UNIT 4 REVIEW

UNDERSTANDING CONCEPTS

Multiple Choice

In your notebook, write the letter of the best answer for each of the following questions.

1. If evolution occurs, we would expect different biogeographical regions with similar environments to
   - **(a)** all contain the same mix of plants and animals
   - **(b)** have land masses that are connected to each other
   - **(c)** each have its own specific mix of plants and animals
   - **(d)** have plants and animals that have similar adaptations
   - **(e)** both (c) and (d)

2. The fossil record provides direct evidence for common descent because you can
   - **(a)** see that types of fossils have changed over time
   - **(b)** sometimes find common ancestors
   - **(c)** trace the ancestry of a particular group
   - **(d)** sometimes find arrangements of bones similar in common ancestors
   - **(e)** all of the above

3. Assuming a Hardy-Weinberg equilibrium, 21% of a population is homozygous dominant, 50% is heterozygous, and 29% is homozygous recessive. What percentage of the next generation is predicted to be homozygous recessive?
   - **(a)** 21%
   - **(b)** 50%
   - **(c)** 29%
   - **(d)** 25%
   - **(e)** 42%

4. In a population of diploid individuals that is in Hardy-Weinberg equilibrium, the frequency of a dominant allele for a certain hereditary trait is 0.3. What percentage of individuals in the next generation would be expected to be homozygous for the dominant trait?
   - **(a)** 9%
   - **(b)** 14%
   - **(c)** 42%
   - **(d)** 49%
   - **(e)** 90%

5. From which of the following areas of study did Darwin and Wallace derive *most* of their evidence for evolution?
   - **(a)** mechanisms of heredity
   - **(b)** comparing the anatomy of different species
   - **(c)** geographic distribution of organisms
   - **(d)** embryology
   - **(e)** animal behaviour

6. Genetic equilibrium occurs when
   - **(a)** populations are small
   - **(b)** there is no immigration to or emigration from a population
   - **(c)** natural selection acts on particular phenotypes
   - **(d)** mutations arise in a population
   - **(e)** individuals that are related or live in close proximity to one another mate

7. A human population has a higher-than-usual percentage of individuals with a genetic disease. The most likely explanation is
   - **(a)** gene flow
   - **(b)** stabilizing selection
   - **(c)** directional selection
   - **(d)** genetic drift
   - **(e)** all of the above are possible

8. Which of these is/are necessary in order for natural selection to occur?
   - **(a)** variation
   - **(b)** differential success at reproduction
   - **(c)** inheritance of difference
   - **(d)** all of the above
   - **(e)** only (b) and (c)

9. Which of the following is a pre-zygotic barrier?
   - **(a)** habitat isolation
   - **(b)** temporal isolation
   - **(c)** hybrid inviability
   - **(d)** hybrid sterility
   - **(e)** (a) and (b)

10. The many species of Galápagos finches were each adapted to eating different foods. This is an example of
    - **(a)** gene flow
    - **(b)** adaptive radiation
    - **(c)** sympatric speciation
    - **(d)** all of the above
    - **(e)** (b) and (c)

11. Which of the following types of reproductive barriers are not pre-zygotic?
    - **(a)** mechanical isolation
    - **(b)** geographical isolation
    - **(c)** temporal isolation
    - **(d)** gametic isolation
    - **(e)** behavioural isolation

Short Answer

In your notebook, write a sentence or a short paragraph to answer each of the following questions.

12. Explain the difference between a fact and a theory. Give an example of each.

13. Explain the difference between analogous structures and homologous structures.

14. Distinguish between mutations and variations.

15. Give an example of each of the following types of mutations: one that would be beneficial to an individual; one that would be detrimental to an individual; and one that would have no effect on an individual.

16. "Evolution can occur without new species arising." Do you agree with this statement? Explain your answer.

17. Explain why diversity within a population is necessary for evolution.

18. Artificial selection can sometimes perpetuate traits that are not desired, such as respiratory problems in some breeds of dogs. Does the same thing happen in natural selection? Explain your answer.

19. Does the process of natural selection always improve the design of organisms? Explain your answer.

20. How might (a) Lamarck and (b) Darwin have explained the elephant's long trunk?

21. Insects reproduce fast enough that they could quickly populate and "overrun" Earth. Explain why this does not occur. How was this significant to Wallace and Darwin?

22. Explain how the ability to sequence DNA furthered the understanding of evolution.

23. Distinguish between macro-evolution and micro-evolution.

24. How do heterozygous individuals and polymorphic populations contribute to variation within a population?

25. In the past, ideas of natural selection have been used to justify injustice and prejudice. Explain why this is a scientifically incorrect use of the idea of natural selection.

26. Explain why the effects of genetic drift are more significant in small populations.

27. Outline the limitations to defining species purely on the basis of reproductive isolation.

28. Distinguish between allopatric and sympatric speciation.

29. Describe how adaptive radiation helps colonize volcanic islands.

30. Describe an example of (a) convergent evolution and (b) coevolution.

31. Give an example of (a) structural adaptation, (b) physiological adaptation, and (c) behavioural adaptation.

32. A doe tends to favour bucks with larger antlers. Is this an example of natural selection? Explain your answer.

33. Explain why most species would not be in Hardy-Weinberg equilibrium.

34. Explain why the evolution of resistance to antibiotics in bacteria is an example of directional selection.

35. If a human population has a higher-than-usual percentage of individuals with a genetic disease, is the most likely explanation gene flow or genetic drift? Explain your answer.

INQUIRY

36. Madagascar separated from the African continent about 50 million years ago. The Canary Islands are volcanic in origin and are about 10 to 15 million years old. Discuss the types of organisms you would expect to find on these islands and why this information supports the theory of evolution.

37. Calculate the genetic structure of a population of flowers in which 150 individuals are homozygous dominant, 130 are heterozygous, and 58 are homozygous recessive. Assuming that the allele for pink is dominant to the allele for white, describe the population's phenotype as well.

38. The following diagrams represent a distribution of genotypes in a population. Copy the diagrams into your notebook and draw and label: (a) another line to show that disruptive selection has occurred; (b) another line to show that stabilizing selection has occurred; and (c) another line to show that directional selection has occurred.

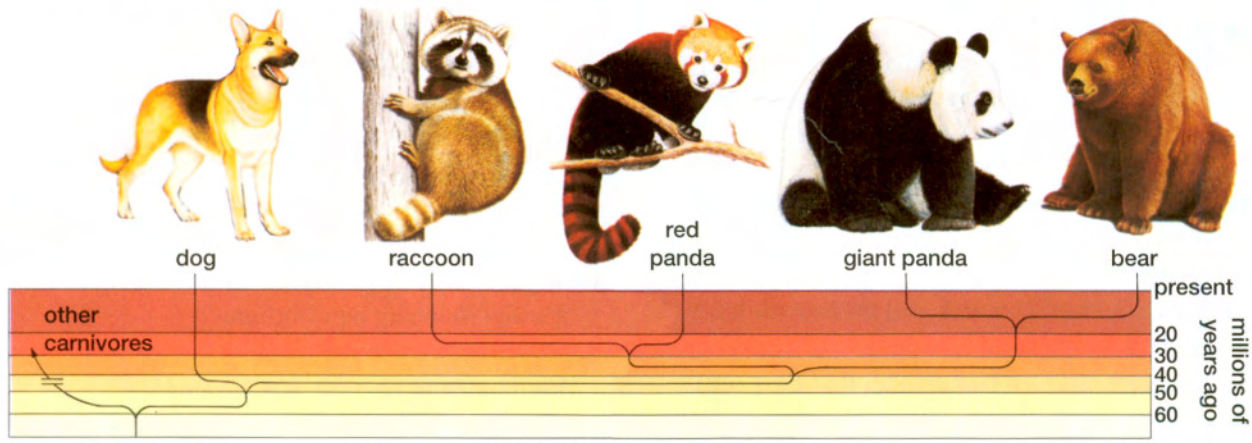
39. You are an investigator studying the frequency of certain traits in a population. You find that 73% of the individuals in the population has freckles. The presence of freckles is controlled by a dominant allele. Calculate the genotype and allele frequencies for the population.

40. Are pandas more closely related to bears or raccoons? This has been a long-standing question for biologists. A biologist determined in the 1950s that, based on behavioural traits, red pandas and giant pandas were closely related to each other and that both more closely resemble bears than raccoons. However, in the 1980s, molecule analysis (including DNA comparison) led to the determination of the evolutionary characteristics shown below. Use this illustration to answer the following questions.

(a) Is the raccoon or the bear more closely related to the red panda?

(b) Is the raccoon or the bear more closely related to the giant panda?

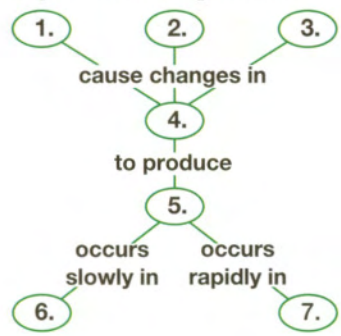
(c) Approximately how long ago did raccoons and bears split into two lineages?



Is the panda a bear or a raccoon?

COMMUNICATING

41. Complete this concept map by using the following vocabulary terms: frequency of alleles, speciation, gradualism, natural selection, geographical isolation, reproductive isolation, punctuated equilibrium.



42. Create a time line or use another graphic organizer to outline the major events and ideas that have led to the current theory of evolution.

43. Use a labelled diagram to show natural selection at work in a population as environmental conditions change.

44. A person tells you that evolution is a hoax because it is "just a theory." Explain to the person what a theory means in a scientific sense and provide five facts that support the theory of evolution.

45. There is concern within a community about the outbreak of a dangerous species of bacterium. As a precaution, people begin to purchase and administer their own antibiotics,

without the advice of physicians. Prepare a communications brief that explains why this practice could worsen the situation.

46. You are organizing a debate on gradualism vs. punctuated equilibrium. Develop an information brief for each debating team.

MAKING CONNECTIONS

47. You discover the remains of an extinct animal that has a small amount of brain tissue preserved in its skull. Outline the scientific techniques you might use to learn more about the evolutionary history of this animal.

48. You are a biologist heading a team of scientists trying to bring whooping cranes back from the brink of extinction. At its smallest, the population had six to eight individuals. Develop a brief presentation that explains to funding officials why this population is still in peril even though it now numbers over 200. Outline the steps you would take to help save this population.

49. A scientist observes that members of a particular plant species are shorter at the top of a mountain than at the bottom. Give an explanation based on natural selection.

50. Several articles published recently in a scientific journal call for the reduced use of antibiotics in the feed given to animals (such as chickens and cattle). Based on your understanding of coevolution, explain why scientists are calling for this change.

51. Explain why zoos exchange animals of one species. How does this benefit society? How does it benefit the environment? What are some of the economic issues?

52. You are a gardening expert who runs a local nursery. A gardener calls you and explains that she had an insect infestation in her garden. When she applied an insecticide, 99 percent of the insects were killed. However, when she applied the insecticide again six weeks later, only 50 percent of the insects were killed. How would you explain why the insecticide did not work as well the second time it was applied?

53. In Canada, Atlantic salmon are farmed on both the Pacific and Atlantic coasts. Some people are concerned about the introduction of domestic salmon to the oceans, fearing that Atlantic salmon that escape from fish farms might affect the genetics of wild salmon if they begin to interbreed and hybridize. Biologists point to the selectional forces that are at play in the two populations. Farmed salmon, for example, are artificially selected and bred for increased growth rate and larger size, among other characteristics. In populations of wild salmon, however, natural selection is at play. Describe the selectional forces that might affect wild salmon populations and note whether the type of selection in farmed and wild salmon populations is directional, stabilizing, or disruptive.