EVOLUTION

Which of these is necessary for natural selection to occur?

A. genetic engineering 
B. genetic variation 
C. asexual reproduction 
D. environmental stability

Correct Answer: B

Rabbits that live in warm climates have larger ears than rabbits that live in cold climates. Larger ears allow rabbits to cool themselves by releasing body heat. Which term describes this characteristic?

A. alteration
B. mutation
C. adaptation
D. recombination

Correct Answer: C

Students collected leaves from four maple trees. They measured the length and width of each leaf. Then they calculated the average values for each tree. The data are shown in the table below.

<table>
<thead>
<tr>
<th>Tree</th>
<th>Average Length (cm)</th>
<th>Average Width (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2</td>
<td>10.0</td>
<td>5.0</td>
</tr>
<tr>
<td>3</td>
<td>19.0</td>
<td>10.0</td>
</tr>
<tr>
<td>4</td>
<td>15.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

According to the data, which tree has a selective advantage in capturing sunlight?

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

Correct Answer: C
The mole rat is an animal that avoids predators by living underground. Its long claws and teeth allow it to dig deep holes. Scientists believe the ancestors of the mole rat lived above ground and had shorter claws and teeth.

Which of these processes resulted in the long claws and teeth found in the modern mole rat?

- A. natural selection
- B. selective breeding
- C. genetic engineering
- D. asexual reproduction

**Correct Answer:**
A

Use the information below to answer the following.

The largest flower in the world, called a rafflesia, is three feet wide and weighs up to 36 pounds. The rafflesia has no roots, stems, or leaves. It lives on and takes nourishment from a vine called tetrastigma. The rafflesia harms the vine.

The seeds of the rafflesia are dispersed in an unusual way. Plantain squirrels and tree shrews eat parts of the rafflesia plant. Scientists observe that when the animals chew the rafflesia, seeds get caught in their teeth. The animals will then chew on tetrastigma vines, leaving the seeds where they can germinate.

Rafflesia flowers produce the smell of rotting flesh. This smell attracts flies. When the flies land on the flowers, the pollen attaches to them. The flies then transport the pollen to other flowers.

Producing a smell to attract flies is an example of

- A. parasitism
- B. adaptation
- C. replication
- D. predation

**Correct Answer:**
B
ELEPHANTS DON’T NEED EMAIL

Researchers have observed that elephants seem to know where other elephants are and where they are going, even when they are separated by miles of dense forest. Elephant families will suddenly stop grazing, turn their heads in the same direction, and walk into the forest. The elephants act as if they are communicating with each other.

It is believed that these elephants are responding to low frequency sounds, called infrasound. Human ears cannot hear most elephant rumbles, but sometimes humans can feel the vibrations. Infrasound vibrations are below 20 cycles per second. The frequencies of sounds normally heard by elephants and humans are shown in the table below.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Minimum Frequency (cycles per second)</th>
<th>Maximum Frequency (cycles per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elephant</td>
<td>14</td>
<td>16,000</td>
</tr>
<tr>
<td>Human</td>
<td>20</td>
<td>20,000</td>
</tr>
</tbody>
</table>

Katherine Payne, a researcher from Cornell University, felt vibrations in the air while she was watching the elephants at the Metro Washington Park Zoo in Portland, Oregon. She believed the elephants might be communicating using infrasound.

Payne and other researchers conducted a study on wild elephants living in southwest Africa. The researchers placed microphones and speakers in areas where elephants live. They recorded the elephants' rumbles and observed their behavior. They found that elephants “talk” to each other in frequencies ranging from 14 cycles per second to 16,000 cycles per second.

To learn how far the rumbles could be heard, they played recordings of low frequency elephant rumbles and watched the reactions of distant elephants. The researchers found that elephants hear low frequency sounds that are produced as far as two and one half miles away. The researchers did not test beyond two and one half miles. The sounds that elephants produce and hear may travel even farther.

Elephants travel long distances in search of food. Using infrasound, family members traveling separately can communicate with each other.

The ability of the elephants to communicate over long distances probably developed

A. slowly over millions of years
B. over a ten year period
C. as a strategy to decrease reproduction
D. as a way to communicate with other species

Correct Answer: A
Honeybees are very important to agriculture. They produce honey and they pollinate many plants, making seed and fruit development possible. In recent years, severe weather and attacks by newly introduced insects have seriously affected both wild and domestic honeybee populations.

Two species of mites entered North America around 1980. These mites weaken and kill honeybees by consuming their bodily fluids, blocking their respiratory passages, and spreading germs. European and South American honeybees developed an immunity to the effects of these mites. However, North American honeybees did not develop this immunity. By 1995, infestation with mites reached epidemic levels. In addition, the harsh winter of 1995 to 1996 killed honeybee colonies in many states.

Scientists have observed a significant decline in both wild and domestic honeybee populations. This loss affects beekeepers and farmers. Fifteen percent of all agricultural crops require bee pollination. Farmers have had to look for other species to pollinate their crops.

Honeybees are not the only pollinators that have decreased in numbers. Many other insect and vertebrate pollinators throughout the world have been killed by the overuse of pesticides and habitat destruction. Many wild plants, including a number of endangered species, depend entirely on one animal species for pollination. The solutions to this “pollination crisis” are complex. It is clear that efforts to save threatened pollinators cannot be separate from efforts to preserve threatened plants and habitats.

South American honeybees are resistant to the mites. Scientists believe that the North American honeybees may also become resistant to the mites in another ten years.

Which of these processes will cause the honeybee population to become resistant to the mites?

A. natural selection
B. chemosynthesis
C. aerobic respiration
D. succession

Correct Answer: A

Which of these will most likely result in variation within a species?

A. mutation
B. succession
C. diffusion
D. competition

Correct Answer: A
Loggerhead turtles in the Atlantic Ocean return to lay their eggs on the same beaches where they hatched. Scientists have observed that the turtles have a “compass sense.” This sense allows them to use Earth's magnetic field to find their way back to the beaches where they were hatched.

Which of these terms best describes the turtle's ability to use Earth's magnetic field?

A. diversity  
B. habitat  
C. succession  
D. adaptation

Correct Answer:  
D

Researchers are studying slider turtles. Slider turtles hatch on the beach. The researchers discovered that larger baby turtles were more likely to survive than smaller baby turtles. They hypothesized that the larger turtles could move more quickly toward the water than the smaller turtles, reducing their exposure to predators.

The survival advantage for the larger baby turtles is a result of

A. natural selection  
B. gene splicing  
C. mutualism  
D. commensalism

Correct Answer:  
A

The figure below shows the skeletal structure of a seal's flipper and a monkey's arm.

The skeletal structures of the flipper and the arm are similar, even though they have different functions. Seals use their flippers for swimming, while monkeys use their arms primarily for grasping and lifting.

The seal's flipper and the monkey's arm differ in appearance. This difference is the result of

A. migration  
B. genetic engineering  
C. succession  
D. natural selection

Correct Answer:  
D
The ears of foxes help to regulate body heat. The fennec fox lives in the North African desert and has large ears that release body heat. The Arctic fox lives in cold climates and has small ears that conserve body heat.

Which of these processes led to the development of different ear sizes in foxes?

A. selective breeding
B. succession
C. natural selection
D. mutualism

Correct Answer:
C

Students conducted an experiment to test the effect of antibiotics on bacteria. They placed bacteria in a petri dish that contained agar treated with an antibiotic. Only one of the bacterial colonies survived.

Which of these statements best explains why only one colony survived?

A. The bacteria in the colonies competed for survival.
B. There was only enough food in the dish for some of the bacteria to survive.
C. There was not enough antibiotic in the dish to kill all the bacteria.
D. The bacteria in the surviving colony had genetic variations that allowed them to survive.

Correct Answer:
D

Amphibians were the first vertebrates to live on land. The ancestors of amphibians were probably lobe-finned fish. The diagram below shows this development of amphibians over time.

Which of these terms best describes how amphibians could have developed from lobe-finned fish?

A. selective breeding
B. cloning
C. migration
D. natural selection

Correct Answer:
D
Male fiddler crabs attract females by quickly waving their large front claw. If a claw is lost in a fight or accident, they quickly grow a hollow claw of equal length. Because the new claw is lighter, they can wave it faster. A male fiddler crab is shown below.

The new claw probably helps the male fiddler crab to

A. successfully reproduce
B. maintain homeostasis
C. fight more successfully
D. evolve into a new species

Correct Answer: A
An insecticide is a chemical that kills insects. Most insects are killed the first time they are exposed to an insecticide. However, some insects carry a gene that enables them to survive their first exposure to an insecticide. When these surviving insects reproduce, this gene may be inherited by their offspring. The number of insecticide-resistant insects usually increases over time because increasing numbers of offspring with this gene are able to survive and reproduce.

Which process enables increasing numbers of insects to survive their initial exposure to an insecticide?

A. cloning  
B. mutation  
C. natural selection  
D. genetic engineering

Correct Answer: C

Use the information and the drawing below to answer the following item.

The desert climate is caused by geographic conditions such as location, high atmospheric pressure, and proximity of mountain ranges. Average desert rainfall amounts are usually less than 50 cm per year. Soil in deserts is coarse, sandy, and rocky. Desert plants and animals have specialized characteristics that help them survive in the harsh environment. An example is the Saguaro cactus. The Saguaro has a shallow root system with a main taproot and other roots that radiate out and collect surface water. The trunk of the Saguaro has the ability to expand while storing water. The sweet-nectar flowers of the Saguaro attract white-winged doves, bats, and other animals. These animals feed on the nectar. They are necessary for cross-pollination. Cross-pollination occurs when the pollen of a flower is carried to a flower on another plant. The illustration below shows the Saguaro cactus.

Which advantage is the most likely result of cross-pollination to Saguaro cacti?

A. disease resistance  
B. variation within the species  
C. larger cacti offspring in each generation  
D. increased number of animals that drink nectar

Correct Answer: B
The desert climate is caused by geographic conditions such as location, high atmospheric pressure, and proximity of mountain ranges. Average desert rainfall amounts are usually less than 50 cm per year. Soil in deserts is coarse, sandy, and rocky. Desert plants and animals have specialized characteristics that help them survive in the harsh environment. An example is the Saguaro cactus. The Saguaro has a shallow root system with a main taproot and other roots that radiate out and collect surface water. The trunk of the Saguaro has the ability to expand while storing water. The sweet-nectar flowers of the Saguaro attract white-winged doves, bats, and other animals. These animals feed on the nectar. They are necessary for cross-pollination. Cross-pollination occurs when the pollen of a flower is carried to a flower on another plant. The illustration below shows the Saguaro cactus.

Which of these adaptations is most important for the Saguaro to survive long periods of drought?

A. deep roots  
B. sweet nectar  
C. large flowers  
D. expanding trunk

Correct Answer:  
D

Crops must be able to compete with weeds in order to be successful. Certain crops have been genetically modified to be resistant to specific herbicides. In areas where these crops are grown, the herbicides can be sprayed to kill weeds without damaging the crops. However, weeds in these areas have begun to show resistance to the herbicides.

The environmental pressure most likely responsible for an increase in the number of resistant weeds is

A. herbicides  
B. non-resistant weeds  
C. competition with crops  
D. genes in genetically modified crops

Correct Answer:  
A
Use the information below to answer the following item.

Plants grow in various environments. Some plants, like mangroves, grow in salty wetlands. Mangroves have specialized structures that prevent salt from entering their cells. Other mangroves have specialized glands that can excrete excess salt.

Glands that excrete salt in the mangroves are examples of

A. meiosis
B. osmosis
C. adaptations
D. successions

Correct Answer:
C

Scientists have recently discovered a new species that lives attached to the side of a tree. An organism from this new species

- is multicellular
- has cell walls
- has vascular tissues
- makes its own food
- has structures that absorb moisture from the air

Which of these terms best describes this new organism?

A. omnivore
B. eukaryote
C. herbivore
D. prokaryote

Correct Answer:
B
Use the information and the table below to answer the following.

Mammals, birds, modern reptiles, and theropod dinosaurs are vertebrates. The table below shows some of the differences and similarities among these groups of vertebrates.

<table>
<thead>
<tr>
<th>Characteristics of Vertebrate Groups</th>
<th>Mammals</th>
<th>Birds</th>
<th>Modern Reptiles</th>
<th>Theropod Dinosaurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ear bones</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Legs directly under body</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Produce milk</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Constant body temperature</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Live birth</td>
<td>yes</td>
<td>no</td>
<td>some</td>
<td>no</td>
</tr>
<tr>
<td>Skin covering</td>
<td>hair</td>
<td>feathers/scales</td>
<td>scales</td>
<td>feathers/scales</td>
</tr>
</tbody>
</table>

According to the table, which of these vertebrates are most closely related?

A. mammals and modern reptiles  
B. theropod dinosaurs and modern reptiles  
C. mammals and theropod dinosaurs  
D. birds and theropod dinosaurs

**Correct Answer:**

D
Scientists have recently discovered hydrothermal vent communities on the ocean floor. A diagram of a hydrothermal vent community is shown in the figure below.

The organisms in this community live near heated vents. Inorganic compounds such as sulfides mix with extremely hot water when they are released from the vents. Bacteria use the sulfides to make food for themselves and other animals. Many of these bacteria live in the bodies of the giant tubeworms and the giant white clams that live in this community.

The bacteria that live in the bodies of the giant tubeworms and the giant white clams are classified as

A. eukaryotes  
B. prokaryotes  
C. plants  
D. fungi

**Correct Answer:**  
B
Gray wolves were reintroduced into Yellowstone National Park in 1995. Two years later, the population of coyotes had decreased by 50%. Coyotes were found in all habitats of the park before the gray wolves were reintroduced. Now, coyotes are most often found in the hills and mountains.

Coyotes and gray wolves have a high degree of relatedness. Which of these best describes why the two species are closely related?

A. They have similar behaviors.
B. They have a common ancestor.
C. They feed on the same types of food.
D. They are found in the same habitat.

Correct Answer:
B
A researcher recently discovered a species of bacteria. DNA sequences were obtained from it and from several other species of bacteria. The DNA sequences came from the same part of the bacterial chromosome of each species.

<table>
<thead>
<tr>
<th>Unknown Species</th>
<th>ACT</th>
<th>GCA</th>
<th>GCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species I</td>
<td>ACA</td>
<td>GCG</td>
<td>CCG</td>
</tr>
<tr>
<td>Species II</td>
<td>ACT</td>
<td>GCT</td>
<td>GGC</td>
</tr>
<tr>
<td>Species III</td>
<td>ACA</td>
<td>GCC</td>
<td>GGG</td>
</tr>
<tr>
<td>Species IV</td>
<td>ACT</td>
<td>GCA</td>
<td>GCG</td>
</tr>
</tbody>
</table>

According to the data above, the unknown bacteria are most closely related to which species?

A. Species I
B. Species II
C. Species III
D. Species IV

Correct Answer: D

Scientists have found many similarities in the proteins of turtles and sharks. These similarities suggest that turtles and sharks

A. have stopped evolving
B. have a common ancestor
C. have all the same DNA sequences
D. have the same number of chromosomes

Correct Answer: B
Students used the three organisms shown below to study evolutionary relationships.

![Image of Bat, Bee, and Whale]

Which of these structures are the best evidence of an evolutionary relationship?

A. bat wing and bee wing  
B. bat lower jaw and whale lower jaw  
C. whale flipper and bee wing  
D. bat wing and whale flipper

Correct Answer:  
D

The figure below shows the skeletal structure of a seal's flipper and a monkey's arm.

![Image of Seal Flipper and Monkey Arm]

The skeletal structures of the flipper and the arm are similar, even though they have different functions. Seals use their flippers for swimming, while monkeys use their arms primarily for grasping and lifting.

Which of these explains why the skeletal structures of the seal's flipper and the monkey's arm are similar?

A. Seals and monkeys have a common ancestor.  
B. Seals and monkeys have identical DNA sequences.  
C. All of the same genetic mutations occurred in seals and monkeys.  
D. All of the same vitamins are used for bone formation in seals and monkeys.

Correct Answer:  
A
The skull of a modern bird, the herring gull, is shown below.

Herring Gull

Which of the vertebrate skulls shown below is probably most closely related to modern birds?

A. 

B. 

C. 

D. 

Correct Answer: D
A researcher is studying raccoons and skunks. She wants to find out how closely these two mammals are related. Which of these characteristics would be best for her to study?

A. sequences of DNA  
B. reproductive habits  
C. movement of RNA  
D. physical appearance

**Correct Answer:**  
A

Use the information and the food web below to answer the following item.

Shallow coastal waters provide an essential habitat to a variety of plants and animals. A small part of a coastal food web is shown below.

Which of these characteristics would provide the best evidence to determine if menhaden and striped bass are closely related?

A. They are both cold-blooded.  
B. They occupy the same trophic level.  
C. They both live in coastal waters.  
D. They have similar DNA sequences.

**Correct Answer:**  
D
Below are parts of the mitochondrial DNA codes for the American black bear, the giant panda, the red panda, and the raccoon.

<table>
<thead>
<tr>
<th>Organism</th>
<th>DNA Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>American black bear</td>
<td>ATT GGA GCA GAC TTA</td>
</tr>
<tr>
<td>Giant panda</td>
<td>ATT GGC ACT AAT CTA</td>
</tr>
<tr>
<td>Red panda</td>
<td>ATT GGA ACT AAC CTT</td>
</tr>
<tr>
<td>Raccoon</td>
<td>ATC GGA TCT AAC CTT</td>
</tr>
</tbody>
</table>

Based on this information, which two species are most closely related?

A. the American black bear and the giant panda
B. the American black bear and the raccoon
C. the red panda and the raccoon
D. the red panda and the giant panda

Correct Answer:
C

Prokaryotic cells possess all of the following except

A. cell membrane
B. ribosomes
C. cell wall
D. nuclear membrane

Correct Answer:
D