

Evolution Pre-Test

LOGIN CODE = BOOPAC3

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

SP3-5

1. *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.
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2. Cichlids are a group of fish that live in freshwater lakes. Scientists wanted to determine whether two populations of cichlids that live at different depths of a lake interbreed. They knew that cichlids must be able to see potential mates in order to reproduce with them. They also knew that cichlids with particular genotypes see better at different water depths. Information about three different genotypes is summarized in the table below:

Genotype	Ability to see potential mates in deep water	Ability to see potential mates in shallow water
LL	Excellent	Poor
HH	Poor	Excellent
LH	Moderate	Moderate

If scientists determined the genotypes of a representative sample of fish from both the deep and shallow water populations, what would provide the best evidence that some of the individuals in the deep and shallow water populations are reproducing with each other?

- A. All individuals in both deep and shallow water populations have just the LL genotype.
 - B. Individuals with the LL, HH, and LH genotypes are present in both the deep and shallow water populations.
 - C. Only the LL genotype is present in the deep water population and only the HH genotype is present in the shallow water population.
 - D. Not enough information is provided.
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CA17-3

3. 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
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RH19-3

4. What do DNA and proteins have to do with each other?

- A. DNA is a type of protein.
 - B. Proteins are a type of DNA.
 - C. DNA provides information for making proteins.
 - D. DNA and proteins have nothing to do with each other.
-

EH8-1

5. When can mutations occur?

- A. Mutations can occur at any time.
 - B. Mutations can occur only when the environment is changing.
 - C. Mutations can occur only when the environment is not changing.
 - D. Mutations can occur only when an individual needs a mutation to survive.
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EN46-10

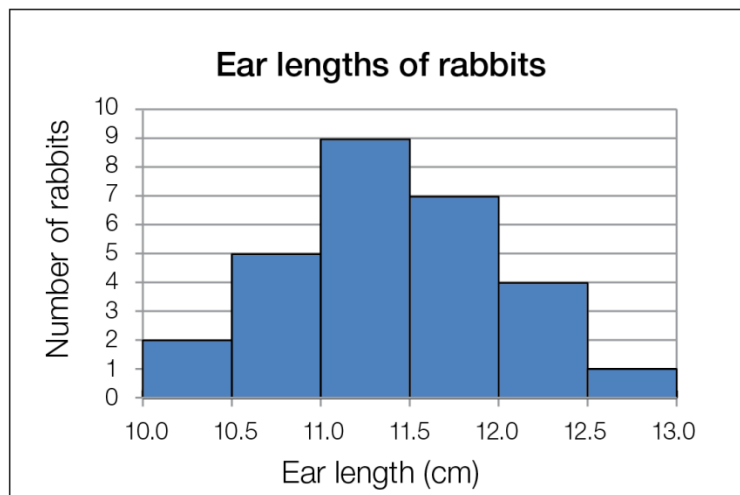
6. Some animals, such as a cat and a dog, have many similarities. Others, such as a fish and a bird, have fewer similarities. What is TRUE about the ancestors of these animals?

- 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.
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7. A population is a group of individuals of the same species. Can the proportion of individuals with certain traits in a population change because the environment changes?

- A. Yes, when the environment changes, individuals in a population can change their inherited traits to better fit the environment, and this changes the proportion of individuals with certain traits in that population.
- B. Yes, when the environment changes, individuals with certain inherited traits survive and reproduce and other individuals with different inherited traits die, and this changes the proportion of individuals with certain traits in a population.
- C. No, the proportion of individuals with certain inherited traits in a population changes randomly from one generation to the next, never as a result of changes to the environment.
- D. No, the proportion of individuals with certain inherited traits in a population cannot change because a population is all one species and so will always have the same inherited traits.

8. The graph below shows the ear lengths of a population of rabbits.



Which of the following claims about the population do the data in this graph support?

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

SP1-1

9. 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.
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10. Scientists studying evolution compared the DNA of several primate species. They looked for genetic similarities.

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 findings, they wrote:

"We studied the DNA of several ape species by sequencing their DNA. Genetic similarities can be used to measure how closely related two species are. Gorillas and chimpanzees have 98% genetic similarity and gorillas and orangutans have 97% genetic similarity. Gorillas and chimpanzees have a more recent common ancestor than do gorillas and orangutans."

Which of the following describes a valid argument that the scientists are making?

- A. **Claim:** Gorillas and chimpanzees have a more recent common ancestor than gorillas and orangutans.
Evidence: The genetic similarity between gorillas and chimpanzees was 98% and the genetic similarity between gorillas and orangutans is 97%.
Reasoning: When comparing multiple species the species with the greater genetic similarity have a more recent common ancestor.
- B. **Claim:** Gorillas and chimpanzees have a more recent common ancestor than gorillas and orangutans.
Evidence: When comparing multiple species the species with the greater genetic similarity have a more recent common ancestor.
Reasoning: The genetic similarity between gorillas and chimpanzees was 98% and the genetic similarity between gorillas and orangutans is 97%.
- C. **Claim:** Gorillas and chimpanzees have more genetic similarity than gorillas and orangutans.
Evidence: The genetic similarity between gorillas and chimpanzees was 98% and the genetic similarity between gorillas and orangutans is 97%.
Reasoning: Genetic similarities can be used to measure how closely related two species are.
- D. **Claim:** When comparing multiple species the species with the greater genetic similarity have a more recent common ancestor.
Evidence: Genetic similarity is a measure of how similar the DNA from two organisms is.
Reasoning: The genetic similarity between gorillas and chimpanzees was 98% and the genetic similarity between gorillas and orangutans is 97%.
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EH49-2

11. 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
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EH17-2

12. Which of the following correctly describes the relationship between two different alleles of the same gene and the DNA sequences of those alleles?

- A. Two alleles of the same gene are completely different. Their DNA sequences do not have any nucleotides in common.
 - B. Two alleles of the same gene have some nucleotides in common in their DNA sequences and some that are different.
 - C. Two alleles of the same gene are identical. All of their nucleotides are the same and they are in the same order.
 - D. There is no relationship between nucleotides and alleles. Nucleotides make up a gene, not an allele.
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RH7-2

13. A change commonly referred to as a mutation occurs to a DNA molecule in an organism's skin cell before the organism reproduces. When the organism reproduces, how many of its children will have the mutation?

- A. All of the organism's children will have the mutation.
 - B. Some of the organism's children will have the mutation.
 - C. None of the organism's children will have the mutation.
 - D. It will depend on how much time passes between when the mutation occurs and when the organism has children.
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CA18-3

14. Cats and dogs are descended from the same ancestor species. Which scenario best describes how this happened?

- A. One group of individuals in the ancestral species population bred with a different, more cat-like species, while another group bred with a different, more dog-like species.
 - B. Two groups in the ancestral species population became separated from each other and could no longer breed with each other. Over many generations, the descendants of one group became cats and descendants of the other group became dogs.
 - C. There were two different groups in the ancestral species population that could interbreed with each other. Over many generations, one group changed into cats and the other group changed into dogs.
 - D. There were two groups in the ancestral species population that interbred with each other. Then they stopped breeding with each other, they became two different species, cats and dogs.
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EH12-2

15. Bacteria make a protein that is poisonous to crop-eating insects. Scientists are trying to insert the gene that codes for this protein into corn plants to protect them against pests. If the bacterial gene is inserted into corn plants, could the plants make the poisonous protein?

- A. Yes, because all living organisms decode DNA to make proteins.
 - B. Yes, because all species already make the same proteins.
 - C. No, because one species could never make another species' proteins.
 - D. No, because one species could never decode another species' DNA.
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16. Dogs, pigs, and cats have similar genes for traits that they share in common (such as four legs, a tail, etc.) One of these genes, Gene X, is pictured below.

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 . . .

Why do you think the DNA sequence of Gene X for dogs, pigs, and cats is the same at some of the positions (pictured in black)?

- A. All three species inherited the gene from a common ancestor.
 - B. All three species had similar needs, so they had to intentionally create similar genes.
 - C. Separate mutations in the three species made the genes similar by coincidence.
 - D. Not enough information is given.
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17. If forelimbs were present in the common ancestor of birds, crocodiles, whales, pigs, and humans, what would be true about the genes that code for forelimbs in these different animals? (Forelimbs include arms, wings, and fins.)

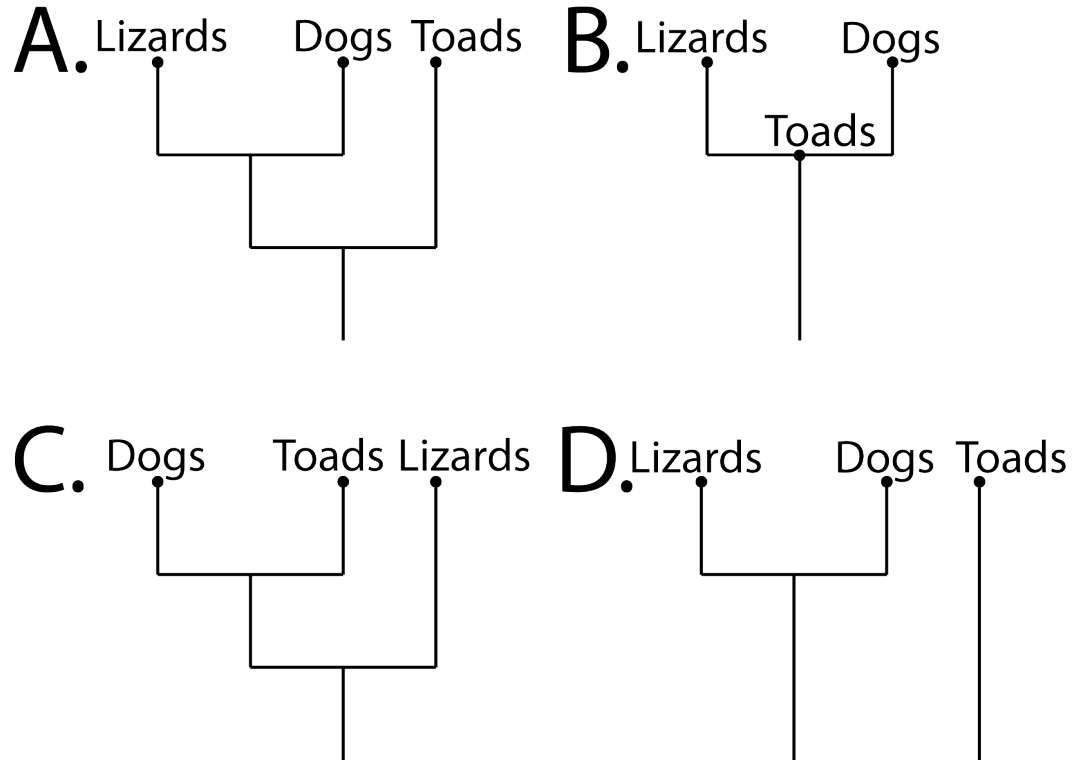
- A. Many of the same genes would code for forelimbs in all of these animals
 - B. Completely different sets of genes would code for forelimbs in each of these animals
 - C. Information about the common ancestors of different species provides no information about similarities and differences in their genes.
 - D. Many of the same genes would code for arms in crocodiles, pigs, and humans, but these genes would be completely different than the genes that code for wings in birds or fins in whales.
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18. A scientist finds some fossils of an extinct species of fish. Which of the following could he do by studying the fossils?

- A. He could discover what anatomical features the extinct species had, and he could discover similarities and differences between the features of the extinct fish and those of currently existing fish.
 - B. He could discover what anatomical features the extinct species had, but he could not discover any similarities and differences between the features of the extinct fish and those of currently existing fish.
 - C. He could discover similarities and differences between the features of the extinct fish and those of currently existing fish, but he could not discover what anatomical features the extinct species had.
 - D. He could neither discover similarities and differences between the features of the extinct fish and those of currently existing fish, nor could he discover what anatomical features the extinct species had.
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19. If the DNA of lizards and dogs is more similar than the DNA of lizards and toads, which diagram most likely depicts the ancestry of these three groups?

Circle the diagram which most likely depicts the ancestry of these three groups..



20. 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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EN30-4

21. Which of the following correctly describes what happens when a population of bacteria becomes resistant to an antibiotic? Note: a bacterium is a single individual in the population of bacteria.

- A. During treatment with an antibiotic, each individual bacterium tries to become resistant to the antibiotic. Only some are able to become resistant, and these individuals survive to pass this trait to their offspring.
 - B. During treatment with an antibiotic, all of the bacteria gradually become more resistant to the antibiotic the more they are exposed to it. They all survive and pass this trait to their offspring.
 - C. During treatment with an antibiotic, a population of bacteria usually dies. Sometimes by chance, all members of the population become resistant at once, survive, and pass their resistance to their offspring.
 - D. During treatment with an antibiotic, only those individual bacteria that already have a trait that helps them survive the effects of the antibiotic will live. Their offspring in the next generation will also have this trait.
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EN23-1

22. According to the theory of natural selection, what would happen to a species of lizards when a new predator is introduced into the environment where the lizards live?

- A. The lizards that already have the physical traits needed to avoid the new predator would be more likely to survive and reproduce, and the ones that do not would be less likely to survive and reproduce.
 - B. All of the lizards would try to develop new physical traits to avoid the new predator.
 - C. Some of the lizards would try to develop new physical traits to avoid the new predator, and the other lizards would die.
 - D. Because all lizards of the same species have the same physical traits, one lizard would not have an advantage over another lizard. They would either all survive or all die.
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23. **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. 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.
- D. Mutation happens when errors are made in copying the DNA, sometimes as a result of environmental causes.

EN46-12

24. Some organisms, such as a chimpanzee and a gorilla, have many similarities. Others, such as a zebra and a worm, have fewer similarities. What is TRUE about the ancestors of these organisms?

- A. Chimpanzees and gorillas share a common ancestor with each other, but zebras and worms do not share a common ancestor with each other.
 - B. Chimpanzees and gorillas share a common ancestor with each other, and zebras and worms share a common ancestor with each other, but chimpanzees and gorillas do not share a common ancestor with zebras and worms.
 - C. Because chimpanzees, gorillas, zebras, and worms are separate species, none of them shares a common ancestor with any other.
 - D. Chimpanzees, gorillas, zebras, and worms all share an ancient common ancestor.
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EN54-2

25. What is TRUE about maple trees and lizards?

- A. There are both similarities and differences between maple trees and lizards.
 - B. There are similarities but no differences between maple trees and lizards.
 - C. There are differences but no similarities between maple trees and lizards.
 - D. There is no way to tell if maple trees and lizards have similarities or differences.
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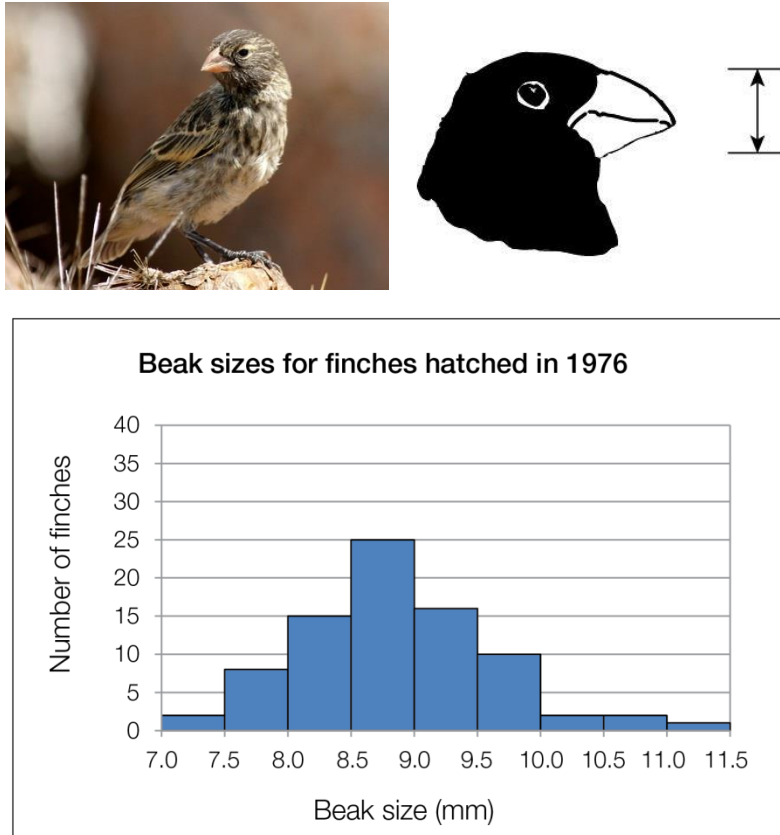
EM42-4

26. 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

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.

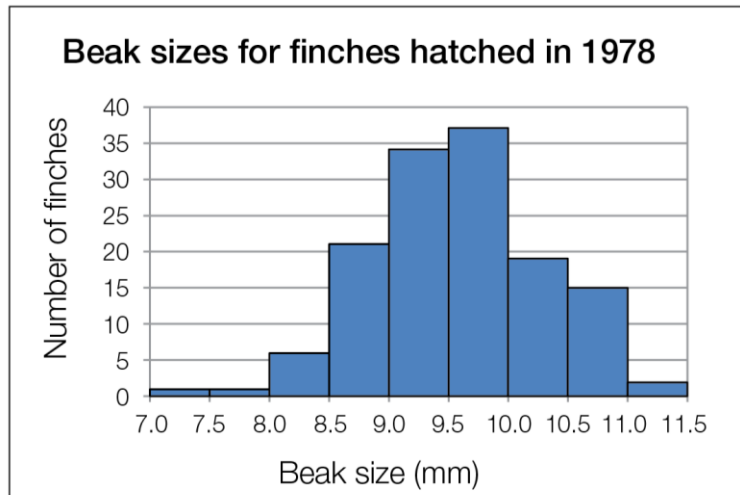
In 1976 scientists collected data on the size of the beaks of a population of finches that hatched that year. The graph below shows the beak size (in millimeters) of the 1976 sample.



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