

BIOS 209 - **FUNDAMENTALS OF BIOLOGY II** - 10 Nov. 2008

**EXAM III (34 QUESTIONS; 68 PTS)**

**MULTIPLE CHOICE** (Fill in the bubble on the Scantron form with the **best** answer).

- 1) The extinction of the dinosaurs caused an evolutionary response among mammals that is called
  - a) a punctuated bottleneck;
  - b) the equilibrium exclusion theory;
  - c\* an adaptive radiation;
  - d) the Eldridge and Gould evolutionary stasis;
  - e) a Hardy-Weinberg equilibrium response.
  
- 2) The Hawaiian plants known as the silverswords are considered to be an adaptive radiation because
  - a\* many distinct species evolved from one parent species;
  - b) of strong selection of secondary sex characteristics such as floral bristles;
  - c) a new species diverged from the parent species;
  - d) the parent species evolved into a new species by anagenesis;
  - e) the parental lineage evolved pigmented photoreceptors, which were strongly adaptive.
  
- 3) Heterochrony
  - a) is a process that has been well documented to cause extinction among vertebrates;
  - b) may cause speciation, but only when there is a geographic barrier separating subpopulations;
  - c) can transform a cladogenetic pattern of evolution into an anagenetic pattern;
  - d\* can cause major changes in adult morphology which may lead to relatively rapid speciation;
  - e) is most likely responsible for gradualist evolution.
  
- 4) The origin of eyes among molluscs
  - a) occurred in the common ancestor of molluscs and vertebrates so now both groups have eyes;
  - b) follows an anagenetic evolutionary pattern, in which there are a chain of "missing links;"
  - c) gradually produced a single type of eye that has become fixed among all living molluscs;
  - d\* was a new development that contributed to the adaptive radiation of the group;
  - e) All of the above are true of the molluscan eye.
  
- 5) Which of the following is most likely to be the origin of a new species?
  - a) An undescribed species of rabbit with an unusual, striped coat was discovered in an isolated region in the Annamite Mountains of Laos in 1999;
  - b\* A polyploid species of hemp nettle was discovered in Europe in 1932 that was otherwise similar to two diploid species that grew in the same area;
  - c) The Saola, a primitive species related to cows and goats, was discovered in the mountain jungles of Vietnam in 1992;
  - d) Two new species of Titi monkeys were discovered in remote parts of the Amazon in 2002;
  - e) Nine undescribed species of lemur were found living the forests of Madagascar in 2000.

- 6) %10In a phylogenetic tree diagram, speciation events are indicated by
- internal branches;
  - external branches;
  - long terminal branches;
  - \* nodes;
  - speciation events are not represented in phylogenetic trees, which are only hypotheses.
- 7) %10The North American flying squirrel, which is a placental mammal, and the sugar glider of Australia, which is a marsupial, are both tree-dwelling mammals with the ability to glide through the air. These similarities
- indicate divergence due to recent allopatric speciation on opposite sides of the Pacific Ocean;
  - \* are only coincidental analogies, since individual marsupial and placental species are only distantly related to each other;
  - were inherited from a recent common ancestor;
  - indicate sympatric speciation, since both species occupy similar arboreal niches;
  - are considered to be homologies, indicative of common ancestry.
- 8) %10The primary goal of phylogenetic studies is to
- date all possible speciation events using radiometric methods;
  - find evidence to support a classification composed of paraphyletic groups;
  - \* find evidence of homology that will identify monophyletic groups;
  - identify as many polyphyletic groups as possible, based on the available evidence;
  - use analogous characters to indicate evolutionary relationships.
- 9) %11The maximum parsimony method of phylogenetic analysis
- \* minimizes the number of inferred mutations so that the shortest tree is considered optimal;
  - maximizes the statistic known as the likelihood for a given mathematical model of evolution;
  - is restricted to phylogenetic analyses of structural/morphological characteristics of organisms;
  - converts character state data into distance measures between all pairs of species;
  - produces an evolutionary tree diagram, unlike the other methods of phylogenetic analysis.
- 10) %11The four-chambered hearts of birds and mammals, which are known to follow different paths of development,
- are considered to be homologous structures;
  - define a single modern taxonomic category of warm-blooded animals;
  - indicate sympatric speciation, since both birds and mammals are warm-blooded;
  - \* evolved independently in the two groups;
  - are characteristic of the monophyletic group called the Endotheria.
- 11) %11Structural (morphological) characters
- are more frequently used by modern biologists than DNA characters to understand phylogenies;
  - are useful for classifying organisms but can not be used to determine phylogenetic trees;
  - can be more easily identified as homologous than can DNA characters from the same species;
  - \* are generally fewer in number than the DNA characters for any particular group of organisms;
  - each have four possible character states: A, C, G or T.

- 12) %11 Given an analysis of two nucleotide sites on two evolutionary trees, if one tree requires two base changes while a second tree requires four base changes then the
- likelihood of the second tree is twice that of the first tree;
  - likelihood of the first tree is twice that of the second tree, since likelihood is an inverse function;
  - second tree is more probable since its distance measure is twice that of the first tree;
  - \* first tree, with fewer evolutionary events, is more parsimonious than the second tree;
  - second tree, with more evolutionary events, is more parsimonious than the first tree.
- 13) %12 Argon-40 vaporizes and escapes from molten lava as a gas. This can be useful to paleontologists because the
- argon-40 would otherwise accelerate the decay of carbon-14 to nitrogen-14;
  - argon-40 would otherwise mask the presence of potassium-40 in volcanic sediments;
  - argon-40 will gradually return from the atmosphere to the lava only after it cools;
  - \* time when a volcano erupted can then be determined by potassium-40/argon-40 dating;
  - volcanic rock, once cooled, will be less radioactive than the lava that produced it.
- 14) %12 A paleontologist discovers two fossils in a region that has long been geologically inactive. Fossil A was found in a layer of sediment above the layer in which fossil B was found, so that in general
- the absolute age of fossil A must be at least one million years older than that of fossil B;
  - the absolute age of fossil A must be at least one million years younger than that of fossil B;
  - the relative age of fossil A must be greater than that of fossil B;
  - \* the relative age of fossil A must be less than that of fossil B;
  - fossil B must be younger than fossil A.
- 15) %12 The half-life of carbon-14 is 5,730 years. If a fossil contains one-third as much carbon-14 as nitrogen-14, then its absolute age is estimated to be
- 2,865 years;
  - 5,730 years;
  - \* 11,470 years;
  - 17,190 years;
  - 22,920 years.
- 16) %12 Which of the following statements describes a feature of the Permian mass extinction?
- A layer of iridium was deposited in sediments at different global locations at this time;
  - \* 90% of marine animals became extinct, approximately 245 million years ago (mya);
  - This extinction was caused by an asteroid impact that occurred about 65 mya;
  - Most species of dinosaurs were extinguished during this mass extinction event;
  - An impact crater was found by gravity anomaly mapping off the Yucatan coast of an age suggesting the cause of this mass extinction.
- 17) %13 Which of the following is NOT a reason to conduct paleoanthropological field work in east Africa?
- Uplift in the rift valley system in east Africa accelerates erosion and the exposure of new fossils;
  - Sahelanthropus*, *Australopithecus africanus*, *A. afarensis* and *Homo* all originated in Africa;
  - Periodic volcanic eruptions occurred over the past 5 million years in the region;
  - Hominid diversification was greatest in Africa from 1-4 million years ago;
  - \* All of the above are reasons to conduct this kind of field research in east Africa.

- 18) %12Which of the following is in the correct order from oldest to youngest?
- a) first algae and invertebrates — first eukaryotes — first seed plants — first insects — first mammals;
  - b\* first eukaryotes — first algae and invertebrates — first insects — first seed plants — first mammals;
  - c) first mammals — first seed plants — first insects — first algae and invertebrates — first eukaryotes;
  - d) first seed plants — first eukaryotes — first algae and invertebrates — first insects — first mammals;
  - e) first eukaryotes — first insects — first seed plants — first algae and invertebrates — first mammals.
- 19) %13The oldest fossils of *Homo sapiens* are the “Herto hominid” fossils dated at about 160,000 years of age
- a\* indicating that our species originated at or before 160,000 years ago;
  - b) in a classic example of island dwarfism in our species on the island of Flores;
  - c) proving that our species interbred with the neanderthals of ancient Africa;
  - d) showing that *Australopithecus africanus*, (“Taung child” and other fossils) was our ancestor;
  - e) suggesting that our species evolved from *Sahelanthropus tchadensis*, (the “Toumai” fossils).
- 20) %13Hominids
- a) include both the great apes (chimpanzees gorillas and orangutans) and humans (*Homo sapiens*);
  - b) is an informal term that is equivalent to the more specific term, “primates;”
  - c\* comprise a group of about 20 species, only one of which is not extinct;
  - d) is an ancient group that originated more than 60 million years ago;
  - e) is a group of species all classified in the one genus, “*Homo*.”
- 21) %13The fossil known as “Lucy” is classified in which species?
- a) *Homo sapiens*;
  - b) *Homo floresiensis*;
  - c) *Australopithecus ergaster*;
  - d\* *Australopithecus afarensis*;
  - e) *Sahelanthropus tchadensis*.
- 22) %01Equatorial habitats are warmer than polar habitats on earth because
- a) the northern hemisphere tilts toward the sun during the June solstice, but away from the sun during the December solstice;
  - b) the angle of the earth’s axis changes from about 31.3° to 21.5° during one annual revolution;
  - c\* sunlight strikes the equator perpendicularly, so there is more light per unit of surface area;
  - d) as earth rotates on its axis, the land near the equator moves faster causing frictional heating;
  - e) neither pole tilts toward the sun during the September and March equinoxes.
- 23) %01Landscape ecology is the study of
- a) individual organisms and their interactions with each other and with their environments;
  - b) how human activities degrade ecosystems in the broader landscape;
  - c) major types of ecosystems such as deserts;
  - d\* arrays of adjacent ecosystems and how they are arranged;
  - e) the abiotic aspects of a community such as sunlight, minerals, and availability of water.

- 24) %02In aquatic biomes,
- a) greater species diversity is found in the deepest (abyssal) zones;
  - b) few organisms can survive in water with salt concentrations greater than about 1%;
  - c) organic nutrients are freely available because they are soluble in water;
  - d\* the major determinant of the structure of the biome is the availability of sunlight;
  - e) there is a natural succession from eutrophic to oligotrophic lakes.
- 25) %01Which of the following would be considered to be a biotic component of the environment?
- a\* Decomposers;
  - b) Ocean currents;
  - c) Solar radiation;
  - d) pH;
  - e) A rain shadow.
- 26) %01The western side of the Sierra Nevada Mountains receives a large amount of precipitation, but the eastern side is a desert because of
- a) the prevailing winds blowing eastward from the great plains;
  - b\* a rain shadow effect;
  - c) seasonal turnover;
  - d) the coriolis effect;
  - e) more solar radiation on the eastern side, which is closer to the sun.
- 27) %02One hundred years ago, most of Illinois would have been classified as which type of terrestrial biome?
- a\* Prairie;
  - b) Chaparral;
  - c) Savanna;
  - d) Pampas;
  - e) Boreal forest.
- 28) %02Temperate lakes typically undergo which of the following because of the properties of water as it approaches freezing?
- a) Oligotrophication, as the lake deepens with time;
  - b) A rain shadow because the bottoms of lakes are typically uneven;
  - c\* Seasonal turnovers in the spring and fall;
  - d) More solar heating in the deepest parts of the lake reducing the density of deep water;
  - e) The coriolis effect.
- 29) %13According to the extensive fossil record of hominids dating back over five million years
- a) the oldest dated fossils of *Australopithecus* and *Homo* were found on the island of Flores;
  - b) all of the early hominid species were exceptionally tall, even as young children;
  - c) the earliest evidence of tool use are 5 million-year-old cut marks on stones found in Kenya;
  - d\* bipedalism originated long before a substantial increase in the size of skulls;
  - e) the size of skulls increased long before bipedalism originated.

- 30) Reef-building corals
- a) are limited to the photic zone of tropical marine environments;
  - b) require high oxygen levels;
  - c) live in a symbiotic relationship with algae that provides the corals with organic nutrients;
  - d) produce habitats of exceptionally high diversity;
  - e\* all of the above are true of reef-building corals.
- 31) A terrestrial biome that covers up to 20% of the earth's surface, has long cold winters and short cool summers, and is home to large animals grazing on lichens, mosses and grasses is called the
- a) temperate grassland;
  - b\* tundra;
  - c) savanna;
  - d) chaparral;
  - e) pampas.
- 32) Many fish automatically orient themselves toward the flow of current
- a) in a kind of irreversibly learned behavior called imprinting;
  - b) after learning this behavior by observing it in adult fish;
  - c\* as an automatic kind of unlearned behavior that promotes survival;
  - d) in what is called kinesis, a type of behavior largely determined by genetic factors;
  - e) only if they have been immersed in flowing water during their sensitive period.
- 33) The photoreceptors of red-crowned cranes respond to increasing day length by altering hormone production so that breeding behavior begins. This is an example of
- a) imprinting;
  - b\* a proximate cause of behavior;
  - c) taxis;
  - d) a learned behavior;
  - e) interspecific communication.
- 34) A fixed action pattern is triggered by an external sensory factor called
- a\* a sign stimulus;
  - b) an imprinting signal;
  - c) a critical feature;
  - d) an olfactory pointer;
  - e) a kinetic activity.