

EVOLUTION REVIEW

B. Sample Multiple Choice Questions

- Which of the following is most often associated with the elaborate courtship rituals conducted by many birds?
 - species recognition
 - migration
 - feeding response
 - altruism
 - kin selection

- The replacement of glutamic acid by valine at a specific position in the beta chains of hemoglobin leads to sickle cell anemia. This change represents which of the following mutational events?
 - DNA base-pair substitution
 - DNA base-pair deletion
 - DNA base-pair addition
 - chromosomal deletion
 - frameshift mutation

- The difference in cricket calls among sympatric species of crickets are examples
 - habitat isolation
 - temporal isolation
 - physiological isolation
 - behavioral isolation
 - geographic isolation

- Which of the following principles is NOT part of Darwin's theory of evolution by natural selection?
 - Evolution is a gradual process that occurs over long periods of time.
 - Variation occurs among individuals in a population.
 - Mutations are the ultimate source of genetic variation.
 - More individuals are born than will survive.
 - Individuals that possess the most favorable variations have the best chance of reproducing.

- In a small group of people living in a remote area, there is a high incidence of "blue skin", a condition that results from a variation on the structure of hemoglobin. All of the "blue-skinned" residents can trace their ancestry to one couple, who were among the original settlers of this region. The unusually high frequency of "blue skin" in the area is an example of
 - mutation
 - genetic drift
 - natural selection
 - sexual selection
 - heterozygote advantage

- Which of the following statements best expresses the concept of punctuated equilibrium?
 - Small variations gradually accumulate in evolving lineages over periods of millions of years.
 - Random mating ensures that the proportions of genotypes in a population remain unchanged from generation to generation.
 - Stability is achieved when selection favors the heterozygote, while both types of homozygotes are at a relative disadvantage.
 - Evolutionary changes consist of rapid bursts of speciation alternating with long periods in which species remain essentially unmodified.

e. Under competition for identical resources, one of the two competing species will be eliminated or excluded.

7. In certain Native American groups, albinism due to homozygous recessive condition in the biochemical pathway for melanin is sometimes seen. If the frequency of the allele for this condition is 0.06, which of the following is closest to the frequency of the dominant allele in this population? (Assume Hardy-Weinberg equilibrium)

- a. 0.04
- b. 0.06
- c. 0.16
- d. 0.36
- e. 0.94

Question 8 - 9: In a certain flock of sheep, 4 percent of the population has black wool and 96 percent has white wool. Assume Hardy-Weinberg equilibrium.

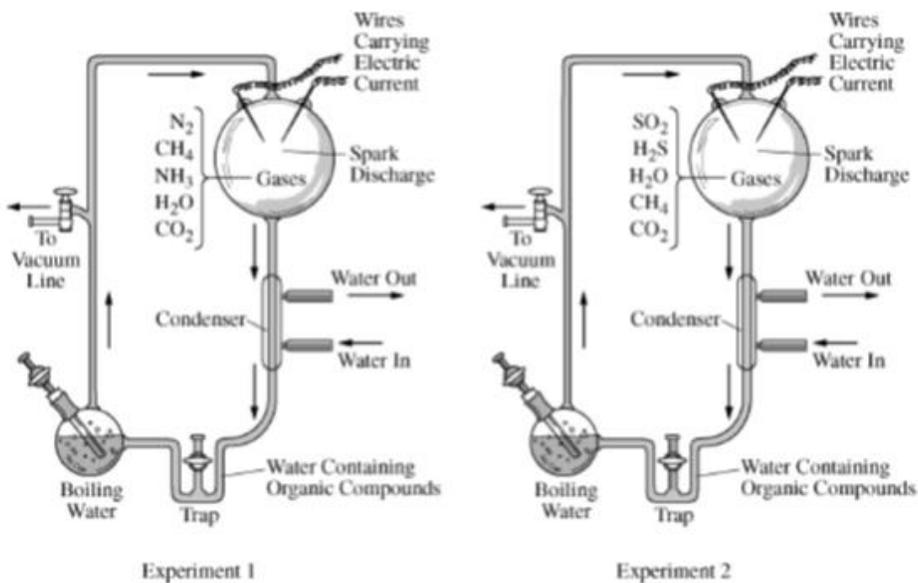
8. If black wool is a recessive trait, what percentage of the population is heterozygous for this trait?

- a. 4%
- b. 20%
- c. 32%
- d. 64%
- e. 80%

9. What percentage of the population is homozygous for white wool?

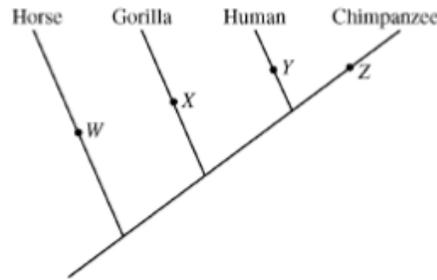
- a. 20%
- b. 40%
- c. 64%
- d. 80%
- e. 96%

10. Two groups of students attempted to re-create the primitive atmospheric conditions of early Earth using the apparatus represented below. Each group ran the experiment with different gas mixtures in the apparatus.



Which of the following statements justifies the claim that the conditions in at least one of the experiments could generate the molecular building blocks essential for life?

- A. The carbon dioxide gas and water vapor in experiment 1 could react spontaneously to produce phospholipids required by the first life forms.
 - B. The nitrogen gas and ammonia gas in experiment 1 could provide the elemental nitrogen required for the formation of amino acids.
 - C. The sulfur dioxide gas in experiment 2 could donate the excited electrons required to drive the process of photosynthesis.
 - D. The methane gas in experiment 2 could act as the electron acceptor required to complete the process of cellular respiration.
11. The cladogram below depicts an accepted model of the evolutionary relationships among selected species.



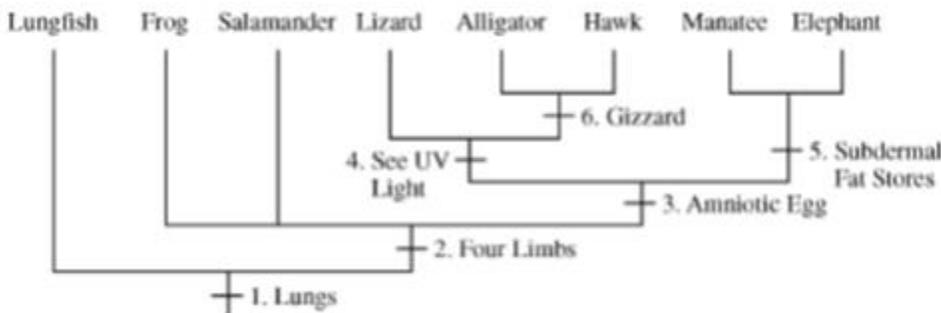
The amino acid at position 104 in the beta-hemoglobin protein for each of these four organisms is listed below.

Species	Amino Acid 104
Horse	Arginine
Gorilla	Leucine
Human	Arginine
Chimpanzee	Arginine

The validity of the cladogram is best supported by molecular evidence for which of the following changes in the amino acid composition of the beta-hemoglobin protein during the evolution of these species.

- A. Arginine to leucine at position X on the cladogram.
- B. Arginine to leucine at position Y on the cladogram.
- C. Leucine to arginine at position W on the cladogram.
- D. Leucine to arginine at position Z on the cladogram.

12. Completion question



The cladogram above shows proposed phylogenetic relationships for several vertebrates. Selected derived traits are indicated on the cladogram by numbered labels. Based on the information presented, which of the derived traits is shared by alligators and manatees but not salamanders? Give your answer as the number label of a character indicated on the cladogram.

3

C. Sample Free Response Questions

1. Darwin is considered the "father of evolutionary biology." Four of his contributions to the field of evolutionary biology are listed below.

- The nonconstancy of species **within a species there is genetic variation (any example will work: in a herd of deer some can run faster than others; peppered moths have variations in color from light brown to dark brown)**
- Branching evolution, which implies the common descent of all species **(all mammals have the same bones in their forelimbs, implying a common ancestor. The bones have changed (evolved / adapted) to different environments, Human - grasping, Bats - flying, Whales - swimming)**
- Occurrence of gradual changes in species **fossil record**
- Natural selection as the mechanism for evolution **genetic variation in organisms, some variation may give some individuals an advantage in their environment, these individuals will survive and reproduce - passing on their genetic advantages. (antibiotic resistant bacteria would be a good example)**

a. For EACH of the four contributions listed above, **discuss** one example of supporting evidence.

b. Darwin's ideas have been enhanced and modified as new knowledge and technologies have become available. **Discuss** how TWO of the following have modified biologists' interpretation of Darwin's original contributions.

- Hardy-Weinberg equilibrium
- Punctuated equilibrium
- Genetic engineering

2. Charles Darwin proposed that evolution by natural selection was the basis for the differences that he saw in similar organisms as he traveled and collected specimens in South America and on the Galapagos Islands.

a. Explain the theory of evolution by natural selection as presented by Darwin. Each of the following relates to an aspect of evolution by natural selection.

b. Explain three of the following.

- Convergent evolution and the similarities among species (ecological equivalents) in a particular biome (e.g., tundra, taiga, etc.)
- Natural selection and the formation of insecticide-resistant insects or antibiotic-resistant bacteria
- Speciation and isolation & Natural selection and behavior such as kinesis, fixed-action-pattern, dominance hierarchy, etc.
- Natural selection and heterozygote advantage