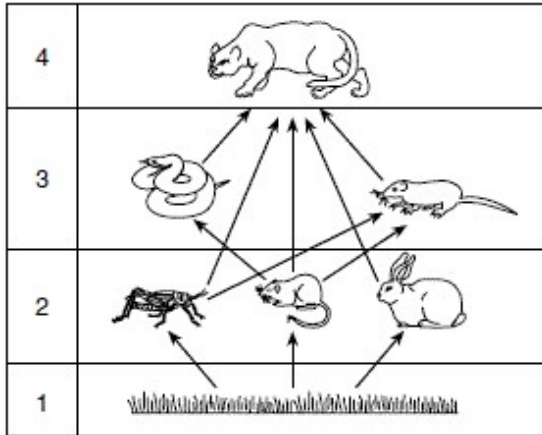


1. The diagram below represents a food web.



Which level contains organisms that carry out autotrophic nutrition?

1. 1 2. 2
3. 3 4. 4
2. Some states require shoppers to pay a deposit on certain beverage containers made of plastic and glass. When shoppers return the containers, their deposits are returned to them. How is this system intended to help the environment?
1. It encourages people to buy products that do not have a deposit.
 2. It reduces the amount of money shoppers actually spend
 3. It reduces the amount of plastics and glass put into landfills.
 4. It forces manufacturers to reduce air pollution when they are making the containers
3. The graph below represents some changes in the number of individuals in a particular population in a stable ecosystem over a period of time.



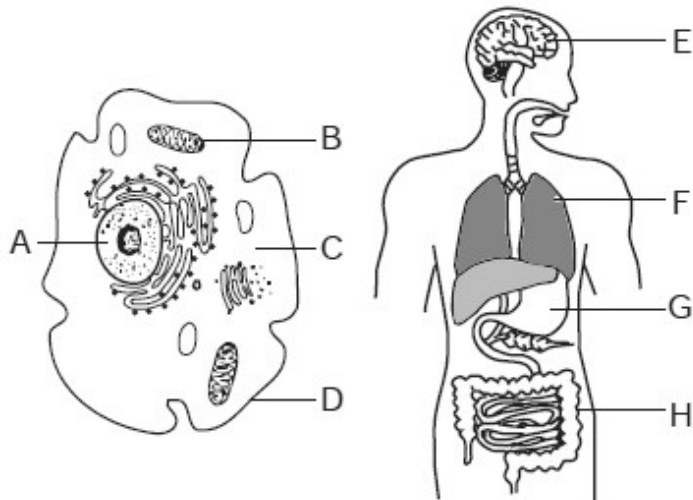
Which statement best describes the trend shown in this graph?

1. Ecosystem conditions will eventually cause a population to become extinct.
2. In a stable ecosystem, the number of individuals in a population is usually maintained within a certain range.
3. The interactions between a population and various factors in an environment are always predictable.
4. In order for any ecosystem to maintain a balance, populations must be reduced to half their original number.

4. Scientists have recently discovered bacteria and clams living under an ice shelf in Antarctica. These organisms live under 600 feet of ice, in the absence of sunlight, and in temperatures considered too cold for most living organisms. The location where these organisms live is unusual because
1. only biotic factors control the size of the populations
 2. bacteria and clams are found in the same area
 3. of the abiotic factors found in their environment
 4. green plants make energy-rich compounds available
5. Mother rattlesnakes care for and protect their young. Baby rattlesnakes find safety in the coils of their mothers. Female snakes stay together for the first few weeks after giving birth. This gathering of female rattlesnakes provides a safe environment for newborn rattlers. This is an example of which type of adaptation?
1. structural
 2. nutritional
 3. molecular
 4. behavioral
6. Which statement is an accurate description of genes?
1. Proteins are made of genes and code for DNA.
 2. Genes are made of proteins that code for nitrogen bases.
 3. DNA is made of carbohydrates that code for genes.
 4. Genes are made of DNA and code for proteins.
-

Figure 1

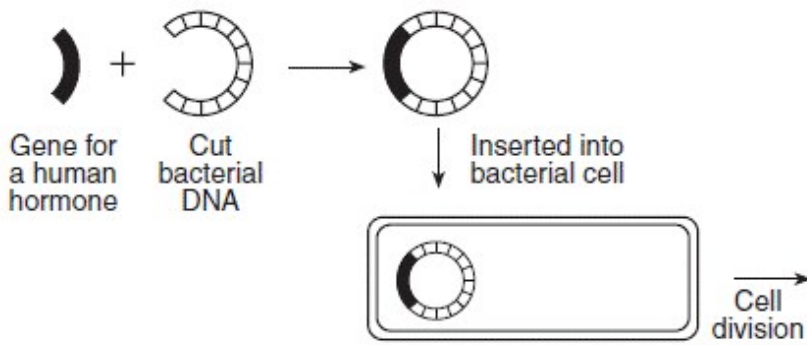
Base your answer to the question on the diagrams below and on your knowledge of biology. The diagrams represent a single-celled organism and a multicellular organism.



7. [Refer to figure 1]
- Cells from structure *E* and cells from structure *G* are similar in that they
1. have the same structure and function
 2. contain the same genetic material
 3. are identical in structure, but different in function
 4. contain only the genetic information needed for their specific job
-

Figure 2

Base your answer to the questions on the diagram below and on your knowledge of biology.

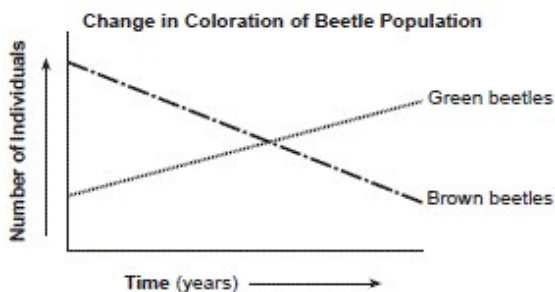


8. [Refer to figure 2]

The original gene for the production of a human hormone was most likely removed from a

1. chromosome
2. ribosome
3. mitochondrion
4. cell membrane

9. The graph below represents the number of brown and green beetles collected in a particular ecosystem.



The change observed in the number of green and brown beetles in the population is most likely due to

1. natural selection
2. selective breeding
3. gene manipulation
4. a common ancestor

10. Which statement is an example of how the external environment can influence gene expression?

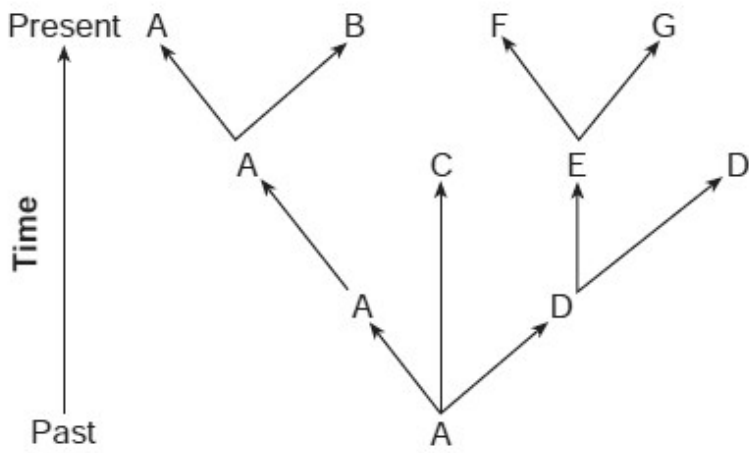
1. Some flowering plants that inherit a gene for white flowers and a gene for red flowers will produce pink flowers.
2. Some animals that inherit genes for brown fur will grow white fur if the outside temperature falls below a certain level.
3. In some breeds of cat, certain fur-color genes are found only in females.
4. A pea plant is short-stemmed only if it inherits the genes for the trait from both parents.

11. A woman changes her hair color to red; however, her children will not inherit this red hair color because the woman does not have

1. genes for red hair in her skin
2. genes for red hair in her sex cells
3. proteins for red hair in the placenta
4. proteins for red hair in her egg cells

Figure 3

Base your answer to the question on the diagram below and on your knowledge of biology. The diagram shows the evolutionary history of several plant species.

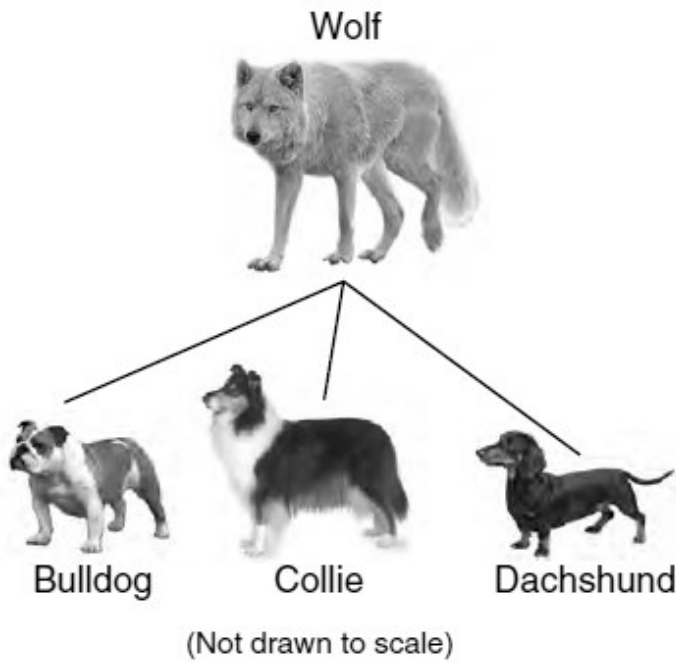


12. [Refer to figure 3]

Identify *one* type of molecular evidence that could have been used to determine the evolutionary relationships illustrated in the diagram.

Answer for #12:

13. The diagram below indicates a few of the many varieties of domestic dogs thought to have originated from wolves that were domesticated thousands of years ago.



Adapted from: <http://evolution.berkeley.edu/evolibrary/article>

The many varieties of domesticated dogs were most likely produced as a result of

1. mutating the body cells of the dogs
2. selective breeding over many generations
3. genetic engineering with specific enzymes
4. cloning dogs with desirable traits

14. A plant was discovered that contained a compound that was found to have potential medicinal value. However, the plant is rare, so it is important to see if a related plant might also produce the same compound. The chart shows some characteristics of the plant and four possible relatives.

Plant	Flower	Leaves	Amino Acid Sequence
Medicinal Plant	Red, 6 petals	simple, parallel veins	Ile-Ile-Try-Gly-Glu-Asp-Pro
A	Red, 9 petals	simple, parallel veins	Ile-Arg-Try-Gly-Glu-Asp-Ser
B	Yellow, 8 petals	compound, branched veins	Ile-Arg-Ala-Gly-Glu-Asp-Pro
C	Pink, 6 petals	simple, parallel veins	Ile-Ile-Try-Gly-Glu-Asp-Ser
D	Yellow, 6 petals	compound, parallel veins	Ile-Arg-Try-Gly-Glu-Asp-Pro

Which plant in the chart would be selected as most similar to the medicinal plant?

1. *A*
2. *B*
3. *C*
4. *D*

15.

A chemical was added to hand sanitizers and dish detergents to kill bacteria. Certain species of bacteria are no longer killed by this chemical. One likely reason for the decreased effectiveness of this chemical is that these bacteria have

1. slower metabolic rates
2. a mutation for resistance
3. been selectively bred for survival
4. an adaptation to a different niche

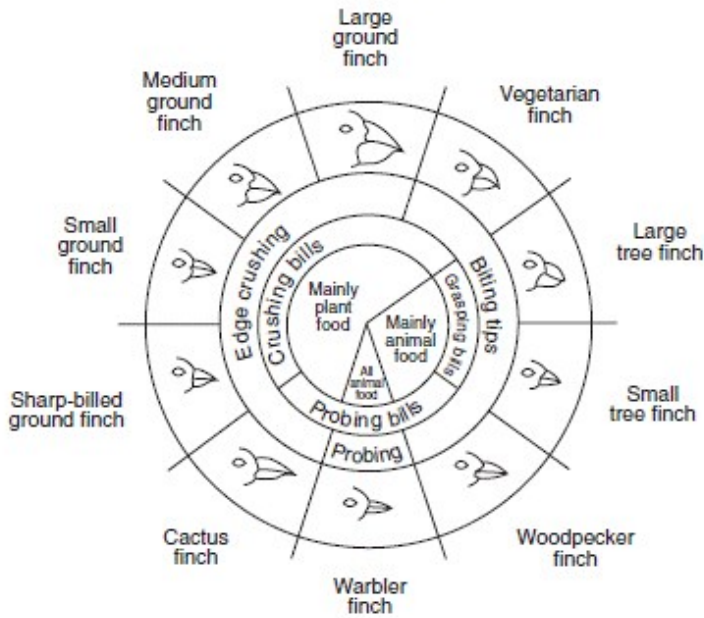
16. As a result of habitat destruction, the size of the Florida panther population has been drastically reduced. It is estimated that there are only 100 to 160 Florida panthers in the wild. Which statement best explains why the Florida panther population may *not* continue to evolve?

1. There is no longer a chance of mutations occurring in the population.
2. There is a lack of competition for limited environmental resources.
3. There is no longer a chance of a trait providing a reproductive advantage to the population.
4. There is a lack of genetic variation for selection to act upon.

Figure 4

Base your answer to the question on the diagram below and on your knowledge of biology.

Variations in Beaks of Galapagos Islands Finches



from: Galapagos: A Natural History Guide

17. [Refer to figure 4]

A finch that picks small insects out from cracks in the bark of trees would most likely have a beak that is

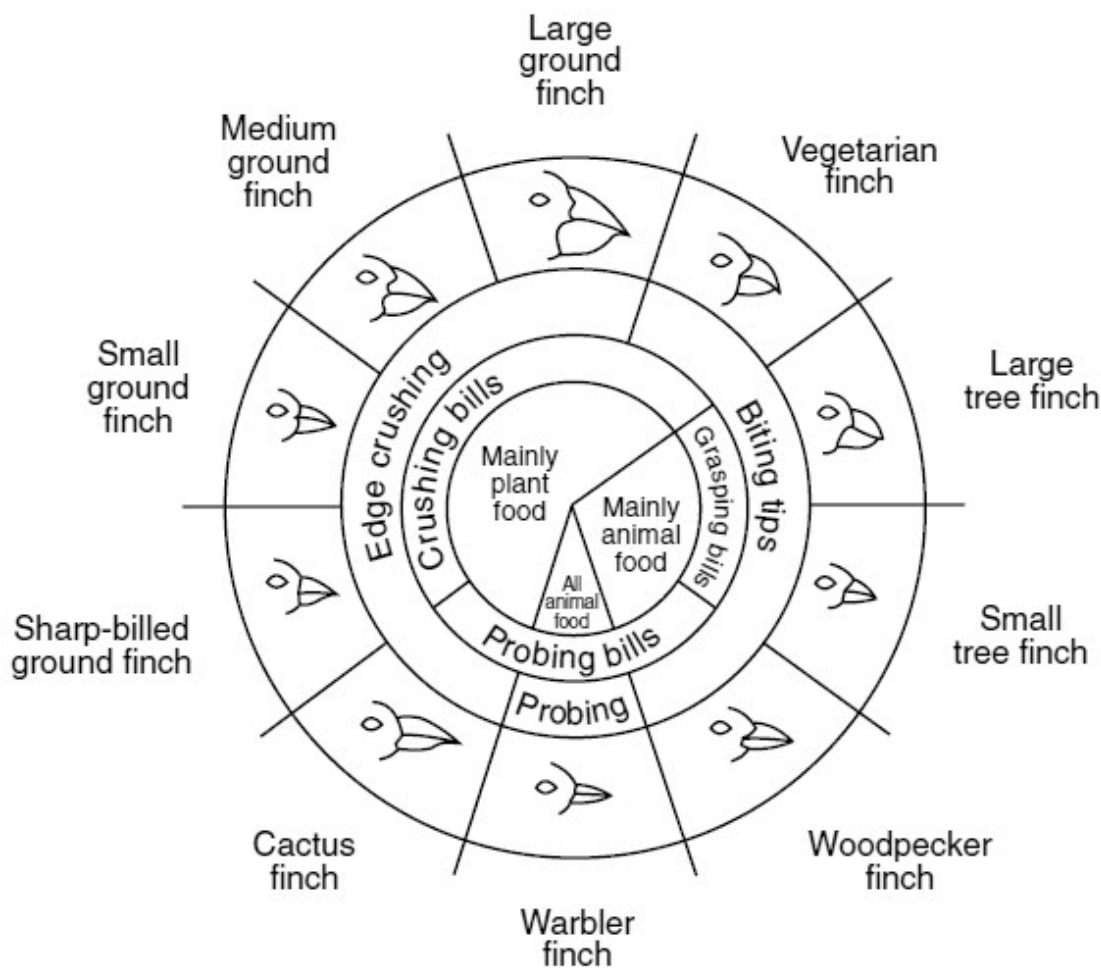
1. sharp and thin
2. sharp and thick
3. rounded and thin
4. rounded and thick

18. Which population in the chart below has the best chance for survival in a rapidly changing environment?

Population	Type of Reproduction	Average Life Span of Individuals	Total Number of Offspring Produced
1.	sexual	13 days	100
2.	asexual	13 days	100
3.	sexual	12 weeks	25
4.	asexual	12 weeks	25

19. The diagram below represents the relationship between beak structure and food in several species of finches found on the Galapagos Islands.

Variations in Beaks of Galapagos Islands Finches



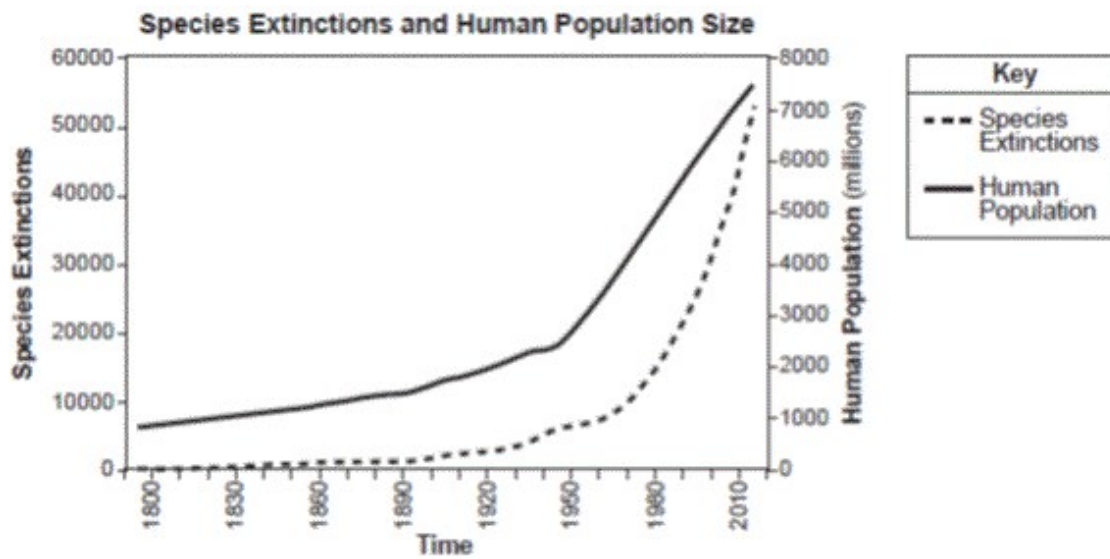
From: *Galapagos: A Natural History Guide*

The different beak structures observed in the diagram are evidence of

1. different species of finches adapting to different environments over many generations
2. finches changing their beak characteristics so that they could feed efficiently
3. finch species with different beak structures coming to the Galapagos Islands from the mainland
4. finches mating with birds of other species and acquiring some of their traits

Figure 5

Base your answer to the question on the graph below and on your knowledge of biology. The graph shows the number of species that have become extinct since 1800. It also shows the change in the size of the human population for the same period of time.



Source: modified from USGS

20. [Refer to figure 5]

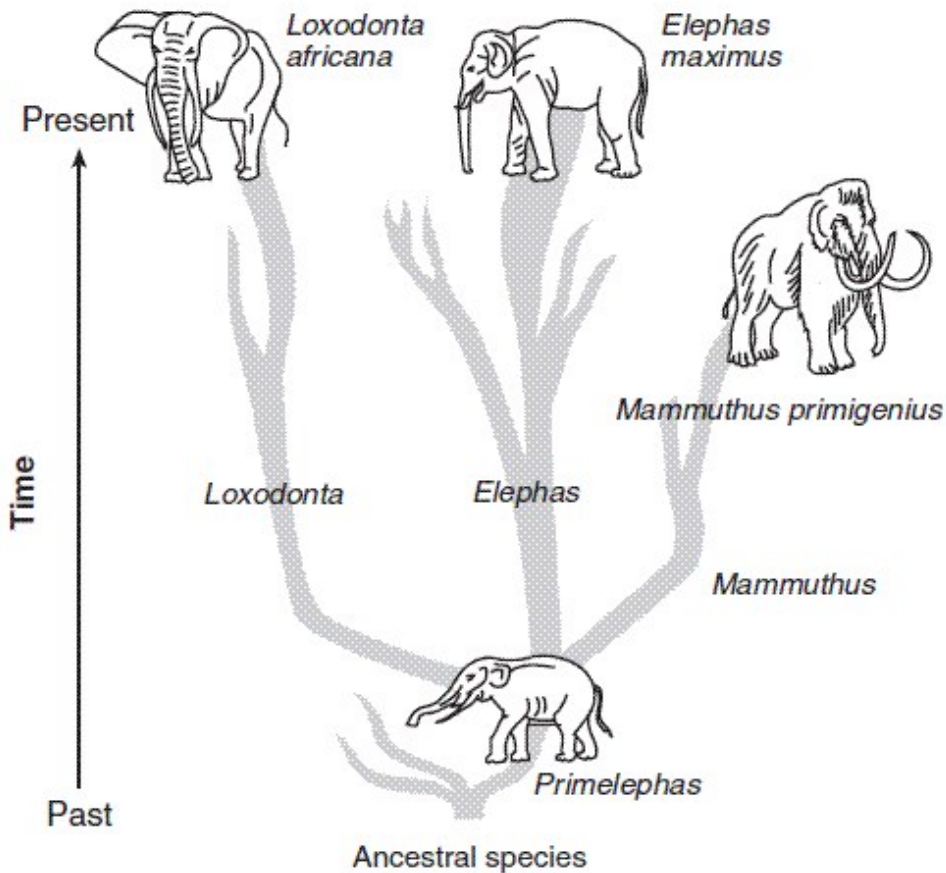
The graph indicates that the number of species that have become extinct

1. has increased with increasing human population
2. has decreased with increasing human population
3. is not affected by the size of the human population
4. is greater than the size of the human population

21. Male turkeys are birds that naturally strut and display their large tail feathers, which attracts female turkeys. This display is an example of

1. a behavioral adaptation
2. selective breeding
3. asexual reproduction
4. a learned behavior

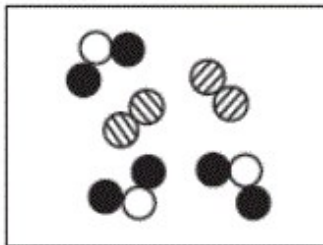
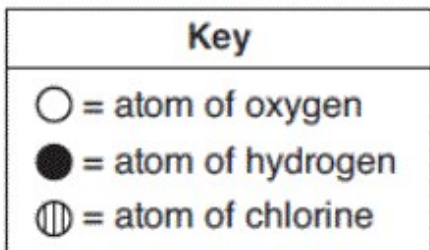
22. One possible pathway for the evolution of elephants is represented in the diagram below.



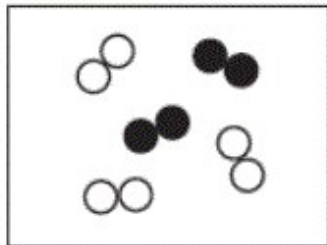
Which statement concerning this pattern of evolution is correct?

1. Evolution always results in favorable traits.
 2. Evolution does not always result in a species that will survive to present time.
 3. Evolution leads to less complex organisms.
 4. Evolution results in the same changes in all species.
23. The theory of evolution states that
1. species that are extinct have no biological relationship to living species
 2. different animal species always interbreed to form new and different species
 3. species change over time, sometimes developing into new species
 4. the environment of Earth is constant over time
24. Evolution can occur at different rates; however, for evolution to occur, there must be
1. variations within a species
 2. extinction of the species
 3. asexual reproduction
 4. no change in the genes of an organism
25. Homeowners have been encouraged to learn how to identify invasive plants and to remove them if they find them. The most likely reason for removing invasive plants is to
1. allow only one type of native plant to grow
 2. preserve biodiversity
 3. eliminate unfamiliar food sources
 4. increase the rate of ecological succession

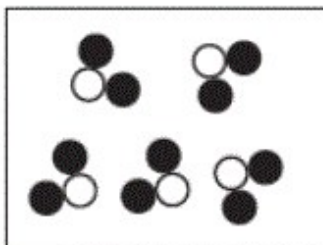
26. Which two particle diagrams each represent a sample of one substance?



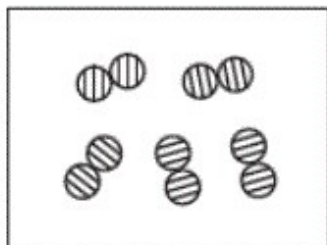
I



III



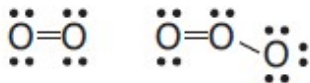
II



IV

1. I and II 2. I and III
3. II and III 4. II and IV

27. Given the formulas of two substances:



These diagrams represent substances that have

- the same molecular structure and the same physical properties
- the same molecular structure and different physical properties
- different molecular structures and the same physical properties
- different molecular structures and different physical properties

28. Which sample of matter is a mixture?

1. air 2. ammonia
3. manganese 4. water

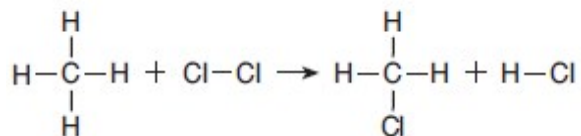
29. Which type of matter can *not* be broken down into simpler substances by a chemical change?

1. an element 2. a solution
3. a mixture 4. a compound

30. The mass of a proton is approximately equal to the mass of

1. an electron 2. a neutron
3. an alpha particle 4. a beta particle

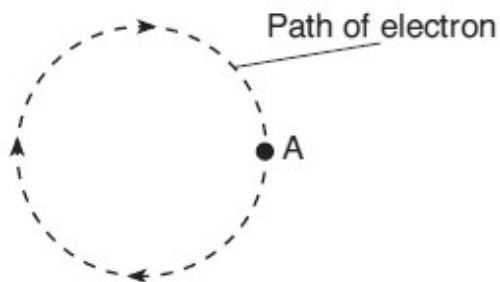
31. Given the equation representing a reaction:



Which type of reaction is represented by this equation?

1. addition
 2. esterification
 3. polymerization
 4. substitution
32. A reaction is most likely to occur when the colliding particles have proper orientation and
1. mass
 2. volume
 3. half-life
 4. energy
33. What occurs when a catalyst is added to a chemical reaction?
1. an alternate reaction pathway with a lower activation energy
 2. an alternate reaction pathway with a higher activation energy
 3. the same reaction pathway with a lower activation energy
 4. the same reaction pathway with a higher activation energy
34. Which process converts mass into energy?
1. distillation of ethanol
 2. filtration of a mixture
 3. fusion of hydrogen atoms
 4. ionization of cesium atoms
35. In which process does a heavy nucleus split into two lighter nuclei?
1. titration
 2. fission
 3. electrolysis
 4. neutralization
36. Fission and fusion reactions both release energy. However, only fusion reactions
1. require elements with large atomic numbers
 2. create radioactive products
 3. use radioactive reactants
 4. combine light nuclei
37. A ball is thrown with a velocity of 35 meters per second at an angle of 30° above the horizontal. Which quantity has a magnitude of zero when the ball is at the highest point in its trajectory?
1. the acceleration of the ball
 2. the momentum of the ball
 3. the horizontal component of the ball's velocity
 4. the vertical component of the ball's velocity

38. An electron in a magnetic field travels at constant speed in the circular path represented in the diagram below.



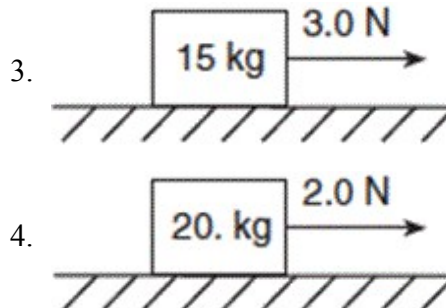
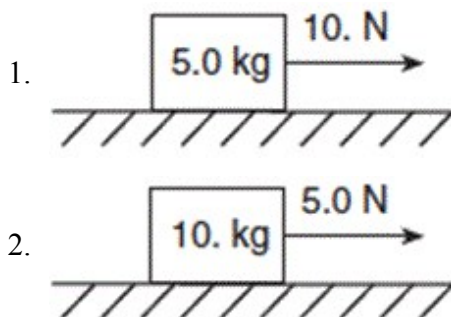
Which arrow represents the direction of the net force acting on the electron when the electron is at position *A*?

1. 
2. 
3. 
4. 

39. The greatest increase in the inertia of an object would be produced by increasing the

1. mass of the object from 1.0 kg to 2.0 kg
2. net force applied to the object from 1.0 N to 2.0 N
3. time that a net force is applied to the object from 1.0 s to 2.0 s
4. speed of the object from 1.0 m/s to 2.0 m/s

40. A different force is applied to each of four different blocks on a frictionless, horizontal surface. In which diagram does the block have the greatest inertia 2.0 seconds after starting from rest?

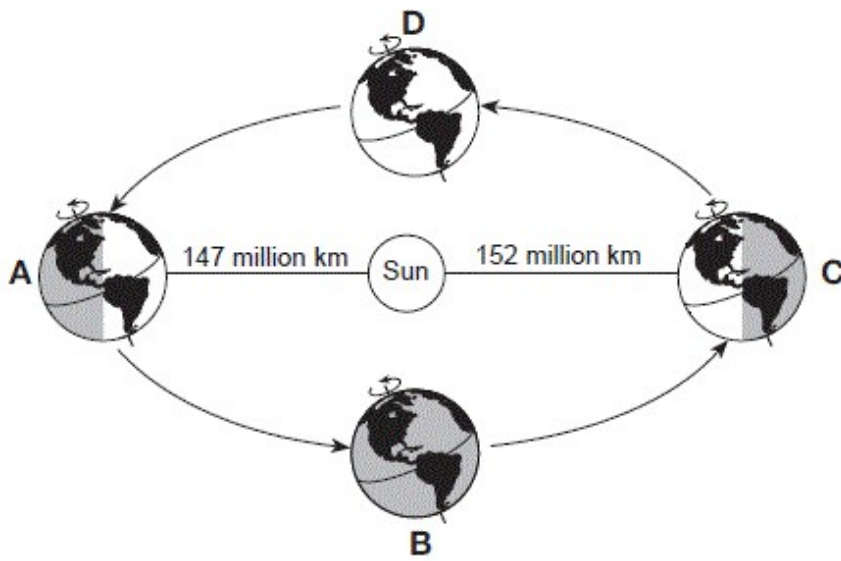


41. An electrostatic force exists between two $+3.20 \times 10^{-19}$ -coulomb point charges separated by a distance of 0.030 meter. As the distance between the two point charges is *decreased*, the electrostatic force of

1. attraction between the two charges decreases
2. attraction between the two charges increases
3. repulsion between the two charges decreases
4. repulsion between the two charges increases

Figure 6

Base your answer to the question on the diagram below and on your knowledge of Earth science. The diagram represents Earth in its orbit around the Sun. Locations *A* through *D* represent four positions of Earth in its orbit. Earth is closest to the Sun (perihelion) at position *A*, and farthest from the Sun (aphelion) at position *C*.



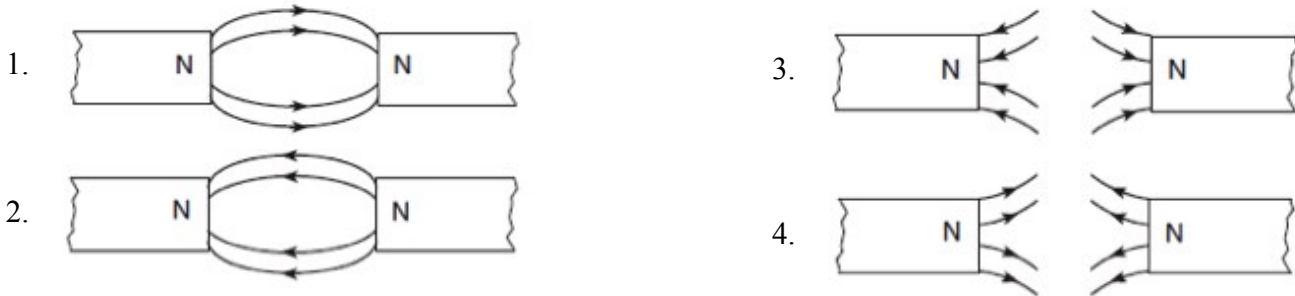
(Not drawn to scale)

42. [Refer to figure 6]

At which position is the gravitational attraction between the Sun and Earth the greatest?

1. A
2. B
3. C
4. D

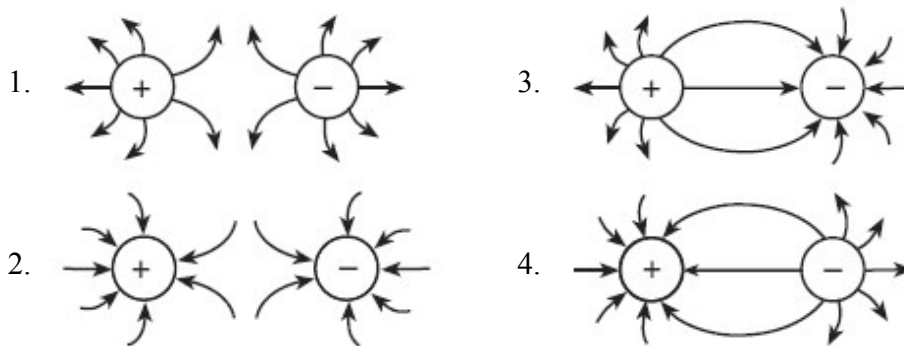
43. Which diagram represents magnetic field lines between two north magnetic poles?



44. If several resistors are connected in series in an electric circuit, the potential difference across each resistor

1. varies directly with its resistance
2. varies inversely with its resistance
3. varies inversely with the square of its resistance
4. is independent of its resistance

45. Which diagram represents the electric field between two oppositely charged conducting spheres?



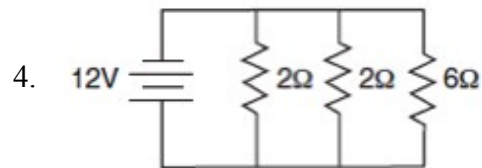
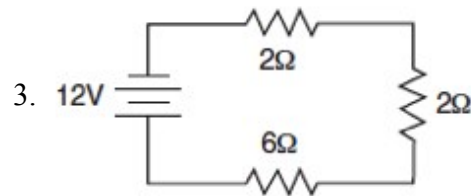
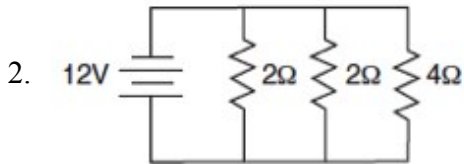
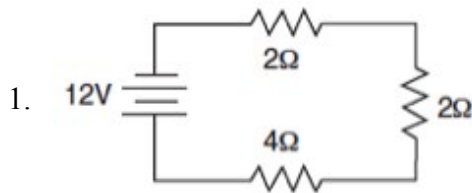
46. The temperature of a substance is a measure of the

1. average kinetic energy of its particles
2. average potential energy of its particles
3. ionization energy of its particles
4. activation energy of its particles

47. A sample of a gas is in a sealed, rigid container that maintains a constant volume. Which changes occur between the gas particles when the sample is heated?

1. The frequency of collisions increases, and the force of collisions decreases.
2. The frequency of collisions increases, and the force of collisions increases.
3. The frequency of collisions decreases, and the force of collisions decreases.
4. The frequency of collisions decreases, and the force of collisions increases.

48. Which circuit has the largest equivalent resistance?

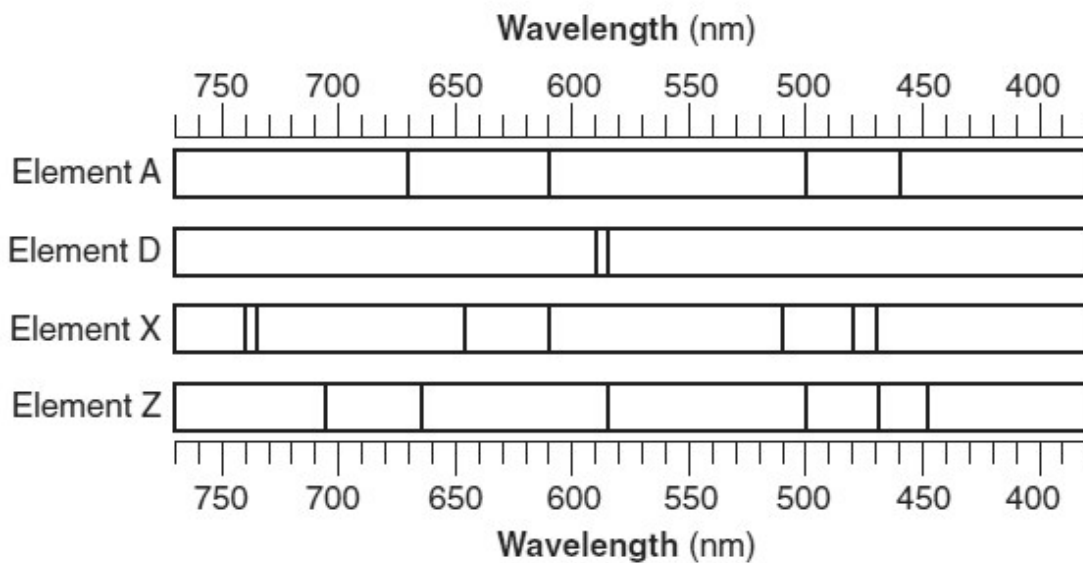


49. Which waves require a material medium for transmission?

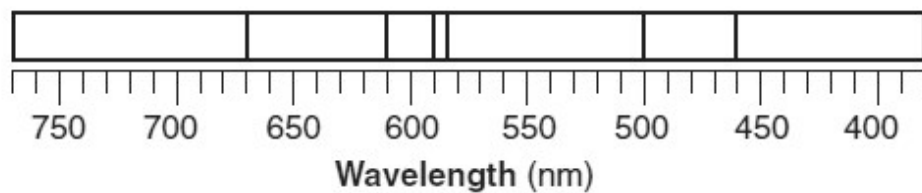
1. light waves
2. radio waves
3. sound waves
4. microwaves

50. The bright-line spectra produced by four elements are represented in the diagram below.

Bright-Line Spectra of Four Elements



Given the bright-line spectrum of a mixture formed from two of these elements:



Which elements are present in this mixture?

1. *A* and *D*
2. *A* and *X*
3. *Z* and *D*
4. *Z* and *X*