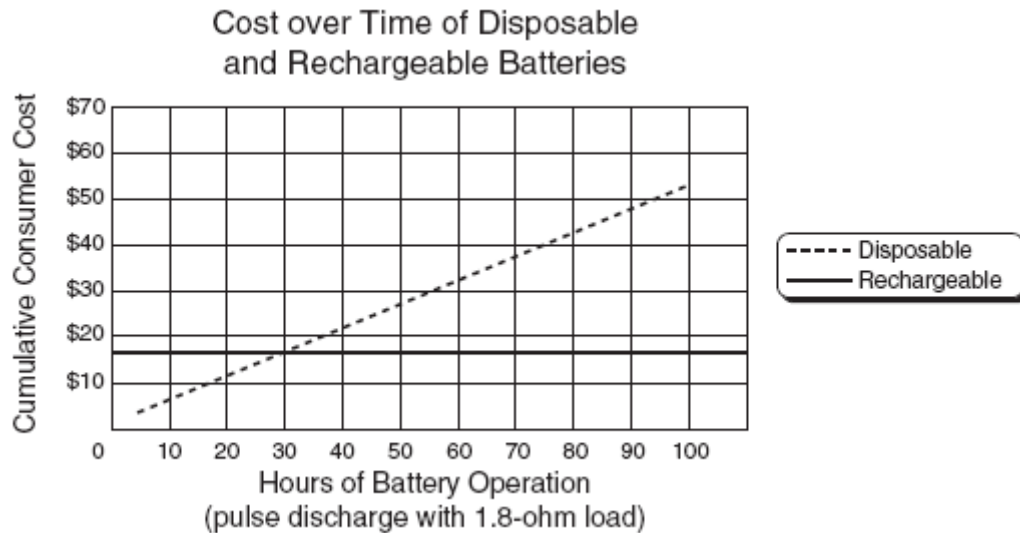
- A Lightbulb Q
- B Lightbulb R
- C Lightbulb S
- D Lightbulb T

42. A diver on a springboard can increase the height of a jump by repeatedly flexing the knees with a rhythm that matches the springboard's natural frequency. This is an example of —

- A interference
- B reflection
- C resonance
- D polarization

43. Heat cannot spread through a solid by convection because —
- A** a heated solid turns into a liquid
  - B** atoms in a solid possess maximum kinetic energy
  - C** heat is rapidly lost from solids through radiation
  - D** particles of a solid are fixed in a rigid structure

44.



44. The graph above shows how the cost of using batteries varies depending on the number of hours of battery operation. What economic and environmental factors should be considered when choosing between disposable and rechargeable batteries for a 40-hour use period?
- A** Disposable batteries are more expensive and produce less solid waste.
  - B** Rechargeable batteries are more expensive and produce more solid waste.
  - C** Disposable batteries are cheaper and produce more solid waste.
  - D** Rechargeable batteries are cheaper and produce less solid waste.

Use the information below and your knowledge of science to answer questions 45–48.

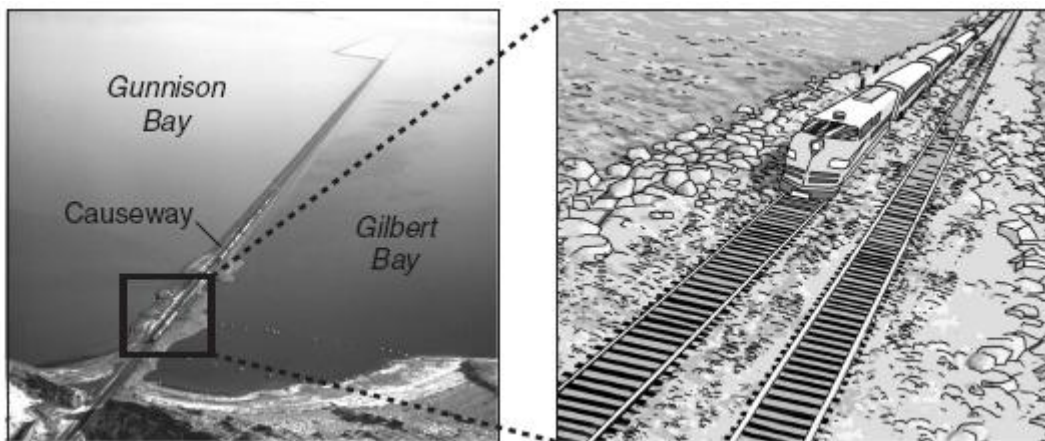
### The Great Salt Lake

The Great Salt Lake is a large inland lake. It is very unusual because it is made up of saltwater. In 1959 a railroad causeway was built across the lake. The causeway, made from rocks and cement, divides the lake into two bays, Gilbert Bay and Gunnison Bay. Although the material in the causeway is tightly packed, the causeway is porous, allowing for the exchange of water between the two bays.

Over time, as fresh surface water flows into the Great Salt Lake, the depth of each bay and the composition of the water can vary. More freshwater flows into Gilbert Bay than into Gunnison Bay. Therefore, the water in Gunnison Bay is saltier than the water in Gilbert Bay. When the difference in salt composition is great, some of the saltier water from Gunnison Bay flows into Gilbert Bay through the causeway. Some properties of both bays were measured in 1998 and are shown in the table below.

Properties of the Great Salt Lake's Bays (1998)

Property	Gunnison Bay	Gilbert Bay
Color of water	Rose-purple	Blue-green
Elevation (m)	1280.6	1280.9
Density (g/mL)	1.193	1.057
Salt concentration	22.5%	8.4%



45. If heavy rainfall causes the water elevation of Gilbert Bay to rise above 1280.9 meters, which of these is the most likely result?

- A** The density of the water in Gunnison Bay will increase.
- B** The salinity of the water in Gilbert Bay will decrease.
- C** The salt concentration of Gilbert Bay will increase.
- D** The mass of sodium ions in Gunnison Bay will decrease.

46. A population of brine shrimp from Gilbert Bay is to be transplanted to Gunnison Bay. Which of these is the most likely effect on these transplanted brine shrimp?

- A** The shrimp with a high salt tolerance will increase in number.
- B** The shrimp will change their method of obtaining nutrients.
- C** The shrimp will alter their method of reproduction.
- D** The shrimp accustomed to lower salt levels will develop salt-removing filters.

47. From the data in the table, what would be the mass of a 3.0 L sample of water collected from Gunnison Bay?

- A** 2515 g
- B** 3171 g
- C** 3579 g
- D** 4193 g

48. After studying salinity in the bays of the Great Salt Lake, students prepared two samples of water having different salinity.

Sample A contained 10% salt, and Sample B contained 25% salt. Both samples were the same size. After leaving the samples in the freezer for the same amount of time, the students discovered that a layer of ice had formed in each sample. Which layer in the samples probably contained the most salt?

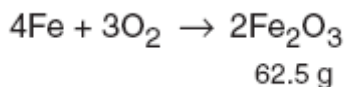
- A** The ice layer in Sample A
- B** The liquid layer in Sample A
- C** The ice layer in Sample B
- D** The liquid layer in Sample B

# GRIDDABLE QUESTIONS

Objective 4

2008 Released Items

49.

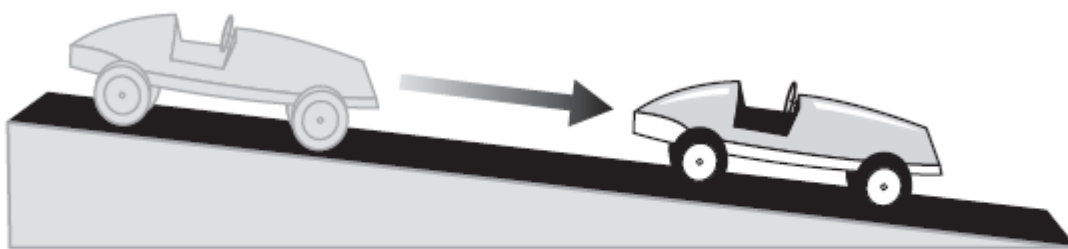


49. If 43.7 g of iron is completely used in the reaction above, how many grams of oxygen are involved in the reaction? Record and bubble in your answer to the nearest tenth on the answer document.

Objective 5

2008 Released Items

50.



Time = 0.0 s  
Initial speed = 2.2 m/s

Time = 5.0 s  
Final speed = 4.5 m/s

50. According to the information above, what is the average acceleration of the racer in  $\text{m/s}^2$ ? Record and bubble in your answer to the nearest hundredth on the answer document.