

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

EXAM II (34 QUESTIONS; 68 PTS)

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

- 1) The fossil known as "Lucy" is classified in which species?
 - a) *Homo sapiens*;
 - b) *Homo floresiensis*;
 - c) *Australopithecus ergaster*;
 - d) *Australopithecus afarensis*;
 - e) *Sahelanthropus tchadensis*.

- 2) In a phylogenetic tree diagram, speciation events are indicated by
 - a) internal branches;
 - b) external branches;
 - c) long terminal branches;
 - d) nodes;
 - e) speciation events are not represented in phylogenetic trees, which are only hypotheses.

- 3) The 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.

- 4) 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.

- 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) The Hawaiian plants known as the silverswords are considered to be an adaptive radiation because
- many distinct species evolved from one parent species;
 - of strong selection of secondary sex characteristics such as floral bristles;
 - a new species diverged from the parent species;
 - the parent species evolved into a new species by anagenesis;
 - the parental lineage evolved pigmented photoreceptors, which were strongly adaptive.
- 7) 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
- temperate grassland;
 - tundra;
 - savanna;
 - chaparral;
 - pampas.
- 8) A fixed action pattern is triggered by an external sensory factor called
- a sign stimulus;
 - an imprinting signal;
 - a critical feature;
 - an olfactory pointer;
 - a kinetic activity.
- 9) The 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) In aquatic biomes,
- greater species diversity is found in the deepest (abyssal) zones;
 - few organisms can survive in water with salt concentrations greater than about 1%;
 - organic nutrients are freely available because they are soluble in water;
 - the major determinant of the structure of the biome is the availability of sunlight;
 - there is a natural succession from eutrophic to oligotrophic lakes.
- 11) The 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.

- 12) Hominids
- include both the great apes (chimpanzees gorillas and orangutans) and humans (*Homo sapiens*);
 - is an informal term that is equivalent to the more specific term, "primates;"
 - comprise a group of about 20 species, only one of which is not extinct;
 - is an ancient group that originated more than 60 million years ago;
 - is a group of species all classified in the one genus, "*Homo*."
- 13) 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) One hundred years ago, most of Illinois would have been classified as which type of terrestrial biome?
- Prairie;
 - Chaparral;
 - Savanna;
 - Pampas;
 - Boreal forest.
- 15) 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) 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) 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) Which of the following is in the correct order from oldest to youngest?
- first algae and invertebrates—first eukaryotes—first seed plants—first insects—first mammals;
 - first eukaryotes—first algae and invertebrates—first insects—first seed plants—first mammals;
 - first mammals—first seed plants—first insects—first algae and invertebrates—first eukaryotes;
 - first seed plants—first eukaryotes—first algae and invertebrates—first insects—first mammals;
 - first eukaryotes—first insects—first seed plants—first algae and invertebrates—first mammals.
- 19) The oldest fossils of *Homo sapiens* are the “Herto hominid” fossils dated at about 160,000 years of age
- indicating that our species originated at or before 160,000 years ago;
 - in a classic example of island dwarfism in our species on the island of Flores;
 - proving that our species interbred with the neanderthals of ancient Africa;
 - showing that *Australopithecus africanus*, (“Taung child” and other fossils) was our ancestor;
 - suggesting that our species evolved from *Sahelanthropus tchadensis*, (the “Toumai” fossils).
- 20) 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.
- 21) The extinction of the dinosaurs caused an evolutionary response among mammals that is called
- a punctuated bottleneck;
 - the equilibrium exclusion theory;
 - an adaptive radiation;
 - the Eldridge and Gould evolutionary stasis;
 - a Hardy-Weinberg equilibrium response.
- 22) Equatorial habitats are warmer than polar habitats on earth because
- the northern hemisphere tilts toward the sun during the June solstice, but away from the sun during the December solstice;
 - the angle of the earth’s axis changes from about 31.3° to 21.5° during one annual revolution;
 - sunlight strikes the equator perpendicularly, so there is more light per unit of surface area;
 - as earth rotates on its axis, the land near the equator moves faster causing frictional heating;
 - neither pole tilts toward the sun during the September and March equinoxes.
- 23) Landscape ecology is the study of
- individual organisms and their interactions with each other and with their environments;
 - how human activities degrade ecosystems in the broader landscape;
 - major types of ecosystems such as deserts;
 - arrays of adjacent ecosystems and how they are arranged;
 - the abiotic aspects of a community such as sunlight, minerals, and availability of water.

- 24) The four-chambered hearts of birds and mammals, which are known to follow different paths of development,
- a) are considered to be homologous structures;
 - b) define a single modern taxonomic category of warm-blooded animals;
 - c) indicate sympatric speciation, since both birds and mammals are warm-blooded;
 - d) evolved independently in the two groups;
 - e) are characteristic of the monophyletic group called the Endotheria.
- 25) Which 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) 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.
- 27) 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
- a) the absolute age of fossil A must be at least one million years older than that of fossil B;
 - b) the absolute age of fossil A must be at least one million years younger than that of fossil B;
 - c) the relative age of fossil A must be greater than that of fossil B;
 - d) the relative age of fossil A must be less than that of fossil B;
 - e) fossil B must be younger than fossil A.
- 28) Temperate 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) According 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) The 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
- a) indicate divergence due to recent allopatric speciation on opposite sides of the Pacific Ocean;
 - b) are only coincidental analogies, since individual marsupial and placental species are only distantly related to each other;
 - c) were inherited from a recent common ancestor;
 - d) indicate sympatric speciation, since both species occupy similar arboreal niches;
 - e) are considered to be homologies, indicative of common ancestry.
- 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 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.
- 34) Structural (morphological) characters
- a) are more frequently used by modern biologists than DNA characters to understand phylogenies;
 - b) are useful for classifying organisms but can not be used to determine phylogenetic trees;
 - c) can be more easily identified as homologous than can DNA characters from the same species;
 - d) are generally fewer in number than the DNA characters for any particular group of organisms;
 - e) each have four possible character states: A, C, G or T.