

Keystone Practice Questions #3

Gene Technology

Evolution

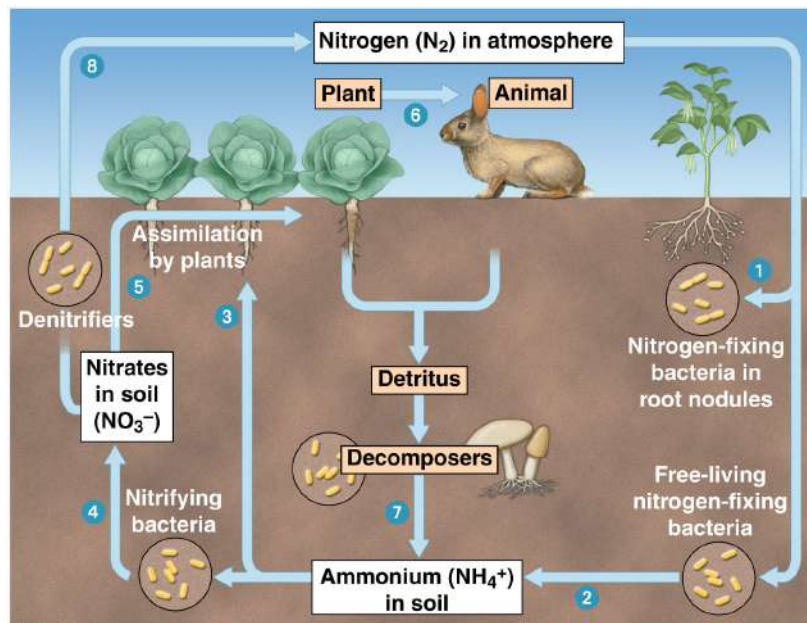
Ecology

1. Which statement correctly describes how nitrogen in the soil returns to the atmosphere?

- A. Soil bacteria convert into nitrogen gas.
- B. Decomposers directly convert ammonium into nitrogen gas.
- C. Plants assimilate nitrites and convert them into nitrogen gas.
- D. Nitrogen-fixing bacteria in plant roots convert nitrates into nitrogen gas.

Nitrogen Cycle

- If you recall the nitrogen cycle, only bacteria can convert nitrogen gas to a useable form, conversely, they are also the only organisms that can return it to the atmosphere.



2. Agricultural runoff can carry fertilizers into lakes and streams. This runoff can cause algae populations to increase. Which effect does this change in the algae population sizes **most likely** have on affected lakes and streams?

- A. an increase in water level
- B. an increase in water clarity
- C. a reduction in dissolved oxygen needed by fish and shellfish
- D. a reduction in temperature variations near the water's surface

Algal Blooms

- An increase in the algae population in a body of water is referred to as an algal bloom.
- This is not good for the other organisms living in that type of ecosystem. The water is difficult to see through, and the algae use all the dissolved oxygen so fish can no longer breath

3. Genetic engineering has led to genetically modified plants that resist insect and bacterial and fungal infections. Which outcome would most likely be a reason why some scientists recommend caution in planting genetically modified plants?

- A. Unplanned ecosystem interactions
- B. Reduced pesticide and herbicide use
- C. Improved agricultural yield and profit
- D. Increased genetic variation and diversity

GMOs

- The biggest threat to using GMOs in agriculture is the possible interactions the organism will have with other organisms in the environment. If the plant were to fertilize a non-GMO plant, the genes could become part of the environment and potentially upset the ecosystem but preventing natural bacteria, fungus, and insects from living where they naturally occur (on plants)

4. A mutation occurs in the genes that code for coat color in deer. Which change will most likely result from this mutation?

- A. A change in the selection pressures acting on coat color.
- B. A change in the coat-color genes of deer predator species.
- C. An increase in coat-color diversity in the population.
- D. An increase in the number of genes for coat color in the population

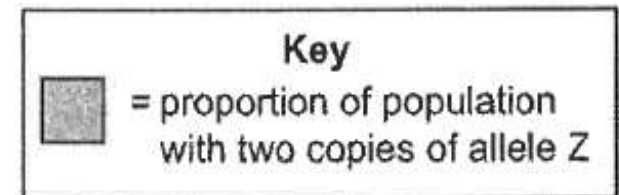
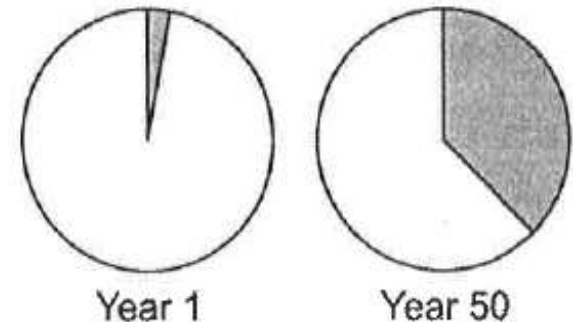
Mutations

- From the wording of the question, you would have to assume that coat color in deer is controlled by only one gene.
- Genes can only control what the organisms looks like, not what is the best fit for the environment.
- Adding another coat color to the population would increase the diversity

5. Use the circle graphs below to answer the question. The graphs illustrate change in a lizard population over time. Which process most likely led to the change in the lizard population?

- A. natural selection for a trait that is beneficial to lizards
- B. natural selection against a trait that is beneficial to lizards**
- C. artificial selection for a trait that is beneficial to lizards
- D. artificial selection against a trait that is beneficial to lizards

Changes In Allele Frequency Over Time

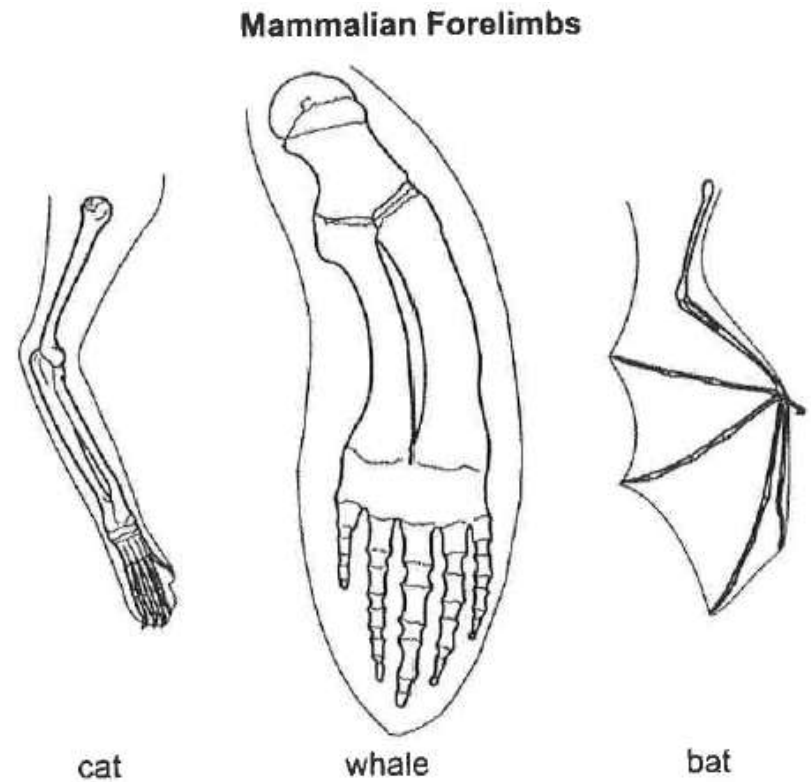


Natural vs. Artificial Selection

- Artificial selection would be the selection for a trait that is beneficial to humans, not necessarily the organism we are breeding.
- Natural selection is the selection of a trait that would lead to increased fitness of the individual (the individual would survive longer and be able to produce more offspring)

6. Use the illustration below to answer the question.
The skeletons of mammalian forelimbs represent variations of a structure that was present in their common ancestor. What has most likely caused the variation in forelimbs?

- A. Changes in muscle structure
- B. Changes in the genetic codes**
- C. Trait formation due to behaviors
- D. Development of vestigial structures



Forelimbs

- The similarity in structure of all the mammalian forelimbs can be attributed to the fact that we all evolved from a common ancestor that had a similar forelimb structure.
- Over time, these structures may change in order to best suit the environment the organism is living in

7. Use the table below to answer the question. The gene COII is the genome of many organisms. A comparison of the number of base differences between the COII gene in a rat and that of two other animals is shown.

Sequence Differences between
COII Genes in Some Animals

Animal	Number of Base Differences from a Rat
mouse	101
cow	136

- **Part A:** Based on the data, describe a possible evolutionary relationship between rats, mice, and cow. **Mice & rats more closely related, smaller differences**
- **Part B:** Describe how different organisms having a common gene, such as COII, supports the theory of evolution. **If 2 organisms share a gene, they likely shared a common ancestor who passed on the gene to each**

Inferring Evolutionary Relationships

- **Part A:** The fewer the number of base differences, the more closely related two organisms are. The mouse and the rat have the fewest number of differences (101), therefore they are more closely related to one another than the rat is to the cow.
- **Part B:** The fact that many organisms use the same protein suggests that we all are descendant from a common ancestor. It would be highly unlikely that different species evolved to use the same proteins to carry out the same functions in the body unless they shared a common ancestor. The common ancestor used the COL1 protein and when it branched into other species, those species continued using the protein.

8. Use the table below to answer the question. A group of students measured a ten-square-meter section of a pond ecosystem and recorded observations. Which statement is a testable hypothesis?

Student's Observations of a Pond Ecosystem

Quantitative	Qualitative
37 fish and 3 frogs	Leaves lie on the bottom of the pond.
2 types of aquatic grass	Water insects move along the water's surface.
12 small rocks and 1 medium rock	All 3 frogs are sitting on a pond bank.
sand	

- A. The frogs living in the pond represent a population
- B. Water is an abiotic component in the pond ecosystem.
- C. If the fish are given more food, then they will be happier.
- D. If the frogs are startled, then they will jump into the water.

9. Use the list below to answer the question. A student wrote several observations in a field notebook. Which term best classifies all of the student's observations?

Observations

- Two grey wolves
- five moose
- several species of conifer trees
- large granite rock
- shallow pond

- A. Population
- B. Food chain
- C. Ecosystem
- D. community

Observations

- The addition of the granite rock and shallow pond makes this list of living and nonliving things.
- A population consists of only one species, a food chain only includes living individuals, and a community includes all living things.

10. A researcher observing an ecosystem describes the amount of sunlight, precipitation, and type of soil present. Which factors is the researcher **most likely** describing?

- A. biotic factors in a forest
- B. biotic factors in a tundra
- C. abiotic factors in a prairie
- D. abiotic factors in an ocean

Biotic vs. Abiotic

- All the things being described are nonliving (Abiotic)
- The addition of soil would indicate this ecosystem is terrestrial (found on land)
- The only option that meets both these criteria is a prairie

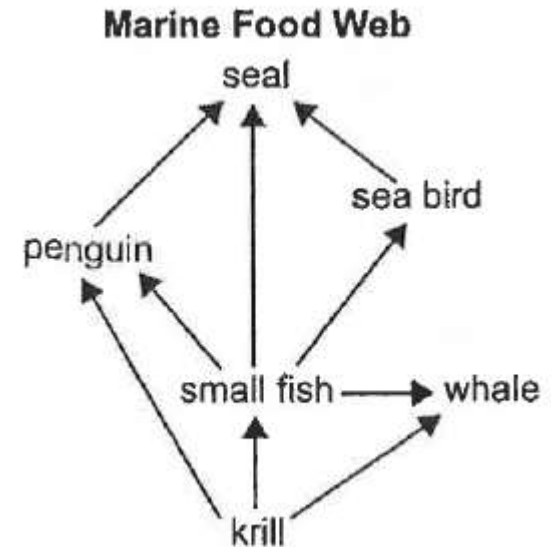
11. A farmer observed that an increase in a field's soil nitrogen content was followed by an increase in producer productivity.

What does this observation **most likely** indicate about the relationship between nitrogen and the producers in the field?

- A. Nitrogen was a biotic factor.
- B. Nitrogen was a limiting factor.**
- C. Nitrogen became a surplus resource.
- D. Nitrogen became a selection pressure.

12. Use the diagram below to answer the question. Which sequence correctly describes the flow of energy between organisms in the marine food web?

- A. from seals to penguins to krill
- B. from whales to krill to small fish
- C. from sea birds to seals to penguins
- D. from small fish to penguins to seals



Food Webs

- The arrows on the food web indicate the movement of the energy.
- The energy in this food web begins with the primary consumer, in this case, krill.
- The correct sequence for this food web is from small fish, to penguins, to seals.

13. A species of snapping turtles has a tongue that resembles a worm. The tongue is used to attract small fish. Which **best** describes the interaction between the fish and the snapping turtle.

A. Predation

B. Symbiosis

C. Parasitism

D. Competition

Symbiosis

- Symbiosis describes any relationship between two species.
- The turtle is using its tongue to attract small fish in order to eat them. This is an example of predation.

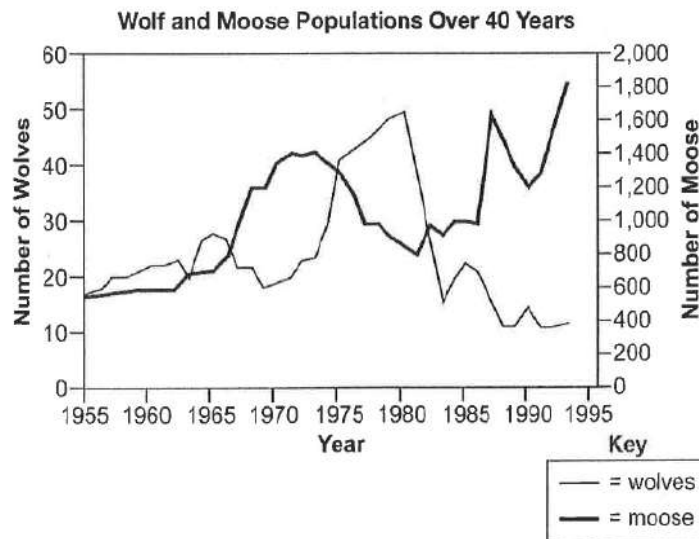
14. In North America, the eastern spotted skunk mates in late winter, and the western spotted skunk mates in late summer. Even though their geographic ranges overlap, the species do not mate with each other. What most likely prevents these two species from interbreeding?

- A. Habitat isolation
- B. Gametic isolation
- C. Geographic isolation
- D. Reproductive isolation

Mechanisms for Speciation

- This is an example of reproductive isolation because these two species are never given the opportunity to produce offspring.
- They live in the same region and could produce offspring if they were to mate at the same time of the year.

15. Use the graph below to answer the question. Isle Royale is located in Lake Superior. Isle Royale is home to populations of wolves and moose. The interactions between the wolves and moose, as well as the individual population sizes, have been studied since 1958. The graph shows the population sizes over time for both wolves and moose.



- **Part A:** Describe one limiting factor for the moose population
- **Part B:** Explain one likely reason why the wolf population rapidly increased between 1975 and 1980.
- **Part C:** Predict what will happen to the moose population's size after 1994 by describing the shape of the curve. In your answer, be sure to explain the reasoning behind your prediction.

A. Limiting Factor – Food supply is a limiting factor on an island because the moose cannot move somewhere else when their food supply runs out. Moose eat plants so there needs to be enough plants for moose to survive.

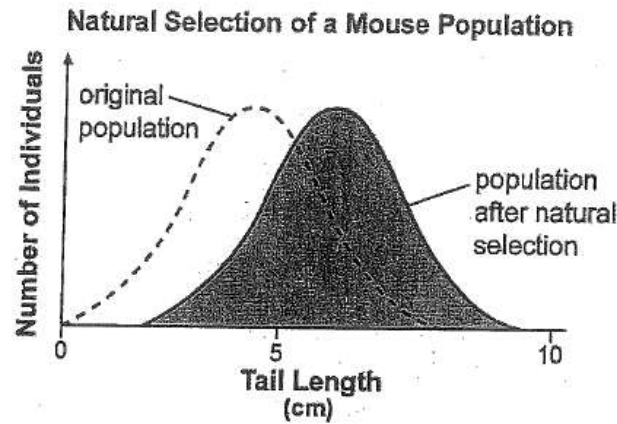
B. Increase? The wolf population increased because they had plenty of food. Wolves can eat moose. The moose population increased between 1970 – 1975 so there was a lot of food for the wolves to eat on the island.

C. What will happen? The moose line could level out (with some fluctuation). This means the moose have reached carrying capacity for the island. The wolf line would likely level out, too. The moose line cannot continue to go up because the moose will run out of food with too many animals on the island.

16. The frequency of an allele in the fly population changes from 89% to 20% after three generations. Which other events most likely occurred during the same time period?

- A. An environmental change and a fly population increase
- B. An environmental change and a fly population decrease = bottleneck effect
- C. Interbreeding of flies with an invasive species and fly population speciation
- D. Interbreeding of flies with an established local species and fly population speciation

17. Use the graph below to answer the question:



Tail length in mice varies within a population. Scientists observed change in the distribution of tail lengths in a mouse population over time. At the genetic level, what has **most likely** happened to the allele for the shortest tail lengths?

- A. The allele changed from being dominant to being recessive
- B. The allele changed from being autosomal to being sex-linked
- C. The allele became less frequent than the alleles for longer tail lengths.
- D. The allele began to code for long tail lengths instead of the shortest ones.

18. Scientist observed that the populations of top-level consumers in a particular ecosystem were rapidly decreasing. Further studies revealed that there was also a decline in producer productivity. Which other changes did the scientist **most likely** observe in the ecosystem?

- A. Increased producer diversity
- B. Decreased population size at all levels
- C. Decreased primary consumer populations only
- D. Increased primary and secondary consumer diversity