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BIL 160 – Spring 2011

Krempels

Exam II

READ CAREFULLY and choose the BEST answer for each question. Two points each.

1. Darwin was the first to make the analogy of evolution resembling the branches of a tree. He suggested that extant species could be imagined as the tips of the branching stems. Which of the following would be analogous to the common ancestor of two sister species?
 - a. the base of a single twig that gets longer over time.
 - b. a twig that branches several times
 - c. the node where two twigs diverge from the lower stem
 - d. the trunk of the tree
 - e. the roots of the tree
2. In using the concept of punctuated equilibrium to explain the "sudden" appearance of a new species in the fossil record, the biologist is suggesting that
 - a. the species is now extinct
 - b. the speciation event occurred instantaneously
 - c. the speciation event occurred in one generation
 - d. speciation took place relatively rapidly, in geologic time
 - e. the species will have a relatively short existence, compared to other species.
3. A small population of cottontail rabbits was transported to an island, and bred there in isolation for about 1000 years. When individuals of that population were discovered, they were described as a new species because all individuals had black fur, yellow eyes, and were much smaller than the brown-furred, brown-eyed cottontails on the mainland, from which they evolved. The black island cottontails could no longer produce fertile, viable offspring with the mainland cottontails. Which of the following terms could NOT correctly be applied to this scenario?
 - a. anagenesis
 - b. Founder Effect
 - c. genetic drift
 - d. punctuated equilibrium
 - e. cladogenesis
4. A population of killifish lives in a mountain stream. Erosion gradually changes the landscape, causing the stream to fork and separate into two branches. Killifish cannot swim over the rocky barriers upstream, so the fish downstream from the fork are physically separated from one another. Over thousands of years, the two demes become reproductively isolated. This scenario describes _____ speciation.
 - a. parapatric
 - b. allopatric
 - c. peripatric
 - d. sympatric
 - e. saintpatric

Choose from among the following terms to link the term MOST CLOSELY ASSOCIATED with the phrases in #5 – 9. Any answer may be used once, more than once, or not at all. You decide.

- | | | |
|---------------------------------|--------------------------------|------------------------|
| a. maladaptive trait | c. disruptive selection | e. monophyletic |
| b. stabilizing selection | d. polyphyletic | |
5. Shared, derived characters
 6. Uniform population
 7. Shared common ancestor
 8. Reduced relative fitness
 9. Polymorphic population
10. The common house fly belongs to all of the taxa listed below. Let's assume you had access to textbooks and other scientific literature to read more about the fly. Which of the following should you read about to obtain the most *detailed* information about this particular organism?
 - a. order Diptera
 - b. family Muscidae
 - c. genus *Musca*
 - d. class Hexapoda
 - e. phylum Arthropoda
 11. Which of the following applies to *BOTH* anagenesis and cladogenesis?
 - a. branching
 - b. increased diversity
 - c. speciation
 - d. adaptive radiation
 - e. multiple species from a single ancestor

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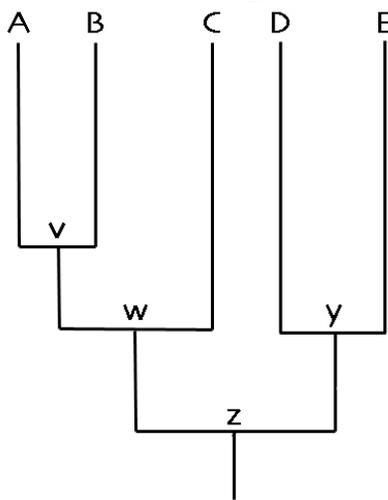
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12. In general, two organisms in the same _____ should have more synapomorphies than two organisms in the same _____, but not in the same _____.
(HINT: Fill in the blanks and read the sentence.)
- a. genus, order, genus
 - b. kingdom, family, kingdom
 - c. phylum, kingdom, domain
 - d. species, genus, class
 - e. class, order, family
13. There are three main groups of mammals, the egg-laying **Monotremes**, the pouch-bearing **Marsupials**, and the live-bearing **Placentals**. All share a *distant* common ancestor that probably laid eggs. When Europeans first discovered Koalas, they classified them as bears in (placental) Family Ursidae (bears). Later, when it became apparent that Koalas were marsupials, they were re-classified in the marsupial family Phascolarctidae. But for that brief time Koalas were classified as bears, Family Ursidae was
- a. monophyletic
 - b. paraphyletic
 - c. polyphyletic
 - d. extinct
 - e. not quite as scary to Stephen Colbert
14. If you are a cladist, which of the following should you use to determine monophyletic taxa?
- a. shared, primitive characters
 - b. analogous characters
 - c. shared, derived characters
 - d. degree of specialization after a clade
 - e. overall phenotypic similarity
15. RNA molecules can be both self-replicating and act as catalytic enzymes. This means that
- a. RNA could have been the first hereditary material in the earliest life forms
 - b. protobionts had a membrane composed of RNA
 - c. free nucleotides would not be needed to make new RNA
 - d. RNA could manufacture energy
 - e. RNA is a polymer of amino acids
16. If you were using cladistic techniques to construct a phylogenetic tree of Family Felidae (cats), which of the following would be the most appropriate **outgroup** to use?
- a. *Panthera leo* (lion)
 - b. *Felis catus* (domestic cat)
 - c. *Panthera tigris* (tiger)
 - d. *Felis concolor* (cougar)
 - e. *Canis lupus* (wolf)
17. Which of the following would be most useful for constructing a cladogram showing the evolutionary relationships of several different species of fish? (Remember your workshop!)
- a. several *analogous* characters shared by all the fish
 - b. a single *homologous* character shared by all the fish
 - c. the total degree of morphological *similarity* among the fish
 - d. several homologous characters that evolved *as the species diverged* from one another
 - e. several homologous characters that evolved/changed *after the species had already diverged*
18. Which of the following would be an informative character state that one could use to determine evolutionary relationships *among* the organisms in the groups below?
- a. lack of a vertebral column in "invertebrate" organisms such as mollusks and insects
 - b. absence of a membrane-bounded nucleus in prokaryotic organisms
 - c. colors and shapes of mate-attracting dewlaps in different genera and species of lizards
 - d. presence of a vestigial tail in the great apes
 - e. any of the above could be used to further classify the organisms in each choice
19. You are reading a scientific paper about the ecology of rats. One sentence reads "Juveniles of *Rattus* spp. are altricial, and require parental care for approximately eight weeks." In this sentence, "*Rattus* spp." refers to
- a. currently undescribed species of *Rattus*
 - b. extinct species of *Rattus*
 - c. polymorphic populations of *Rattus rattus*
 - d. paedomorphic species of *Rattus*
 - e. multiple different species in genus *Rattus*

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Refer to this cladogram to answer questions #20 – 22.



20. Which of the following is NOT true of this tree?
- taxon D and C are more closely related to each other than taxon E and C are to each other.
 - taxa represented by v, w, y and z are ancestral to taxa A, B, C, and D.
 - there are four instances of cladogenesis shown
 - ancestor v existed more recently than ancestor z.
 - all of the above are true.
21. The more branch points between two taxa on the tree, the more divergent their DNA sequences should be.
- true
 - false
 - what is this "DNA"?
22. Each branch point represents a point in absolute time.
- true
 - false
 - what time *is* it, anyway?
23. Which of the following characteristics is most likely to result in an individual member of a species being fossilized in sedimentary rock?
- Species is adapted to life in the desert
 - The species is very rare
 - The species has hard body parts
 - Species existed for only a short time
 - The species has a very small geographic range
24. The Galapagos emerged from the ocean about two million years ago. In the distant past, a single, ancestral species of finch colonized the islands. Today, several Galapagos islands are home to unique species of finches, each evolved from that single, ancestral finch population. Which of the following is most likely to have contributed to the current finch diversity?
- 1. cladogenesis**
 - 2. anagenesis**
 - 3. allopatric speciation**
 - 4. adaptive radiation**
 - 5. sympatric speciation**
- 1 and 3
 - 1 and 4
 - 2 and 3
 - 1, 4, and 5
 - 1, 3, and 4
25. You are trying to classify a group of mammals on the basis of their dental morphology, but find that the different species in your group differ in that character state. To find out which is the most primitive character state, you should examine the dental morphology of an appropriate
- common ancestor
 - ingroup
 - outgroup
 - fossil record
 - museum lobby
26. Typically, a mutation that affects the active site of an enzyme is more likely to be deleterious than a mutation that affects a structural region of the enzyme. You are studying the amino acid sequences of an enzyme composed of four different domains, A, B, C, and D. You have sequenced the four domains in five related species of insects, and found that the four domains have the following degrees of amino acid homology among your five species:
- | | |
|--------------------------|--------------------------|
| Domain A: 96% homologous | Domain C: 18% homologous |
| Domain B: 10% homologous | Domain D: 57% homologous |
- Which domain probably contains the active site? (HINT: This question is about *evolution*.)
- Domain A
 - Domain B
 - Domain C
 - Domain D
 - need more information to determine
27. The structures/organisms listed below all exist today. Which of them most closely resembles the earliest autotrophs to first contribute to earth's oxygen-rich atmosphere?
- chloroplasts
 - kelp (brown algae)
 - cyanobacteria
 - endosymbionts
 - Giardia*

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28. After 5730 years, half of a beginning quantity of carbon 14 (parent isotope) has decayed to nitrogen (stable isotope). Which of the following measurements would yield useful information to someone trying to determine the age of a fossil containing both isotopes?
- ratio of carbon 14 to carbon 12 in the sample
 - amount of nitrogen in the sample
 - ratio of carbon 14 to nitrogen in the atmosphere
 - loss of carbon 12 in the sample
 - accumulation of carbon 14 in the sample
29. If one uses 24-hour day analogy to represent the history of life, then *Homo sapiens* has been here
- for about 10 minutes
 - for about 5 minutes
 - for about a minute
 - for less than a second
 - just in time for happy hour
30. Many animals and plants in India are evolutionarily distantly related to those found just north over the Himalayas, in southeastern Asia. This is most likely because
- The Himalayas promote migration of species between India and southeast Asia
 - Indian species have evolved more rapidly than southeast Asian species
 - The climates in the two regions are completely different
 - In the Pleistocene, volcanoes wiped all life out of India, and everything re-evolved from scratch
 - When the species in question (in India and southeastern Asia, respectively) were evolving, India was part of Gondwanaland, and the land north of the Himalayas was part of Laurasia.
31. Which of the following was least abundant in the Earth's first atmosphere?
- carbon monoxide
 - methane
 - ammonia
 - oxygen
 - water vapor
32. Which of these primordial earth conditions was NOT simulated in the Miller-Urey apparatus?
- presence of water vapor
 - lack of oxygen
 - lightning storms
 - warm ocean water
 - coacervate formation
33. Molecular evidence indicates that birds share a recent common ancestor with crocodilians and dinosaurs. However, classical evolutionary taxonomists once classified birds separately ("Class Aves") because birds seemed to have evolved so many specialized traits *after their lineage branched* from that of the crocodilians. Read carefully. Similar logic would lead one to conclude that
- dolphins should be classified as fish because of their fins and streamlined shape and fins.
 - because some plants in the Old World family Euphorbiaceae and the New World family Cactaceae have undergone convergent evolution so that desert-adapted members of both families look very similar, they should all be placed in the same family.
 - although molecular evidence suggests that pandas are closely related to bears, they should be instead be placed in Family Procyonidae along with raccoons, because they resemble raccoons more than they resemble bears.
 - humans should be placed a family separate from that of the Great Apes because no other great apes have as many evolutionary adaptations for bipedalism and tool-using.
 - all of the above use the same logic as the classical evolutionary classification of birds.
34. If you radiometrically analyze a fossil sample and find that 12.5% of the original isotope remains, how many half lives have elapsed since the fossil was formed?
- one
 - two
 - three
 - four
 - five
35. The absence of a membrane-bounded nucleus provides strong evidence that true bacteria and archaeans share a more recent common ancestor with each other than either does with eukaryotes.
- true
 - false
 - nucleolus
 - pudding
36. Before complex, multicellular life forms such as plants could exist, which of the following had to be operating first?
- heterotrophy
 - the Nitrogen Cycle
 - photorespiration
 - herbivory
 - continental drift

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Match the following groups of organisms to the most appropriate statement below for #37-40.

You may use an answer once, more than once, or not at all. Your choice.

- a. cyanobacteria** **c. methanogenic archaeans** **e. thermophilic archaeans**
b. Gram + bacteria **d. denitrifying bacteria**

37. You would expect these organisms to have a thick layer of peptidoglycan in the cell wall.
38. These prokaryotic organisms are believed to be the most closely related to Eukaryotes
39. These bacteria convert fixed nitrogen back into its atmospheric, molecular form.
40. These prokaryotes have photosynthetic pigments, phycoerythrin and phycocyanin, found elsewhere only in the red algae (Rhodophyta)
41. Which of the following is TRUE with respect to reproduction in prokaryotes?
a. They form gametes via meiosis
b. Zygotes are formed by the fusion of two haploid individuals
c. Prokaryotes never undergo any type of genetic exchange/sexual reproduction
d. Mutation is the primary source of genetic variation in prokaryote populations
e. Gametes are formed when plasmids pinch off into independent reproductive units.
42. The eukaryotic flagellum is apparently a very primitive structure. Hence, the presence of a flagellum is a characteristic useful for classifying flagellated protists into smaller, less inclusive taxa.
a. true b. false c. what the heck is a flagellum?
43. Some physicians administer antibiotics to patients at the first sign of any disease symptoms. What is the most significant problem that this practice poses for the patients receiving the antibiotics, *as well as for those not yet infected, but who may be in the future?*
a. The antibiotic administered may kill off viruses that are keeping the bacteria in check
b. Antibiotics may cause harmful side effects in the patients who receive them.
c. Overuse of antibiotics can select for antibiotic-resistant strains of bacteria.
d. Antibiotics may not selectively kill only pathogens, but may also kill beneficial bacteria.
e. All of the above
44. Penicillin inhibits bacterial enzymes from catalyzing peptidoglycan synthesis. Which bacteria should be the most sensitive to the effects of penicillin?
a. mycoplasmas c. Gram-positives e. cyanobacteria
b. Gram-negatives d. spirochetes
45. Choose the correct sequence, from earliest to most recent, in the evolution of life on earth.
1. origin of earth's reducing (O₂ rich) atmosphere **4. origin of cyanobacteria**
2. origin of multicellular eukaryotes **5. origin of terrestrial herbivores**
3. origin of chloroplasts
a. 4, 3, 2, 1, 5 b. 4, 1, 2, 3, 5 c. 4, 1, 3, 2, 5 d. 3, 4, 1, 2, 5 e. 1, 3, 4, 5, 2
46. The evolution of eukaryotes from prokaryotes probably
a. involved horizontal gene transfer c. allowed formation of multicellularity
b. resulted from multiple endosymbiosis events d. all of the above
47. The parabasalid (e.g., the intestinal symbionts of termites) and diplomonad (e.g., diarrhea-inducing *Giardia lamblia*) protists have tiny remnants of mitochondria that lack DNA. If you were trying to confirm the hypothesis that the lack of mitochondrial DNA is due to horizontal gene transfer, where would you look, in these organisms?
a. centrioles c. chloroplasts e. nucleus
b. cilia and flagella d. transport vesicles

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48. The deep ocean floor is covered with a deep layer of ooze made up of glassy, silica particles. It is composed primarily of the empty tests/shells of which of the following types of protists?
- a. foraminiferans
 - b. dinoflagellates
 - c. ciliates
 - d. radiolarians
 - e. rhodophytes
49. The strongest evidence for the endosymbiont model of eukaryotic origin is the similarity between extant prokaryotes and
- a. nuclei and chloroplasts
 - b. mitochondria and chloroplasts
 - c. mitochondria and ribosomes
 - d. mitochondria and chromosomes
 - e. cilia and flagella
50. Which of the following are responsible for both “red tides” and the toxin-related illness ciguatera?
- a. diatoms
 - b. Gram-negative bacteria
 - c. *Giardia lamblia*
 - d. dinoflagellates
 - e. *Euglena* spp.

BONUS QUESTIONS: No penalty for not answering (or getting them wrong).

Just a chance for some redemption.

51. The taxon Stramenopila gets its name from characteristic fuzzy flagella found in no other organisms. Which of the following do NOT share this synapomorphy?
- a. diatoms
 - b. brown algae (kelp)
 - c. golden algae
 - d. water molds
 - e. *Giardia lamblia*
52. The famous “White Cliffs of Dover” in the British Isles are composed primarily of the calcium carbonate skeletons of
- a. haptophyte algae
 - b. diatoms
 - c. shelled amoebas
 - d. brown algae
 - e. dead Leprechauns
53. In very cold water, you are more likely to find shelled protists with shells made of _____, rather than _____, which requires more energy to precipitate.
- a. keratin; calcium carbonate
 - b. silica; calcium carbonate
 - c. calcium carbonate; silica
 - d. chitin; keratin
 - e. chitin; silica
54. The closest living eukaryotic relatives to the Green Plants are the
- a. red algae
 - b. choanoflagellates
 - c. cyanobacteria
 - d. diatoms
 - e. brown algae

I don't think God put me on this planet to judge others.

I think he put me on this planet to gather specimens and

Take them back to my home planet.

Deep Thoughts by Jack Handey