

Evolution Pre-Test

LOGIN CODE = BOOPAA1

This is a multiple-choice test on evolution ideas you will cover during the next several weeks. You may not know the answers to some questions, but that is ok. We ask you to do your best.

As you move through the test:

- Carefully read each question and circle the answer choice you think is correct.
- Work slowly and carefully. You will have the whole class period to complete the test.
- Answer as many test questions as you can. Your answers are very important to the research team and will help them further improve the teaching material.

Thank you for your help and good luck!

Please provide the following information (optional):

- What is your gender?
 - Male
 - Female
- What best describes your race/ethnicity? (Choose all that apply)
 - American Indian or Alaskan Native
 - Asian
 - Hispanic of Latin American
 - Native Hawaiian or other Pacific Islander
 - White
 - Other
- What is your age? (Write below)

- Is English your primary language?
 - Yes
 - No
- What is your current or highest level of education?
 - 7th grade
 - 8th grade
 - 9th grade
 - 10th grade
 - 11th grade
 - 12th grade
- High School Graduate

CA15-3

1. The table below shows the presence or absence of traits in seven different species.

| Character | Frog | Bird | Crocodile | Whale | Pig | Gorilla |
|----------------|------|------|-----------|-------|-----|---------|
| Blowhole | | | | Yes | | |
| Body hair | | | | Yes | Yes | Yes |
| Amniotic egg | | Yes | Yes | Yes | Yes | Yes |
| Forelimbs | Yes | Yes | Yes | Yes | Yes | Yes |
| Backbone | Yes | Yes | Yes | Yes | Yes | Yes |
| Holes in Skull | | Yes | Yes | | | |

Based only on the traits presented in the table, which organism is most closely related to whales?

- A. Pigs
 - B. Birds
 - C. Gorillas
 - D. Not enough information is provided
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EM42-4

2. Which of the following would support the claim that a particular behavioral trait found in a population of organisms is inherited?

- A. If many individual organisms in that population had the trait
 - B. If a gene was found for the trait
 - C. If the trait could be learned by offspring from their parents
 - D. If the trait was found in only one individual in that population
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CA44-2

3. A student is reading an article on evolution and comes across the statement:

“Algae and yeast have a common ancestor.”

They aren't sure whether this claim is true or not, so they look for evidence supporting it. Which of the following is scientific **evidence** that could be used to support the claim?

- A. Algae and yeast both produce the proteins required for cellular respiration.
 - B. Algae and yeast have identical DNA.
 - C. The more traits two organisms have in common the more closely related they are.
 - D. Algae and yeast couldn't have a common ancestor.
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EN50-5

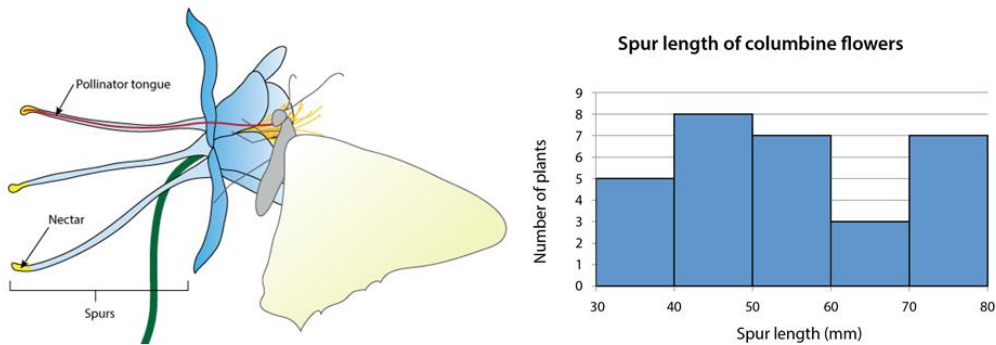
4. Which of the following statements is TRUE about the evolution of plants and animals?

- A. All plants and all animals share a common ancestor with each other.
 - B. All plants share a common ancestor, but all animals do not share a common ancestor.
 - C. All animals share a common ancestor, but all plants do not share a common ancestor.
 - D. No plants species share a common ancestor with each other, no animal species share a common ancestor with each other, and no plants share a common ancestor with any animals.
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5. Assume that some type of forelimb was present in the common ancestor of birds, crocodiles, whales, and pigs, and that the ancient forelimb evolved into the legs, wings, and fins of animals that exist today. What would be true about the genes that code for forelimbs in these different animals that evolved from the forelimbs of the common ancestor?

- A. Completely different sets of genes would code for forelimbs in these different animals.
 - B. Many of the same genes would code for arms in crocodiles and pigs but these genes would be completely different than the genes that code for wings in birds or fins in whales
 - C. Many of the same genes would code for forelimbs in all of these animals.
 - D. There is no relationship between the traits of organisms and which genes for forelimbs the organisms have.
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6. The columbine is a flowering plant with long projections called "spurs" that contain nectar. Nectar is a sweet tasting liquid that attracts insects and animals. The organisms that feed on the nectar are called pollinators, because they move pollen from male to female flowers during this feeding process. The graph below shows spur length in a sample from a columbine population.



Left: Diagram of a columbine flower and a pollinator feeding on nectar in a spur. Right: Graph of spur length in a sample from a columbine population.

Which of the following claims about spur length does this graph support?

- A. Spur length is changing over time.
- B. Spur length varies among individuals in the population.
- C. Spur length is undergoing natural selection in the population.
- D. Spur length is the same throughout the population

7. Meadowlarks are small birds that live across North America. Scientists studying these birds have identified two types of Meadowlarks that look alike but make different songs. They want to find out if these two types of Meadowlarks are different species. Which of the following is the most convincing evidence that the two types are actually different species?

- A. One type eats berries and the other type eats seeds.
 - B. The two types cannot reproduce with each other.
 - C. Genetic tests show that the two types have a common ancestor.
 - D. One type lives mostly in eastern North America and the other type lives mostly in western North America.
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EM55-3

8. Atlantic Tomcod is a type of fish found in the coastal waters of the Northeast United States. Atlantic Tomcod has a gene AHR2 which has two possible alleles, allele 1 and allele 2.

Allele 1 is thought to be associated with resistance to toxins, such as PCBs (polychlorinated biphenyls). PCBs were formerly used as coolants, among other things, but were later found to be extremely toxic. The table below shows the frequencies of allele 1 and allele 2 in the Atlantic Tomcod populations in two different rivers in the Northeast United States.

| Allele Frequency | Niantic River | Hudson River |
|-------------------------|----------------------|---------------------|
| Allele 1 | 0.06 | 0.99 |
| Allele 2 | 0.94 | 0.01 |

The AHR2 allele frequencies in the Hudson River population used to look like the current allele frequencies of the Niantic river population. Could natural selection have caused the allele frequency change in the Hudson River tomcod population?

- A. Yes, heavy exposure to PCBs could have caused Hudson River tomcod to increase their toxin resistance in order to survive.
 - B. Yes, heavy exposure to PCBs could have killed Hudson River tomcod that had Allele 2, while those with Allele 1 were more likely to survive and reproduce.
 - C. No, the allele frequency change could only have occurred after a natural disaster.
 - D. No, the change could only be explained by a new population of fish migrating into the Hudson.
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EM41-3

9. Which of the following describes genes?

- A. Genes are protein molecules.
 - B. Genes are segments of DNA molecules.
 - C. Genes are sequences of amino acid molecules.
 - D. Genes are traits, not molecules.
-

10. According to the theory of natural selection, what happens to organisms of the same species when a major change occurs in their environment (for example, the amount of rainfall decreases or the temperature increases)?

- A. The individual organisms that already have traits better suited for the changed environment would be more likely to survive and reproduce, and those that do not have those traits would be less likely to survive and reproduce.
 - B. All of the individual organisms would try to develop new traits so that they could survive in the changed environment.
 - C. Some of the individual organisms would try to develop new traits so that they could survive, and the other organisms would die.
 - D. Because all organisms of the same species have the same traits, one organism would never have an advantage over another of its species. They would either all survive, or they would go extinct.
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11. *Chikungunya* is a disease that is transmitted to humans by infected mosquitoes. The disease, which causes fevers, rashes, and joint pain for years after infection, is caused by the Chikungunya virus.

In 2006, a new outbreak of *Chikungunya* infected many more people than usual. To understand why the disease was spreading, scientists collected samples of the virus from people infected in 2006 and found that three new strains of the virus had developed. They labeled these virus strains X, Y, and Z. Then they compared the DNA sequences of these three new strains to the 2005 virus. They assumed that these new 2006 strains were all descended from the 2005 virus and were caused by a series of mutations in the DNA sequence of the 2005 virus. (The DNA sequence of each strain is represented by the letters ATGC.)

Key differences between the 2005 virus and the three new 2006 strains that the scientists found are highlighted below. For the following question, assume that each mutation happened only once and then was inherited by all descendants of the strain in which it occurred. You should also assume that once a mutation occurred in the DNA sequence, it did not mutate back to the original sequence.

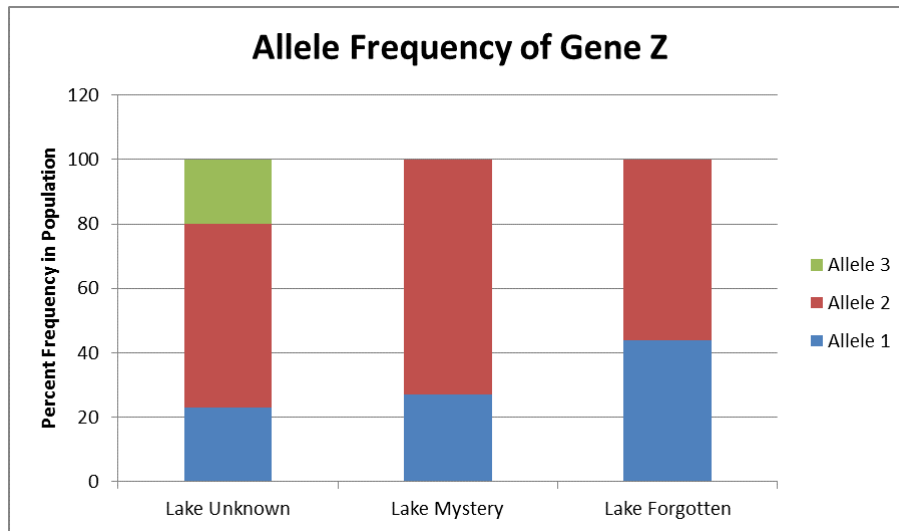
| Virus Strain | DNA Sequence |
|---------------------|---------------|
| 2005 Virus | CGTTTGGCATCGC |
| 2006 Virus Strain X | TGAATAACATTGC |
| 2006 Virus Strain Y | CGTCTGGCATTGC |
| 2006 Virus Strain Z | CATTTAACACTGT |

Which sequence likely represents the most recent common ancestor of Virus X and Virus Z?

- A. TGAATAACATTGC
- B. CGTCTGGCATTGC
- C. CATTTAACACTGT
- D. CGTTTAACATTGC

12. A hundred years ago, a network of streams connected three lakes: Lake Unknown, Lake Mystery, and Lake Forgotten. These streams allowed trout to travel freely between the three lakes and interbreed.

Due to environmental changes, the streams dried up, so trout in each lake can no longer breed with trout from the other two lakes. Biologists are interested in how this change has affected the frequencies of different alleles of Gene Z. The chart below shows the allele frequencies of Gene Z in the three populations.



Which sequence of events provides the simplest and most likely explanation of how Allele 3 appeared in Lake Unknown, but not in the other two lakes?

- A. Step 1: The streams dried up.
Step 2: Allele 3 appeared in the Lake Unknown population because of gene mutations.
- B. Step 1: Allele 3 appeared in the Lake Unknown population because of gene mutations.
Step 2: The streams dried up.
- C. Step 1: The streams dried up.
Step 2: Allele 3 appeared in the Lake Unknown population because of a change in environment. No gene mutations occurred.
- D. Step 1: Allele 3 appeared in the Lake Unknown population because of a change in the environment. No gene mutations occurred.
Step 2: The streams dried up.

EM36-3

13. Which of the following describes the process of evolution by natural selection?

- A. Individuals change to better fit the environment, and these changes become more frequent in the population.
 - B. The environment changes, and all members of a species either evolve into a new species or the species goes extinct (dies out).
 - C. Individuals of the same species have different versions of heritable traits, and a particular version increases in frequency over many generations if individuals with that version contribute more offspring to the next generation.
 - D. Individuals of two species compete for resources like food, water, and space, and one species wins and lives on, and the other species loses and goes extinct (dies out).
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EH14-1

14. Which of the following processes creates new alleles in a population?

- A. Disease
 - B. Natural Selection
 - C. Predation
 - D. Mutation
-

15. A student is reading a newspaper article and comes across the statement:

“Sharks and dolphins share a common ancestor.”

Their teacher asks them to read the article to see whether the journalist provides clear evidence and good reasons to support the claim.

Which of the following should the student look for in the article?

- A. **Evidence:** Data comparing the DNA sequence of sharks and dolphins.
Reasoning: A statement that having a similar DNA sequence suggests common ancestry.
 - B. **Evidence:** Data comparing the DNA sequence of sharks and dolphins.
Reasoning: A statement that new species can be produced when the environment favors the survival and reproduction of a population with particular traits.
 - C. **Evidence:** A statement that says that all vertebrates are related.
Reasoning: A statement that says that if all vertebrates are related, they must have similarities in their DNA sequence.
 - D. **Evidence:** A description of the similarities between the skeletons of sharks and the skeletons of dolphins.
Reasoning: A statement that both humans and fish have internal skeletons that include backbones and a skull.
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EH49-2

16. The DNA sequences of dogs and the DNA sequences of beetles differ in many ways. Which of the following mechanisms could lead to differences in the DNA sequences of dogs and beetles?

- A. Gene mutations
 - B. Recombination of genes
 - C. Gene mutations and recombination of genes
 - D. Gene mutations, recombination of genes, and natural selection
-

RH22-7

17. Because the traits of organisms depends on the proteins they produce, evolutionary biologists study the proteins that organisms make. Which of the following describes ways that protein molecules are important to an animal?

- A. Protein molecules help cells carry out many of their functions, and they are part of body structures such as hair and nails.
 - B. Protein molecules are part of body structures such as hair and nails, but they do not help cells carry out many of their functions.
 - C. Protein molecules help cells carry out many of their functions, but they are not part of body structures such as hair and nails.
 - D. Protein molecules do not help cells carry out many of their functions, and they are not part of body structures such as hair and nails.
-

EN46-10

18. Some animals, such as a cat and a dog, have many similarities. Others, such as a fish and a bird, have fewer similarities. What is TRUE about the ancestors of these animals?

- A. Cats and dogs share a common ancestor with each other, but fish and birds do not share a common ancestor with each other.
 - B. Cats and dogs share a common ancestor with each other, and fish and birds share a common ancestor with each other, but cats and dogs do not share a common ancestor with fish and birds.
 - C. Because cats, dogs, fish, and birds are separate species, none of them shares a common ancestor with any other.
 - D. Cats, dogs, fish, and birds all share an ancient common ancestor.
-

CA34-2

19.

Gene X in Dog  . . . T A C G C A A C A A T . . .

Gene X in Pig  . . . T A A G C C A C C T T . . .

Gene X in Cat  . . . T A C G C A C C A C T . . .

Assume that Gene X is a gene that codes for a trait that dogs, pigs, and cats have in common (such as forelegs, tail, etc.). Based only on the composition of Gene X for dogs, pigs, and cats, which of these organisms do you think are most closely related?

- A. Dogs and Cats
 - B. Dogs and Pigs
 - C. Cats and Pigs
 - D. Not enough information is given.
-

20. **Observation:** Two grey mice had a baby mouse pup that was black.



Question: How did grey parents produce a black mouse pup?



Claim: A new allele of the MC1R gene was produced by mutation in one of the parent's sex cells, and then passed on to the mouse pup.

Evidence: DNA sequencing revealed that the mouse pup has an allele of the MC1R gene that results in the production of more black pigment in the fur. Neither parent has a copy of this black MC1R allele in its body cells.

Which of the following statements provides the best reasoning to justify why the evidence supports the claim?

- A. Mutation is a natural process that produces genetic variation.
- B. DNA is passed from parents to offspring so that each individual has half their genetic information from their father and half their genetic information from their mother.
- C. The black MC1R allele is dominant to the other MC1R allele.
- D. Since offspring inherit DNA from their parents, if neither parent carried the black MC1R allele in its body cells, the allele must have been produced by mutation in a parent's sex cell.

21. Some organisms, such as a chimpanzee and a gorilla, have many similarities. Others, such as a chicken and an oak tree, have fewer similarities. What is TRUE about the ancestors of these organisms?

- A. Chimpanzees and gorillas share a common ancestor with each other, but chickens and oak trees do not share a common ancestor with each other.
 - B. Chimpanzees and gorillas share a common ancestor with each other, and chickens and oak trees share a common ancestor with each other, but chimpanzees and gorillas do not share a common ancestor with chickens and oak trees.
 - C. Because chimpanzees, gorillas, chickens, and oak trees are separate species, none of them shares a common ancestor with any other.
 - D. Chimpanzees, gorillas, chickens, and oak trees all share an ancient common ancestor.
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RH20-3

22. Which of the following does DNA provide information for?

- A. Both the types of amino acids that make up a protein, and the sequence of those amino acids
 - B. The types of amino acids that make up a protein molecule, but not the sequence of amino acids
 - C. The sequence of amino acids that make up a protein molecule, but not the types of amino acids
 - D. Neither the types of amino acids that make up a protein, nor the sequence of those amino acids
-

23. The table below shows the presence or absence of traits in seven different species.

| Character | Frog | Bird | Crocodile | Whale | Pig | Gorilla |
|----------------|------|------|-----------|-------|-----|---------|
| Blowhole | | | | Yes | | |
| Body hair | | | | Yes | Yes | Yes |
| Amniotic egg | | Yes | Yes | Yes | Yes | Yes |
| Forelimbs | Yes | Yes | Yes | Yes | Yes | Yes |
| Backbone | Yes | Yes | Yes | Yes | Yes | Yes |
| Holes in Skull | | Yes | Yes | | | |

Based only on the traits presented in the table, which organism would you expect to have the most genetic similarity with crocodiles?

- A. Birds
 - B. Gorillas
 - C. Whales
 - D. Not enough information is available
-

SP1-1

24. Cichlids are fish that live in freshwater lakes. There are over a thousand different species of cichlids that differ in size, color, habitat, and diet. Which piece of evidence might scientists use to determine that two populations of cichlids are from different species?

- A. The two populations have a common ancestor.
 - B. One population eats algae and the other population eats snails.
 - C. Individuals from the two populations cannot reproduce with each other.
 - D. One population lives at the bottom of the lake and the other lives near the surface.
-

CA9-4

25. If the DNA of lizards and dogs is more similar than the DNA of lizards and toads, what is a reasonable conclusion about the common ancestors of these three groups?

- A. Lizards and dogs have a common ancestor, but lizards and toads do not.
- B. Lizards and dogs have a more recent common ancestor than lizards and toads.
- C. Lizards and toads have a more recent common ancestor than lizards and dogs.
- D. Similarities in DNA cannot provide information about the common ancestors of lizards, dogs, and toads because lizards, dogs, and toads do not have a common ancestor.

SP3-5

26. *Annosum* are a group of sexually reproducing fungi that live on and eat trees in North America, Europe, and Asia. Which of the following would provide the strongest evidence that that the *Annosum* living in Europe and Asia are different species?

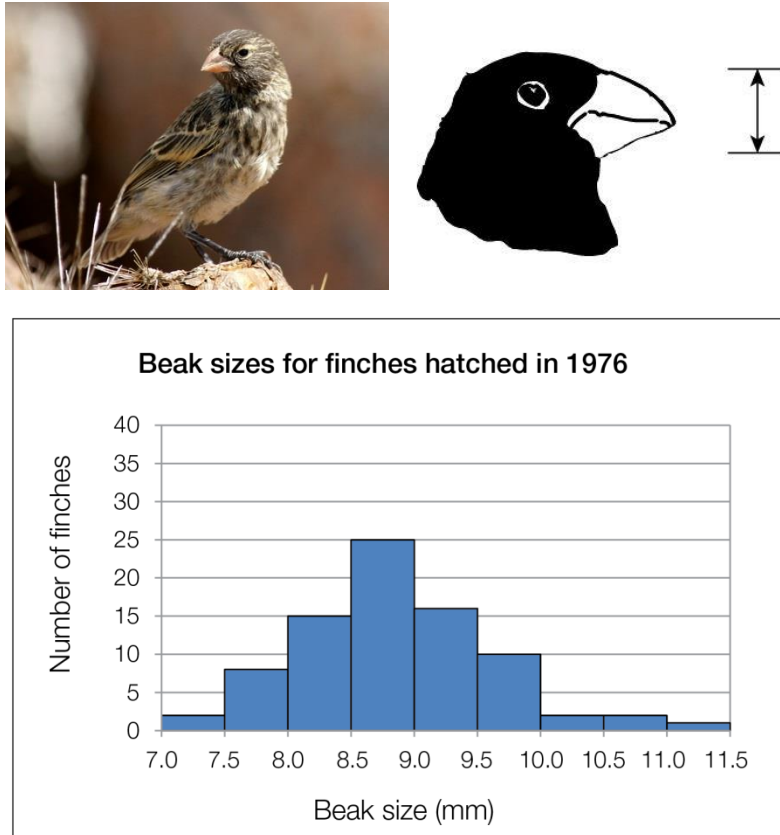


Photo taken by James Lindsey, distributed under a CC-BY-SA 2.5 license

- A. *Annosum* collected in Europe have genetic differences compared to *Annosum* collected in Asia.
- B. *Annosum* collected in Europe are all white in color and *Annosum* collected in Asia are all brown in color.
- C. *Annosum* collected in Europe and *Annosum* collected in Asia do not mate because they live on different continents.
- D. *Annosum* collected in Europe and *Annosum* collected in Asia cannot mate to produce viable offspring even when they are brought together.

27. The ground finch is a species of bird. Seeds are the finches' main source of food. Finches with small beaks can eat only small seeds, but finches with large beaks can eat both small and large seeds. Beak size is inherited.

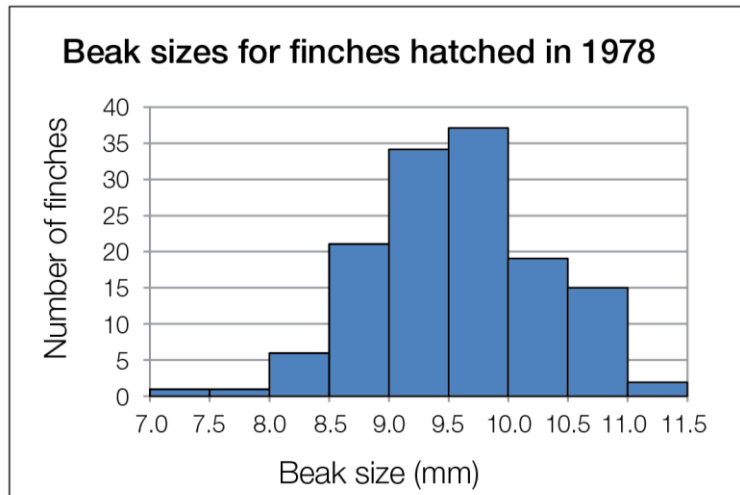
In 1976 scientists collected data on the size of the beaks of a population of finches that hatched that year. The graph below shows the beak size (in millimeters) of the 1976 sample.



Left: An individual female ground finch. Middle: A drawing showing the part of the finches' beaks that the scientists were measuring. Right: Graph showing beak size (in millimeters) of ground finches hatched in 1976.

In 1977, during a long period without rain many plants that produced small seeds died.

To learn how this influenced the next generation of finches; scientists returned in 1978 and measured the beak size of finches that hatched that year. The graph below shows the beak size (in millimeters) of the 1978 sample.



Graph showing beak size (in millimeters) of ground finches that hatched in 1978.

Do you think the process of natural selection caused the changes in the finch populations between 1976 and 1978?

Write your answer in the form of an **argument**. Your argument should include: A **claim** that answers the question, **evidence** in the form of specific scientific data that supports your claim, and **reasoning** that uses appropriate scientific principles and justifies why the data counts as evidence for your claim. If you need more space to write your argument use the back of this page.

28. Scientists studying evolution compared the DNA of chimpanzees, gorillas, and orangutans.

The scientists summarized their data in the following table:

| Pair of Species Compared | Average Genetic Similarity |
|---------------------------------|-----------------------------------|
| Chimpanzee and Gorilla | 98% |
| Chimpanzee and Orangutan | 97% |
| Gorilla and Orangutan | 97% |

When the scientists published their research, they made the following claim:

"Chimpanzees and gorillas have a more recent common ancestry than chimpanzees and orangutans."

What **evidence** and **reasoning** are the scientists using to make this **claim**?

Your answer should include **evidence** in the form of specific scientific data that supports the scientists' claim, and **reasoning** that uses scientific principles about heredity and common ancestry to justify why the data counts as evidence for their claim. If you need more space to write your argument use the back of this page.

End of Test