Chapter 25

Tracing Phylogeny

1) A randomly selected group of organisms from a family would show more genetic variation than a
randomly selected group from a
A) class.
B) genus
s.
e) kingdom.
C) order.
D) phylum.

2) Which of the following can be a mechanism of macroevolution?
A) a change in a regulatory gene, which has a major impact on morphology
B) a change of the classification protocol from phenetic to
cladistic
e) DNA-DNA hybridization
C) introgression
D) genetic drift

3) The half-life of carbon 14 is 5,600 years. A fossil that has one-eighth the normal proportion of carbon
14 to carbon 12 is probably
A) 1,400 years old.
B) 2,800 years
old.
e) 11,200 years old.
C) 16,800 years old.
D) 22,400 years old.

4) A biologist discovers two new species of organisms, one in Africa and one in South America. The organisms resemble one another closely. Which type of evidence would be LEAST useful in determining whether these organisms are closely related or are the products of convergent evolution?
A) the history and timing of continental drift
B) a comparison of DNA from the two species
C) the fossil record of the two species
D) analysis of the behavior of the two species
E) comparative embryology

Use Figure 25.1 *to answer the following questions.*

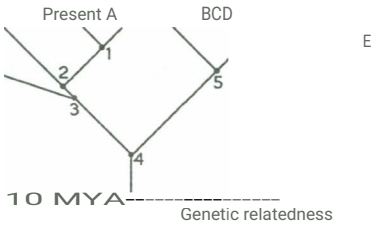

Figure 25.1

5) A common ancestor for species C and E could be at position number
A) 1.
B) 2.
C) 3.
D) 4.
E) 5.

6) The most closely related species are
A) Aand B.
B) Band D.
C) Cand B.
D) DandE.
E) EandA.

7) Which species is extinct?
A)A
B) B
C) C
D)D
E) E

8) The ostrich and the emu look very similar and live in similar habitats, although they are not very closely related. This is an example of
A) divergent evolution.
B) convergent evolution.
C) coevolution.
D) adaptive radiation.
E) sympatric speciation.

9) Phylogeny is the -
A) life history of an organism.
B) evolutionary history of a species.
C) theory of evolution by natural selection.
D) branch of biology concerned with the diversity oflife.
E) branch of biology concerned with the relations between plants and the Earths surface.

10) The only taxon that actually exists as a natural unit is the
A) class.
B) family.
C) genus.
D) phylum.
E) species.

11) The taxonomic school that places grea test emphasis on the chronology of phylogenetic branching is
A) systematic taxonomy.
B) classical taxonomy.
C) numerical taxonomy.
D) cladistics.
E) phenetics.

12) A major evolutionary episode that corresponded in time most closely with the formation of Pangaea
was the
A) origin of humans.
B) Cambrian explosion.
C) Permian extinctions.
D) Pleistocene ice ages.
E) Cretaceous extinctions.

13) All of the following are usual methods for dating fossils EXCEPT
A) molecular clocks.
B) carbon 14.
C) potassium 40.
D) L- and D-amino acids.
E) superposition of sedimentary rock.

14) The anomalous layer of iridium clay tha t has figured so prominently in the asteroid theory is loca ted
at which geological boundary?
A) Laurasia-Gondwana
B) Mesozoic-Cenozoic
C) Paleozoic-Mesozoic
D) Precambrian-Paleozoic
E) North American-Pacific plates

15) The asteroid hypothesis is associated most prominently with which of the following events in the history of life?
A) origin of life
B) origin of humans
C) origin of eukaryotes
D) Permian extinctions
E) Cretaceous extinctions

16) The correct sequence from the most to the least comprehensive taxonomic level is
A) family, phylum, class, kingdom, order, species, and genus
B) kingdom, phylum, class, order, family, genus, and species
C) kingdom, phylum, order, class, family, genus, and species
D) phylum, kingdom, order, class, species, family, and genus
E) phylum, family, class, order, kingdom, genus, and species

17) The vertebrate eye and the eye of squids are similar in structure and function. Which of the following processes accounts for most of this similarity?
A) cladogenesis
B) convergent evolution
C) the iridium anomaly
D) parapatric speciation
E) balanced polymorphism

18) A technique used in molecular systematics relies on the comparison of cytochrome c in different
animals. This technique is referred to as
A) DNA-DNA hybridization.
B) restriction mapping.
C) electron transport.
D) protein comparison.
E) translation.

19) The two names of a species' binomial are its specific name and its
A) class.
B) family.
C) genus.
D) order.
E) phylum.

20) All of the following statements about macroevolution are correct EXCEPT:
A) Long stable periods have been interrupted by brief intervals of extensive species extinction.
B) Most evolutionary trends appear to be the result of gradual phyletic change in an unbranched lineage.
C) Major adaptive radiations have often followed the evolution of novel features.
D) Continental drift has had a significant impact on macroevolution.
E) Differential speciation is probably a driving force behind macroevolution.

The questions below refer to the following geological time periods. Each answer may be used once, more than once, or not at all.

A. Cretaceous
B. Precambrian
C. Pleistocene
D *Paleocene*
E. *Permian*

21) epoch when humans appeared

22) epoch when mammals first flourished

23) era of the origin of the first animals

24) period when the dinosaurs became extinct

25) period of mass extinctions about 250 million years ago

The questions below refer to the following terms. Each term may be used once, more than once, or not at all.

A. nonadaptive
B. analogous
C. homologous
D. paraphyletic
E. polyphyletic

26) shared derived characters

27) shared primitive characters

28) the class Reptilia

29) human hand and lobster claw

30) whale flipper and horse foreleg

31) The following questions refer to the hypothetical patterns of taxonomic hierarchy shown in Figure 25.2.

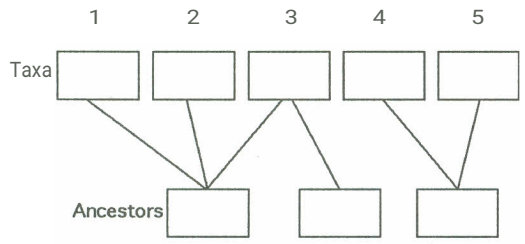

Figure 25.2

31) Which of the following numbers could represent monophyletic taxa?
A) 2 only
B) 4 only
C) 5 only
D) 1,2,and3
E) 1, 2, 4, and 5

32) Which of the following numbers could represent polyphyletic taxa?
A) 2 only
B) 3 only
C) 5 only
D) 1,2, and 3
E) 1,2,3,4, and 5

33) Which combination of the following species characteristics would cause the greatest likelihood of
fossiliza tion?

I. aquatic
IT. arctic
III. hard body parts
IV. presence of organic material
V. flight
VI. long lasting

A) I, III, and VI
B) I, IT, and VI
C) IIIonly
D) III and VI
E) IT, IV, and V

34) Which of the following would NOT be considered fossils?
A) All of the below are considered fossils.
B) dinosaur footprints preserved in rocks
C) insects enclosed in amber
D) mammoths frozen in arctic ice
E) ancient pollen grains

35) How could flying vertebrates evolve from earthbound ancestors?
A) A structure somehow evolved in anticipation of future use for flight.
B) The flying vertebrates evolved from aquatic vertebrates with winglike fins.
C) Existing structures were gradually modified for flight.
D) Natural selection improved a structure in the context of its later utility for flight.
E) The vertebrates were destined to fly because there have been flying reptiles, birds, and mammals.

36) In all of the following pairs, BOTH processes have played important roles in causing macroevolution EXCEPT
A) chance and natural selection
B) homeosis and heterochrony
C) mutation and molecular systematics
D) extinction and adaptive radiation
E) allometry and paedomorphosis

37) Which of the following is believed to be the most likely cause of the Cretaceous extinctions?
A) adaptive radiation
B) continental drift
C) the eruption of Mount Pinatubo
D) the impact of an asteroid or a comet
E) the collapse of food chains

38) Which of the following can best be explained by continental drift?
A) the relative age of fossils
B) the scarcity of eutherian (placental) mammals in Australia
C) the Chicxulub crater
D) the survival of *Purgatorius*
E) polyphyletic taxa

39) Which of the following can be used to determine the absolute age of fossils?
A) index fossils
B) the "DNA clock"
C) cladistics
D) sedimentary strata
E) the half-life of isotopes

40) When using a cladistic approach to systematics, which of the following is considered most important for classifica tion?
A) shared primitive characters
B) analogous primitive characters
C) shared derived characters
D) a common five-toed ancestor
E) overall phenotypic similarity

41) Which of the following technologies would you use when trying to determine the evolutionary relationship between horses and zebras?
A) All of the techniques below might prove useful.
B) DNA-DNA hybridization
C) analysis of cytochrome c differences
D) restriction mapping of DNA
E) analysis of fossil DNA

42) The best index fossils for assigning relative ages to different strata are those of
A) dinosaurs.
B) flightless birds.
C) shelled marine organisms.
D) soft-bodied invertebrates.
E) bacteria.

43) Generally, which of the following divisions of geologic time are the longest?
A) periods
B) eras
C) epochs
D) ages
E) millennia

44) Racemization of amino acids might be a useful technique for dating all of the following EXCEPT
A) a mammoth frozen in arctic ice.
B) remains of bird eggs found associated with paleoindian villages.
C) an insect preserved in amber.
D) ancient trees in the Petrified Forest National Park.
E) leaf films pressed between layers of sandstone or shale.

45) Which of the following evolutionary events opened up a major new adaptive zone?
A) walking legs on the first terrestrial vertebrate
B) stinging tail on the first scorpion
C) enlargement of the brain in human ancestors
D) stinging nematocysts of early Cnidarians
E) camera like eyes in squids and octopuses

46) The "Cambrian explosion" refers to
A) events that resulted in the formation of the Earth.
B) a dramatic increase in the diversity of marine invertebrates.
C) an explosive period of mass extinctions.
D) a massive increase in the total number of terrestrial organisms.
E) the impact of a huge asteroid or comet.

47) A major evolutionary innovation helping to fuel the Cambrian explosion may have been the origin of
A) wings.
B) fins.
C) hard body parts.
D) complete digestive tracts.
E) photosynthesis.

48) Which of the following land masses preda tes the other four?
A) Gondwana
B) Laurasia
C) Eurasia
D) India
E) Pangaea

49) A thin layer of iridium separating Mesozoic from Cenozoic sediments is one of the most compelling pieces of evidence for
A) an extreme episode of vulcanism.
B) the impact hypothesis for the Cretaceous extinctions.
C) a drastic cooling of the climate.
D) the disruption of Pangaea.
E) the Cambrian explosion.

50) All of the following are correct taxa for the common house fly. Assuming you had access to textbooks
or other scientific literature, knowing which of the following would provide you with the greatest amount of information about this organism?
A) Order Diptera
B) Family Muscidae
C) Genus Musca
D) Oass Hexa poda
E) Phylum Arthropoda

51) Which of the following assemblages could produce a taxon that is monophyletic? ~
A) lizards and snakes
B) fish and porpoises
C) insects and spiders
D) salamanders and lizards
E) sea stars and corals

52) Which of the following assemblages could produce a taxon that is polyphyletic?
A) crocodiles, caymans, and alligators
B) crocodilians and birds
C) porpoises and whales
D) sharks and rays
E) flatworms, roundworms, and segmented worms

53) Which of the following is an example of convergent evolution?
A) the exoskeleton of a spider and the exoskeleton of an insect
B) the digging front legs of a mole and the digging front legs of a mole cricket
C) the wings of a monarch butterfly and the wings of a luna moth
D) the tadpole stage of a frog and the tadpole stage of a salamander
E) the stinging hairs of a sea anemone and the stinging hairs of a jellyfish

54) Which of the following molecular systematic techniques is the LEAST beneficial for phylogenetic studies because it provides information about the smallest amount of molecular information in an
organism?
A) DNA-NA hybridization
B) restriction mapping of the genome
C) amino acid sequencing of proteins
D) nucleotide sequencing of DNA
E) nucleotide sequencing of RNA

55) Evidence from DNA-DNA hybridization puts the giant panda with the bears, but places the panda in the racoon family. The similarity of body morphology of these two animals must therefore be due to
A) inheritance of acquired characteristics.
B) sexual selection.
C) inheritance of synapomorphies.
D) convergent evolution.
E) possession of shared primitive characters.

56) The lakes of northern Minnesota harbor many similar species of damselflies of the genus *Enallagma* that have apparently undergone speciation from ancestral stock since the last glacial retreat of approximately ten thousand years ago. Which of the following techniques would be most useful in sorting out evolutionary relationships among these species?
A) study of comparative anatomy
B) sequencing of mitochondrial DNA
e) sequencing of genomic DNA
C) sequencing of ribosomal RNA
D) sequencing of amino acids in proteins

57) The polymerase chain reaction (peR) has made feasible the widespread use of which of the following molecular systematic techniques?
A) nuclear DNA sequencing
B) mitochondrial DNA sequencing
e) amino acid sequencing of cytochrome c
D) amino acid sequencing of hemoglobin
E) both A and B

58) Possession of which of the following could be considered a synapomorphy in the decision to group bumblebees and honeybees together in the same taxon (family Apidae)?
A) hairy bodies
B) win gs
e) six legs
C) an exoskeleton
D) compound eyes

59) In the cladistic analysis that puts bumblebees and honeybees in the same taxon (family Apidae), which of the following would represent a reasonable outgroup for study?
A) oak trees
B) fro gs
e) beetles
C) wasps
D) spiders