

MCDB 1150-003 Biofundamentals NAME _____
Midterm 1- Fall 2015

Directions: Select the answer that is **INCORRECT** and in one or two sentences explain why it is wrong. In a few questions, all of the answers are correct, if this is the case, briefly explain why. Do not exceed the space provided.

Each question is worth 5 points and there is a total of 20 questions on the exam. Remember you can check "I have no idea" you will receive 1 point (no reasoning is required).

- 1) Which of the following is a question that can be tested scientifically?
- A. Is it morally correct to vaccinate your children?
 - B. Do taller people make more money?
 - C. Does the human papilloma virus (HPV) cause AIDS?

A: is incorrect because....science is not able to decipher between what is morally correct or incorrect – morals belong to a belief system and therefore are outside of the scientific paradigm.

- 2) Which statements are correct about the scientific process?
- A. Making an observation, forming a hypothesis, and testing the hypothesis are a part of the scientific process
 - B. Once scientific models are established based on an observation they are recognized as being true
 - C. Collecting experimental or observational data and drawing conclusions that are communicated to the broader scientific community are a part of the scientific process

B is incorrect because.... scientific models are continually being modified, expanded, or replaced in order to explain more and more phenomena more and more accurately.

- 3) Which of the following best describes how a deleterious (i.e., harmful) allele can become fixed in a population?
- A. This can happen when the population size become very small
 - B. This can happen when a population is becomes very large
 - C. This can happen due to gene linkage.

B is incorrect because... as populations get larger any given allele (including a deleterious allele) is less likely to become fixed in a population by genetic drift.

- 4) You want to group a number of organisms together so that the grouping has biological significance and can be used to ask questions about trait evolution – which of the following criteria should one follow?
- A. Only group those organisms that include the ancestor and all of its descendants
 - B. Only group organisms that cluster together on a phylogenetic tree (i.e., that are directly connected on a phylogenetic tree)
 - C. Only group organisms that have the trait of interest

C is incorrect because.... you do not know if organisms with a similar trait share that trait due to common ancestry or due to convergent evolution

- 5) Which of the following statement best describes the characteristics of small populations?
- A. Small populations are more likely to go extinct
 - B. Genetic drift is more likely happen in small populations
 - C. Small populations have increased genetic variation

C is incorrect because.... small populations have decreased genetic variation (fewer individuals, fewer alleles present)

- 6) Which of the following would be a process most likely to create a new species?
- A. Founder effect
 - B. Stabilizing selection
 - C. Disruptive selection

B is incorrect because.... stabilizing selection often results in a reduction of population variation

- 7) Which of the following provide evidence to support the conclusion that all life on earth originated from one common ancestor?
- A. All organisms use double stranded DNA as their genetic material
 - B. All organisms use a common genetic code
 - C. All organisms use the same molecular systems, transcription and translation, to access the information stored in DNA

ALL OF THESE ARE CORRECT

- 8) If you prevented a population of humans from eating any vitamin C at all, which of the following are **possible** outcomes?
- A. A new mutation would be induced in the population that allows humans to make vitamin C
 - B. Everyone in the population would die
 - C. Allele(s), already present in the population, that enable people to make vitamin C would be revealed

A is incorrect because.... selection does not induce or cause specific mutations, rather mutations are random and selection only acts upon variation that is already present.

- 9) Evolution as a result of natural selection will result when you have which of the following?
- A. Phenotypic variation in a population
 - B. Differential reproductive success
 - C. Phenotypic variation has a inheritable component

ALL OF THESE ARE CORRECT

- 10) Which of the following organismal examples work well with the biological species concept where successful sexual reproduction is used to define species?
- A. Primates (such as humans)
 - B. Ring species (such as *Ensatina* salamanders)
 - C. Canines (such as wolves and coyotes)

B is incorrect because.... ring species show continuous gene flow across the entire distribution of populations, yet not all populations can successfully interbreed directly

- 11) Which of the following statements about natural selection are correct?
- A. Natural selection can result in solutions that are less than perfect in terms of an organism's adaptation to its environment.
 - B. Natural selection can lead to the fixation of a trait that shortens an individual's life span.
 - C. Natural selection creates optimal (perfect) solutions for organisms to deal with environmental pressures

C is incorrect because.... natural selection does not create optimal solutions rather natural selection results in solutions that are just good enough to influence fitness

- 12) In a rapid environmental shift (for example global warming) which populations would you predict would be more susceptible to extinction?
- A. Large populations with many different alleles at many different genes
 - B. A population with low allelic diversity little phenotypic variation
 - C. A population that has undergone a bottleneck in its recent past

A is incorrect because.... the larger a population the more likely alleles will be present that allow the population to persist in diverse environmental conditions

- 13) If we ignore the sex chromosomes (X and Y), which of the following statements apply to species that are diploid (such as humans)?
- A. Individuals that comprise the species have different sets of genes.
 - B. There are two copies of each gene the genome
 - C. Individuals that comprise the species have different sets of alleles

A is incorrect because.... individuals within a species share a common set of genes – it is alleles that differ between individuals

14) If a trait was analogous in two different species, which of the following would expect to be true?

- A. The trait would have evolved due to similar selective pressures
- B. The common ancestor of those two species would have the trait
- C. The trait appeared independently in the two lineages
- D.

B is incorrect because.... if the common ancestor of the two species had the trait it would likely be homologous.

15) Which of the following statements about evolution are correct?

- A. Similarity (shared derived characters) between species can be used to reconstruct evolutionary relationships
- B. The size of the of differences between species can be used to reconstruct evolutionary relationships
- C. Evolution is a continuous process

B is incorrect because.... differences are infinite and therefore cannot be used to determine evolutionary relationships

16)The half-life of a radioactive isotope (atom) is 10 days. If you had 100 billion atoms and were to measure any one particular atom on day 10

- A. You could confidently predict whether or not it had decayed
- B. You could not predict with certainty whether that particular atom had decayed
- C. As you increased the numbers of atoms you measured, you would find that approximately half had decayed by day 10

A is incorrect because.... decay is a spontaneous process that can only be estimated via statistical probability, which requires a large sample size

17)Given what you know about germ line cells and somatic cells, which of the following statements is correct?

- A. Mutations are just as likely to occur in somatic cells as they are in germ line cells
- B. Somatic cells and germ line cells in humans have the same ploidy
- C. Somatic cells undergo mitosis while germ line cells undergo meiosis

B is incorrect because.... somatic cells are diploid and germ line cells are haploid in humans

18)Consider Sewall Wright's equation [$r * b > c$] where c =cost, b =benefit & r =relatedness in terms of group/kin selection. Which of the following statements is true?

- A. When $r=0$ a social trait will not be fixed in a population.
- B. When $r*b$ is greater than c a social trait will be selected for in a population
- C. As the value for r increases, selective pressure increases for social traits

A is incorrect because.... r can never equal zero since all organisms are ultimately derived from a single common ancestor (i.e., all organisms are related)

19) Which of the following might explain why males of a specific bird species are very colorful as opposed to the females of this same species?

- A. Robustness of offspring correlates with the robustness of the male and this is reflected in the male coloration
- B. The coloration is used in displays that allow males to successfully establish and defend mating territory
- C. Coloration allows males to blend into their surrounding environment therefore avoiding predation

C is incorrect because.... if their coloration was selected for as a means of camouflage both males and females would display the trait.

20) You notice that the males and females of a particular rodent species are very different morphologically, what could you hypothesize about this species?

- A. This species is experiencing sexual selection
- B. This species is experiencing disruptive selection
- C. This species has females that invest more energy in egg production than the males invest in sperm production

B is incorrect because.... disruptive selection acts on an entire species (males & females together) – it does not separate the sexes into different evolutionary populations because of course if it did then the species would cease to exist.