

## Study Guide Keys

### **Evolution Questions**

1. Which of the following is most often associated with the elaborate courtship rituals conducted by many birds? (1990:14)

**a. species recognition**

- b. migration
- c. feeding response
- d. altruism
- e. kin selection

2. The replacement of glutamic acid by valine at a specific position in the beta chains of hemoglobin leads to sickle cell anemia. This change represents which of the following mutational events? (1990:32)

**a. DNA base-pair substitution**

- b. DNA base-pair deletion
- c. DNA base-pair addition
- d. chromosomal deletion
- e. frameshift mutation

3. The differences in cricket calls among sympatric species of crickets are examples of (1990:51)

- a. habitat isolation
- b. temporal isolation
- c. physiological isolation

**d. behavioral isolation**

- e. geographic isolation

4. Which of the following statements best expresses the concept of punctuated equilibrium? (1990:51)

- a. Small variations gradually accumulate in evolving lineages over periods of millions of years.
- b. Random mating ensures that the proportions of genotypes in a population remain unchanged from generation to generation.
- c. Stability is achieved when selection favors the heterozygote, while both types of homozygotes are at a relative disadvantage.
- d. Evolutionary changes consist of rapid bursts of speciation alternating with long periods in which species remain essentially unmodified.**
- e. Under competition for identical resources, one of the two competing species will be eliminated or excluded.

5. Which of the following principles is NOT part of Darwin's theory of evolution by natural selection? (1999:53)

- a. Evolution is a gradual process that occurs over long periods of time.
- b. Variation occurs among individuals in a population.
- c. Mutations are the ultimate source of genetic variation**
- d. More individuals are born than will survive
- e. Individuals that possess the most favorable variations have the best chance of reproducing.

6. In a small group of people living in a remote area, there is a high incidence of "blue skin", a condition that results from a variation in the structure of hemoglobin. All of the "blue-skinned" residents can trace their ancestry to one couple, who were among the original settlers of this region. The unusually high frequency of "blue skin" in the area is an example of (1999:44)

- a. mutation
- b. genetic drift**
- c. natural selection
- d. sexual selection
- e. heterozygote advantage

7. In certain Native American groups, albinism due to a homozygous recessive condition in the biochemical pathway for melanin is sometimes seen. If the frequency of the allele for this condition is 0.06, which of the following is closest to the frequency of the dominant allele in this population? (Assume Hardy-Weinberg equilibrium.) (1999:54)

- a. 0.04
- b. 0.06
- c. 0.16
- d. 0.36
- e. 0.94**

### Genetics Questions

1.  $A$  represents the dominant allele and  $a$  represents the recessive allele of a pair. If, in 1000 offspring, 500 are  $aa$  and 500 are of some other genotype, which of the following are most probably the genotypes of the parents? (1990:4)

- a.  $Aa$  and  $Aa$
- b.  $Aa$  and  $aa$**
- c.  $AA$  and  $Aa$
- d.  $AA$  and  $aa$
- e.  $aa$  and  $aa$

2. A form of vitamin D-resistant rickets, known as hypophosphatemia, is inherited as an X-linked dominant trait. If a male with hypophosphatemia marries a normal female, which of the following predictions concerning their potential progeny would be true? (1990:44)

- a. All of their sons would inherit the disease
- b. All of their daughters would inherit the disease**
- c. About 50% of their sons would inherit the disease
- d. About 50% of their daughters would inherit the disease
- e. None of their daughters would inherit the disease

3. Which of the following best describes the parents in a testcross? (1999:9)

- a. One individual has the dominant phenotype and the other has the recessive phenotype.**
- b. Both individuals are heterozygous.
- c. Both individuals have the dominant phenotype.
- d. Both individuals have the recessive phenotype.
- e. Both individuals have an unknown phenotype.

4. Which of the following is the most likely explanation for a high rate of crossing-over between two genes? (1999:51)

- a. The two genes are far apart on the same chromosome.**
- b. The two genes are both located near the centromere.
- c. The two genes are sex-linked.
- d. The two genes code for the same protein.
- e. The two genes are on different chromosomes.

5. In peas the trait for tall plants is dominant ( $T$ ) and the trait for short plants is recessive ( $t$ ). The trait for yellow seed color is dominant ( $Y$ ) and the trait for green seed color is recessive ( $y$ ). A cross between two plants results in 296 tall yellow plants and 104 tall green plants. Which of the following are most likely to be the genotypes of the parents? (1999:28)

- a.  $TTYy \times TTYy$
- b.  $Ttyy \times TTYy$
- c.  $TtYy \times TtYy$
- d.  $TtYy \times TTYy$**
- e.  $TtYY \times Ttyy$

6. In humans, red-green color blindness is a sex-linked recessive trait. If a man and a woman produce a color-blind son, which of the following *must* be true? (1999:43)

- a. The father is color-blind.
- b. Both parents carry the allele for color blindness.
- c. Neither parent carries the allele for color blindness.
- d. The father carries the allele for color blindness.
- e. The mother carries the allele for color blindness.**

7. In the pedigree below, squares represent males and circles represent females. Individuals who express a particular trait are represented by shaded figures. Which of the following patterns of inheritance best explains the transmission of the trait? (1999:56)

- a. Sex-linked dominant
- b. Sex-linked recessive
- c. Autosomal recessive
- d. Autosomal dominant**
- e. Incompletely dominant

**Questions 8 & 9.** These two questions refer to the birth of a child with blood type A to a mother with blood type B. (1999:102-103)

8. The father must have which of the following blood types?

- a. AB only
- b. Either AB or B
- c. Either AB or O
- d. Either AB or A**
- e. AB or A or O

9. If the father has blood type AB, which of the following statements is correct about the mother?

- a. She contributes an IB allele, which is recessive to the father's IA allele.
- b. She contributes an i allele, which is recessive to the father's IA allele.**
- c. She contributes an IB allele, which is codominant to the father's IA allele.
- d. She contributes an i allele, which is codominant to the father's IB allele.
- e. She is homozygous for the IB allele.

10. If in the F1 and F2 generations the same characteristics appeared in both male and females, it would be safe to assume that these traits for eye color and wing length...

- a. are sex-linked
- b. vary in dominance according to sex
- c. are sex-influenced characteristics
- d. are autosomal characteristics**
- e. follow the Mendelian rule of independent assortment

11. In the F2 generation, the results are best explained by the fact that...

- a. the test cross with the F1 flies resulted in sterile offspring
- b. these genes for eye color and wing shape do not pass through the F1 generation
- c. these genes for eye color and wing shape are found on the same chromosome**
- d. crossing over decreases variability
- e. the genes are sex-linked

12. If a single locus controls wing shape, then the alleles for this gene act as...

- a. **dominant-recessive alleles**
- b. incomplete-dominance alleles
- c. codominant alleles
- d. multiple alleles
- e. variable alleles

13. DNA replication can be described as (1990:70)

- a. **semiconservative**
- b. conservative
- c. degenerative
- d. dispersive
- e. radical

14. What would be the sequence of bases of an mRNA molecule that was transcribed from the sequence of DNA bases shown below? (1990:40)

GTAGTAGGT

- a. GTAGTAGGT
- b. **CAUCAUCCA**
- c. UCGUCGUUC
- d. AUGAUGAAU
- e. CATCATCCA

**Questions 15–19.** Refer to the following list to answer the following questions. The answers may be used once, more than once, or not at all. (1999:92-95)

- a. transcription
- b. translation
- c. transformation
- d. replication
- e. reverse transcription

15. Process in which a protein is assembled at a ribosome. \_\_\_\_\_B\_\_\_\_\_

16. Process in which naked DNA is taken up by a bacterial or yeast cell \_\_\_\_\_C\_\_\_\_\_

17. Process in which RNA is produced by using a DNA template. \_\_\_\_\_A\_\_\_\_\_

18. Process that results in the production of cDNA from an RNA molecule \_\_\_\_\_E\_\_\_\_\_

19. Process in which DNA is produced by using a DNA template. \_\_\_\_\_D\_\_\_\_\_

**\*\*NOT ON THE MIDTERM\*\*** Questions 20–22 refer to an experiment that was performed to separate DNA fragments from four samples radioactively labeled with <sup>32</sup>P. The fragments were separated by gel electrophoresis. The visualized bands are illustrated in the figure below.

20. The electrophoretic separation of the pieces of DNA in each of the four samples was achieved because of differential migration of the DNA fragments in an electric field. This differential migration was caused by the

- a. relative amounts of radioactivity in the DNA
- b. number of cleavage points per fragment
- c. size of each fragment**
- d. overall positive charge of each fragment
- e. solubility of each fragment

21. The DNA was labeled with  $^{32}\text{P}$  in order to

- a. stimulate DNA replication
- b. inhibit the uptake of unlabeled ATP
- c. show which fragments included the 5' end and which fragments included the 3' end
- d. visualize the fragments**
- e. speed up the rate of separation by electrophoresis

22. Which of the following is an additional use of the gel electrophoresis technique?

- a. To express a gene
- b. To separate proteins in a mixture**
- c. To ligate DNA fragments
- d. To transform E. coli
- e. To amplify genes

### Metabolism Questions

1. The carbon that makes up organic molecules in plants is derived directly from

- a. combustion of fuels
- b. carbon fixed in photosynthesis**
- c. carbon dioxide produced in respiration
- d. carbon in the lithosphere
- e. coal mines

2. If plants are grown for several days in an atmosphere containing  $^{14}\text{CO}_2$  in place of  $^{12}\text{CO}_2$ , one would expect to find

- a. very little radioactivity in the growing leaves
- b. large amounts of radioactive water released from the stomates
- c. a large increase in  $^{14}\text{C}$  in the starch stored in the roots**
- d. a large decrease in the rate of carbon fixation in the guard cells
- e. an increase in the activity of RuBP carboxylase in the photosynthetic cells

3. The  $O_2$  released during photosynthesis comes from

- a.  $CO_2$
- b.  $H_2O$**
- c. NADPH
- d. RuBP
- e.  $C_6H_{12}O_6$

4. The end products of the light-dependent reactions of photosynthesis are

- a. ADP,  $H_2O$ , NADPH
- b. ADP, G3P, RuBP
- c. ATP,  $CO_2$ ,  $H_2O$
- d. ATP, NADPH,  $O_2$**
- e.  $CO_2$ ,  $H^+$ , G3P

5. Which of the following enzymes is responsible for  $CO_2$  fixation in  $C_3$  plants?

- a. succinate dehydrogenase
- b. RuBP carboxylase**
- c. hexokinase
- d. amylase
- e. DNA polymerase

6. Which of the following is an important difference between light-dependent and light-independent reactions of photosynthesis?

- a. The light-dependent reactions occur only during the day; the light-independent reactions occur only during the night.
- b. The light-dependent reactions occur in the cytoplasm; the light-independent reactions occur in chloroplasts.
- c. The light-dependent reactions utilize  $CO_2$  and  $H_2O$ ; the light-independent reactions produce  $CO_2$  and  $H_2O$ .
- d. The light-dependent reactions depend on the presence of both photosystems I and II; the light-independent reactions require only photosystem I.
- e. The light-dependent reactions produce ATP and NADPH; the light-independent reactions use energy stored in ATP and NADPH.**

7. During respiration, most ATP is formed as a direct result of the net movement of

- a. potassium against a concentration gradient
- b. protons down a concentration gradient**
- c. electrons against a concentration gradient
- d. electrons through a channel
- e. sodium into the cell

8. Which of the following processes is carried out more efficiently by a C4 plant than by a C3 plant?
- a. light absorption
  - b. chemiosmotic coupling
  - c. photolysis
  - d. fixation of CO<sub>2</sub>**
  - e. transport of sugar
9. On a sunny day, the closing of stomata in plant leaves results in
- a. a decrease in CO<sub>2</sub> intake**
  - b. a shift from C3 photosynthesis to C4 photosynthesis
  - c. an increase in transpiration
  - d. an increase in the concentration of CO<sub>2</sub> in mesophyll cells
  - e. an increase in the rate of production of starch
10. Oxygen consumption can be used as a measure of metabolic rate because oxygen is
- a. necessary for ATP synthesis by oxidative phosphorylation**
  - b. necessary to replenish glycogen levels
  - c. necessary for fermentation to take place
  - d. required by all living organisms
  - e. required to break down the ethanol that is produced in muscles

### **Biochemistry**

1. A compound unrelated to the substrate that binds to and alters a group in the active site is usually a(n)
- A. Promoter
  - B. Terminator
  - C. Activator
  - D. Producer
  - E. Inhibitor**
2. The disorder of a system is measured by its
- A. activation energy
  - B. heat of reaction
  - C. entropy**
  - D. energy
  - E. enteron
3. Which is the optimum pH of most human enzymes?
- A. 1
  - B. 2
  - C. 5
  - D. 7**
  - E. 10



4. Which compounds would be lipids or derivatives of lipids?
- A. glycogen and cellulose
  - B. cholesterol and estrogen**
  - C. keratin and protease
  - D. chlorophyll and hemoglobin
  - E. DNA and RNA

Base your answers to questions 5 and 6 below on the reading passage that follows and your knowledge or lack of same in biology.

A student ground 1 gram of fresh liver in a mortar, placed the ground liver in a test tube, and added 1 ml of peroxide. The gas that was generated was collected. A glowing splint burst into flames when placed in the gas. The student then repeated the procedure, using one gram of boiled liver and one gram of liver treated with a strong acid. When peroxide was added to each sample of liver, no gas was generated.

5. The gas that was generated was most likely
- A. oxygen**
  - B. nitrogen
  - C. carbon dioxide
  - D. hydrogen
  - E. ammonia
6. If the substance in the liver that acted on the peroxide was an enzyme, it could
- A. be recovered from the living tissue that had not been boiled or treated with acid after the reaction ceased**
  - B. not be recovered because it was consumed while engaging in its catalytic reaction activities
  - C. not be recovered because there is no enzyme in liver that catalyzes the breakdown of peroxide
  - D. not be recovered because grinding would break up the molecule
  - E. be recovered only before the peroxide was added
7. Which of the following molecules is smallest?
- A. sucrose
  - B. glucose**
  - C. glycogen
  - D. starch
8. Which element is not required in order for the compound to be considered organic?
- A. carbon
  - B. oxygen**
  - C. hydrogen
  - D. all must be present

9. Which element is usually found in proteins but not in triglycerides?
- A. calcium
  - B. phosphorus
  - C. nitrogen**
  - D. oxygen
10. Structurally lipids are a very diverse group but they are all placed in one group because of what property?
- A. They are composed of glycerol and fatty acids.
  - B. They are all relatively insoluble in water.**
  - C. They all contain four interlocking rings.
  - D. They all are important as energy storage molecules.
  - E. None of the answers is correct.
11. In the digestive process, the macromolecules are broken down into small molecules that can cross cell membranes. This process is called:
- A. hydrolysis**
  - B. dehydration synthesis
  - C. cellular respiration
  - D. protein synthesis
12. The functional group(s) associated with amino acids is/are
- A. hydroxyl
  - B. carbonyl
  - C. phosphate
  - D. amino
  - E. carboxyl
  - F. both amino and carboxyl**
13. The following equation (G stands for glucose)
- $$G + G + G \text{ -----} > G-G-G + 2H_2O, \text{ is an example of}$$
- A. ionic bond formation
  - B. peptide bond formation
  - C. dehydration synthesis**
  - D. hydrolysis
14. All the following reactions involve dehydration synthesis except
- A. the formation of a disaccharide
  - A. the production of a polypeptide
  - B. the formation of a fat
  - C. digestion of a polysaccharide**
  - D. the production of a complex sugar.

15. Which term is most inclusive?
- A. glucose
  - A. amylose
  - B. sucrose
  - C. carbohydrate**
  - D. fructose
16. All of the following are storage carbohydrates except
- A. starch
  - B. glycogen
  - C. amylopectin
  - D. amylose
  - E. cellulose**
17. All the following are true concerning fats except
- A. their monomers consist of glycerol and three fatty acids
  - B. they are used for protection of vital organs
  - C. plants may contain fats in their seeds
  - D. saturated fats have many double bonds between their carbons**
  - E. one gram of fat gives off 9 calories of energy.
18. Which statement is true?
- A. Proteins are made of amino acids held together by ester bonds.
  - B. A polysaccharide is a complex lipid needed for storage and structure.
  - C. The primary protein structure is based on the order of its amino acids.**
  - D. Steroids are complex proteins needed to control the bodies chemistry.
19. All the following molecules contain more than one ring comprising them **except**
- A. Cholesterol
  - B. glucose**
  - C. progesterone
  - D. sucrose
20. A consequence of the cell membrane being composed of phospholipids is:
- A. it is hydrophobic at the ends and hydrophilic in the middle
  - B. it is hydrophilic at the ends and hydrophobic in the middle**
  - C. it is a steroid
  - D. it is a nonpolar molecule
  - E. it is high in energy

21. All the following are proteins except:
- A. hemoglobin
  - B. keratin
  - C. enzymes
  - D. antibodies
  - E. **glycogen**
22. The main difference between the secondary and quaternary structure of a protein is
- A. bond angles between amino acids
  - B. sequence of amino acids
  - C. **number of polypeptides in the molecule**
  - D. the folding pattern of the molecule
23. The 'primary structure' of a protein refers to
- A. interactions among the side chains or R-groups of the amino acids
  - B. coiling due to hydrogen bonding between amino acids
  - C. **the number and sequence of amino acids**
  - D. the alpha-helix, or pleated sheets
  - E. the weak interaction of two or more polypeptides
24. A fatty acid containing at least two double bonds is called
- A. cholesterol
  - B. saturated
  - C. **polyunsaturated**
  - D. dehydrogenase
  - E. monounsaturated
25. Which is NOT a function of carbohydrates (as a class)?
- A. Structural support
  - B. Immediate energy
  - C. Energy storage
  - D. **Enzymatic catalysis**
  - E. All are carbohydrate functions.

## Cell Questions

1. The nucleolus functions in the production of (1994:12)
  - A. Golgi apparatus
  - B. microtubules
  - C. mitochondria
  - D. ribosomes**
  - E. endoplasmic reticulum
  
2. Which is a characteristic of mitochondria and chloroplasts that supports the endosymbiotic theory (1994:10)
  - A. Both have bacteria-like polysaccharide cell walls
  - B. Both can reproduce on their own outside the cell
  - C. Both contain DNA molecules**
  - D. Both contain endoplasmic reticulum and Golgi bodies
  - E. Both contain ribosome that are identical to ribosomes of the eukaryotic cytoplasm
  
3. All of the following cell components are found in prokaryotic cells EXCEPT (1990:17)
  - A. DNA
  - B. ribosomes
  - C. cell membrane
  - D. nuclear envelope**
  - E. enzymes
  
4. The organelle that is the major producer of ATP and is found in both heterotrophs and autotrophs is the (1990:7)
  - A. chloroplast
  - B. nucleus
  - C. ribosome
  - D. Golgi apparatus
  - E. mitochondrion**
  
5. If plant cells are immersed in distilled water, the resulting movement of water into the cells is called (1990:34)
  - A. conduction
  - B. active transport
  - C. transpiration
  - D. osmosis**
  - E. facilitated diffusion

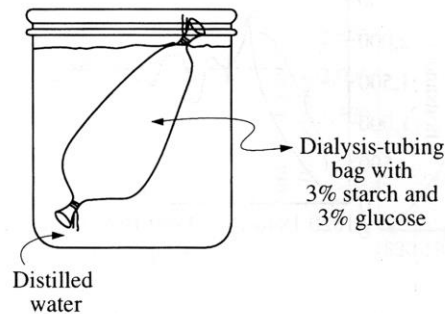
6. Which of the following is the primary role of the lysosome (1990:46)

- A. ATP synthesis
- B. intracellular digestion**
- C. lipid transport
- D. carbohydrate storage
- E. protein synthesis

7. Cytoplasmic channels between plant cells which are most similar to gap junctions between animal cells are called (1990:64)

- A. middle lamellas
- B. tonoplasts
- C. plasmodesmata**
- D. tight junctions
- E. desmosomes

**Questions 8-10.** The following questions refer to an experiment in which a dialysis-tubing bag is filled with a mixture of 3% starch and 3% glucose and placed in a beaker of distilled water, as shown at right. After 3 hours, glucose can be detected in the water outside the dialysis-tubing bag, but starch cannot. (99:114.116)



8. From the initial conditions and results described which of the following is a logical conclusion? (99:114)

- A. The initial concentration of glucose in the bag is higher than the initial concentration of starch in the bag.
- B. The pores of the bag are larger than the glucose molecules but smaller than the starch molecules.**
- C. The bag is not selectively permeable.
- D. A net movement of water into the beaker has occurred.
- E. The molarity of the solution in the bag and the molarity of the solution in the surrounding beaker are the same.

9. Which of the following best describes the conditions expected after 24 hours? (99:115)

- A. The bag will contain more water than it did in the original condition.**
- B. The contents of the bag will have the same osmotic concentration as the surrounding solution.
- C. Water potential in the bag will be greater than water potential in the surrounding solution.
- D. Starch molecules will continue to pass through the bag.
- E. A glucose test on the solution in the bag will be negative.

10. If, instead of the bag, a potato slice were placed in the beaker of distilled water, which of the following would be true of the potato slice? (99:116)

**A. It would gain mass.**

B. It would neither gain nor lose mass.

C. It would absorb solutes from the surrounding liquid.

D. It would lose water until water potential inside the cells is equal to zero.

E. The cells of the potato would increase their metabolic activity.