

一、選擇題 choose one best answer from each question (30%) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. Which of the following is NOT true about natural selection?

- A) It depends on both inheritance and variation.
- B) It explains how environments affect which organisms live and reproduce.
- C) It ensures that only the strongest and most fitted organisms survive.
- D) It results in adaptations that improve an organism's chances of survival.

2. What does "the fittest" mean in an evolutionary sense?

- A) The strongest; B) The longest lived; C) The most reproductively successful; D) The best able to avoid predators

3. According to the concept of the tree of life, what is the goal for phylogenetic analysis?

- A) To explain how all species are related
- B) To be a library of all life that has ever lived
- C) To describe how natural selection works
- D) To summarize the fossil record.

4. For a mutation to affect evolution, it must:

- A) Involve more than one chromosome
- B) Provide a benefit to the organism
- C) Be able to get passed from parent or offspring
- D) Be neutral—neither help nor harm the organism

5. "An organism that is closely related to the group you're interested in, but not a part of it. A way to establish a basis of comparison for a trait analysis." This is a definition of

- A) an ancestor; B) a molecular marker; C) an outgroup; D) a monophyletic group

6. Oceanic islands such as Hawaii and Philippines can be home to species found nowhere else on Earth. Why?

- A) Island habitats are more diverse than non-island habitats.
- B) Islands are free of disease and carnivores
- C) Islands are often isolated, minimizing gene flow and maximizing diversification.
- D) Island habitats are stable, minimizing adaptation and maximizing reproduction.

7. Which of the following statements about genetic drift is TRUE?

- A) Genetic drift can rapidly homogenize allele frequencies in different populations.
- B) If population size is small, genetic drift will result in a genetically uniform population.
- C) Genetic drift changes only genotype frequencies, not allele frequencies.
- D) The effective population size is usually larger than the actual population size.

8. A friend is going on vacation to Africa this summer and explains he's excited to visit the birthplace of all human ancestors. Which hypothesis does your friend's point of view support and why?

- A) Your friend agrees with the African replacement hypothesis, which states that all humans evolved in Africa and then migrated to other parts of the world
- B) Your friend agrees with the multiregional hypothesis, which states that Africa was the birthplace for humanity even though humans eventually evolved in other areas
- C) Your friend agrees with the multiregional hypothesis, which states that humans originated in Africa and migrated to other parts of the world on foot.

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D) Your friend agrees with the African replacement hypothesis, which states that humans evolved independently all over the globe

9. Neutral mutations (Non-coding sections of DNA) are useful for phylogenetic reconstruction because:

- A) neutral mutations objectively reflect the actions of natural selection.
- B) neutral mutations accumulate approximately regularly over time.
- C) neutral mutations fail to be removed by directional selection.
- D) neutral mutations are more frequent in the first codon position, which contains more evolutionary information.

10. Which one of the following is not a mechanism by which a species may acquire new genetic variation? A) Transposition; B) Gene conversion; C) Horizontal gene transfer; D) Hybridization; E) Mutation

二、簡答題 short answers (70%) ※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

1. What is bio-magnification? (5%). Why is this process of concern to harm human health? (5%)
2. To protect a rare species, a minimum viable population (MVP) is needed. What is MVP? (5%) Justify your answer on how to determine the size (numbers of individuals) of a MVP. (5%)
3. Define species richness, diversity indexes, and species abundance (5%). Explain and give an example how scientists compare these measures to understand the diversity? (5%)
4. Due to Global warming, some lands close to the Arctic tundra can now grow crops. Thus some people claim that warming will actually help to increase crops yield in those previous ice sheet covered landmasses. Do you agree or not? Justify your reasons. (10%)
5. Explain what DNA barcodes and molecular phylogeny are. (5%) Apart from identifying species, give example how they are useful to solve ecological or evolutionary questions. (5%)
6. Discuss 2 examples in modern biology where Darwin's natural selection ideas are used and how these ideas are applied. (10%)
7. In the figure below, justify your explanation why did the divergence of HIV (black line, upper subset) become nearly horizontal after year 6? (10%)

