

MCDB 1111: Biofundamentals '08 Spring Answer key

1. The physiochemical theory of life implies that ...

- A. The behavior of living organisms can be predicted based on physiochemical laws.
- B. Living organisms must be made of carbon.
- C. Living organisms do not violate physical or chemical laws.
- A or B B or C A or C no idea

Can't predict behavior, but must be consistent with.



2. Charles Darwin wrote "Ignorance more frequently begets confidence than does knowledge: it is those who know little, and not those who know much, who so positively assert that this or that problem will never be solved by science." What gives us confidence that problems, like the origin of life, will eventually be solved scientifically?

- A. simple human arrogance
- B. a belief that the world was created in such a way so that we would be able to understand it

C. previous experience with difficult problems

Belief is based on past experience (it works), could justify B

3. In a particular population the average male and female each produce ...

- A. the same number of offspring
- B. males produce more
- C. females produce more

Each offspring has 1 male and 1 female parent

4. You find a completely new form of life, one that does not use DNA to store genetic material or proteins to get things done. Where would you put such an organism on the circular tree of life?

- A. I would put it on a new circle
- B. I would put it near the center of the circle
- C. I would put it on the periphery, but unconnected to other organisms

Although you could justify A as well

5. Which do you think is beyond the ability of science to achieve ...

- A. the creation of a living organism
- B. the construction of a thinking (self-conscious) machine
- C. the construction of machine that generates more energy than it uses

Only because it violates the laws of thermodynamics you could justify A as well

6. You go to Whole Foods and you see a new holistic "supplement" that suggests it can help people with "social awkwardness disorder" (SAD). When you read the instructions, you discover that you are supposed to take a shower and brush your teeth after you take the supplement. What kind of study might you want to perform in order to convince yourself that the supplement actually works as advertised.

- A. take a shower and brush your teeth without taking the medicine
- B. take the medicine, but don't take a shower or brush your teeth
- C. take the medicine, brush your teeth and take a shower

But A or A&B can also be justified

7. There is a human gene which, when mutated, leads to significant increase in intelligence, and this increase occurs in young children. There is evidence that the "smart version" of the gene is always rapidly eliminated from populations of humans. Which is a plausible reason?

- A. genetic drift leads to its elimination
- B. higher intelligence makes it harder to find a mate
- C. the early increase in intelligence drives parents crazy, and they abandon their "smart ass" children

C is clearly correct, but B could be justified - A cannot

8. Some lost and befuddled aliens visit the earth about 120 million years ago, they are most likely to find ...

- A. humans
- B. apes
- C. the ancestors of humans

Apes and human have a common ancestor, but both diverged from that ancestor much more recently, 5 to 10 million years ago.

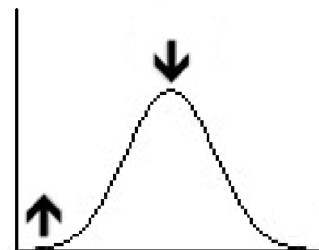
9. Consider humans, how would you describe the effects of sexual selection; it ...

- A. exclusively effected males
- B. exclusively effected females
- C. produced different effects on males and females

Since there is clear dependence of females on males in successful rearing of offspring (and males need to be selected as mates, or to "capture and maintain" access to females, both are influenced by sexual selection.

10. Consider the following distribution of a trait (within a population); over time the number of organisms at the position of the down arrow decreases, while those at the up arrow increases; what type of selection is occurring?

- A. Disruptive
- B. Conservative
- C. Directed



but you could justify A with some additional assumptions.

11. Under what conditions would disruptive selection be most likely to occur?

- A. a uniform environment, with a small population
- B. rapidly changing environment with a large population
- C. a very diverse environment, independent of population size

But you might be able to make some argument for B (although diversity rather than rapid change is needed to drive divergent selection).

12. How does population size influence genetic drift?

- A. no effect, drift is independent of population size
- B. the smaller the population, the more rapid is the effect of genetic drift
- C. the larger the population, the more rapid is the effect of genetic drift

Directly from the genetic drift exercise!

13. When fossils were first understood to represent organisms that lived long ago, it was hard to understand why any type of organism would become extinct. Now we understand that extinct organisms ...

- A. were unable to adapt to a changing environment
- B. were unable to survive due to genetic drift and high levels of mutation
- C. were badly designed from the onset

Good adaptation to one environment is no guarantee to survival in a different one.

14. Most adult mammals are intolerant of milk sugar (lactose). However, there are populations of humans in which lactose tolerance is high. We can assume that ...

- A. lactose tolerance is a homologous trait
- B. lactose tolerance is harmful
- C. lactose tolerance is an analogous trait

Adult mammals can digest lactose (they turn off the gene), the ability to digest lactose as an adult (in humans) is an adaptation to cattle rearing and the consumption of milk products, it has arisen independently in a number of cultures.

15. Even among species that form stable mating pairs, and in which the males aggressively "protect their females", it is not uncommon to find evidence of sexual "cheating." This is because....

- A. such a strategy can enhance the reproductive success of females
- B. such a strategy permits all males a chance to breed
- C. animals are unaware of their own behavior, that is, they do not think they are cheating

Strict adherence to sexual fidelity might lead to "missed opportunities" that could improve a female's reproductive success. Males could also adapt to exploit this "liberality"

16. The most extreme forms of sexual selection generally affect males because ...

- A. males differ more than females in terms of reproductively success
- B. females lack the genetic variation to produce such traits
- C. females are less interested in sex than males
- A or B B or C A or C no idea

Since males differ much more dramatically that females in reproductive success, the competitive selective pressures are greater on them.

17. Genetic drift can be beneficial in terms of subsequent evolution because

- A. it decreases the size of the population on which selection acts
- B. an originally harmful trait can be changed by mutation and subsequent selection
- C. it preferentially removes harmful traits, leaving beneficial ones

Changes based on drift are random, but once in place can lead to new selective opportunities (or hurdles).

18. Predict the appearance of the most recent common ancestor of humans and cows...

- A. large and scaly
- B. small and furry
- C. furry and egg laying

probably lived very long ago, clearly furry (both are mammals), not egg laying, likely small.

19. A number of different organisms have eyes, these are...

- A. homologous
- B. analogous
- C. depends on the organisms

Eyes have evolved multiple times in different lineages, but other answers could be justified.

20. Domesticated dogs range from the smallest Chihuahua (~ 2 lbs) to the largest English Mastiff (~280 lbs), a range of over two orders of magnitude (10^2). Why isn't there a similar range in the sizes of domestic cats?

- A. Dogs have more genetic variation than cats
- B. Large cats are more dangerous than large dogs
- C. The social nature of dogs makes it easier to breed for "controllability"

If cats were social, they might have been chosen