Mini-diagnostic Test

Biology E/M

With Answers and Analysis

Directions: Each of the questions or incomplete statements below is followed by five possible answers or completions. For both Biology-E and Biology-M, answer questions 1–30. Select the one choice that is the best answer and fill in the corresponding space on the answer sheet.

1. Referring to this list of vertebrates, which is the correct sequence of evolution?
   (A) Bony fish—amphibians—reptiles—birds
   (B) Birds—bony fish—amphibians—reptiles
   (C) Amphibians—reptiles—bony fish—birds
   (D) Reptiles—birds—bony fish—amphibians
   (E) Reptiles—birds—amphibians—bony fish

2. Which of the following is an endotherm?
   (A) Grasshopper
   (B) Hydra
   (C) Earthworm
   (D) Blue jay
   (E) Frog

3. Mycorrhizae are
   (A) plants that have no vascular tissue
   (B) nitrogen-fixing bacteria that live in nodules on the roots of legumes
   (C) primitive plants like mosses, which show a dominant gametophyte stage
   (D) vascular bundles in the stems of tracheophytes
   (E) symbiotic structures living in the roots of plants that increase uptake of nutrients from the soil
4. All of the following are matched correctly EXCEPT
   (A) nerve net—hydra
   (B) Malpighian tubules—earthworms
   (C) nematocysts—hydra
   (D) contractile vacuoles—amoeba
   (E) flame cells—planaria

5. The tissue in a plant that constantly undergoes mitosis is the
   (A) pith
   (B) xylem
   (C) phloem
   (D) cortex
   (E) cambium

6. According to Hardy-Weinberg theory, which of the following represents a heterozygous individual?
   (A) \( p \)
   (B) \( p^2 \)
   (C) \( 2pq \)
   (D) \( q^2 \)
   (E) \( q \)

7. In the case of pea plants, tall \((T)\) is dominant over dwarf \((t)\). What is the genotype of the parents of a generation of plants half of which are tall and half of which are dwarf?
   (A) \( Tt \times tt \)
   (B) \( Tt \times Tt \)
   (C) \( TT \times tt \)
   (D) \( X^T X^t \times X^T X^t \)
   (E) \( X^T X^t \times X^t X^t \)

8. Within less than 2 years of the introduction of a new antibiotic, bacteria appear that are resistant to that antibiotic. This is an example of
   I. Divergent evolution
   II. Adaptive radiation
   III. Directional selection
   (A) I only
   (B) II only
   (C) III only
   (D) I and III only
   (E) I, II, and III
9. For which of the following pairs is the first term NOT a building block of the second term?
   (A) Fatty acid—insulin
   (B) Glucose—chitin
   (C) Thymine—nucleotide
   (D) Amino acid—hemoglobin
   (E) Nitrogen—uric acid

10. A boy with red-green color blindness has a color-blind father and a mother who is not color-blind. The boy inherited his color blindness from
   (A) his father
   (B) his mother
   (C) either his father or his mother
   (D) both parents; this is an example of incomplete dominance
   (E) it cannot be determined

11. All of the following are related to locomotion EXCEPT
   (A) setae
   (B) tendons
   (C) pseudopods
   (D) hydrostatic skeleton
   (E) typhlosol

12. During which phase of the cell cycle does DNA replication occur?
   (A) Prophase
   (B) Metaphase
   (C) Cytokinesis
   (D) Interphase
   (E) Telophase

Directions: Each set of lettered choices below refers to the numbered questions or statements immediately following it. Select the one lettered choice that best answers each question and fill in the corresponding space on the answer sheet. A choice may be used once, more than once, or not at all in each set.

Questions 13–16
   (A) Global warming
   (B) Eutrophication of lakes
   (C) Depletion of the ozone layer
   (D) Magnification in the food chain
   (E) Acid rain

13. Related to the use of chlorofluorocarbons

14. Pesticides sprayed in the environment can threaten predators in the area.
15. Caused by an increase in CO₂ concentration in the atmosphere

16. Caused by SO₂ in the air

Questions 17–18

I. Acoelomate
II. Radial symmetry
III. Development of a head

17. Cnidarians are characterized by which of the following?
   (A) I only
   (B) II only
   (C) III only
   (D) I and III only
   (E) I, II, and III

18. Flatworms are characterized by which of the following?
   (A) I only
   (B) II only
   (C) III only
   (D) I and III only
   (E) I, II, and III

Questions 19–21

(A) Ethylene gas
(B) Abscisic acid
(C) Auxin
(D) Gibberellins
(E) Cytokinins

19. Enhances apical dominance

20. The reason that “One bad apple spoils the whole barrel.”

21. Responsible for phototropisms

Questions 22–24

(A) Transformation
(B) Translation
(C) Transcription
(D) Translocation
(E) Replication

22. Occurs at the ribosome in eukaryotes
23. DNA codes for mRNA

24. Ability of bacteria to absorb genes from other cells

Questions 25–26

An experiment is carried out to explore inheritance of the bar-eyed trait in fruit flies. Homozygous bar-eyed and wild-type flies are mated, producing two $F_1$ generations. Then those $F_1$ offspring are mated with each other, producing two $F_2$ generations. One hundred offspring from each cross are recorded. Here are the data from those 4 crosses.

<table>
<thead>
<tr>
<th>Cross 1</th>
<th>Cross 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parents</strong></td>
<td><strong>Parents</strong></td>
</tr>
<tr>
<td>Bar-eyed Female $\times$ Wild-type Male</td>
<td>Wild-type Female $\times$ Bar-eyed Male</td>
</tr>
<tr>
<td><strong>$F_1$</strong></td>
<td><strong>$F_1$</strong></td>
</tr>
<tr>
<td>53 Bar-eyed males</td>
<td>48 Wild-type males</td>
</tr>
<tr>
<td>47 Bar-eyed females</td>
<td>52 Bar-eyed females</td>
</tr>
<tr>
<td><strong>$F_2$ flies from cross 1 were mated</strong></td>
<td><strong>$F_2$ flies from cross 2 were mated</strong></td>
</tr>
<tr>
<td><strong>$F_2$</strong></td>
<td><strong>$F_2$</strong></td>
</tr>
<tr>
<td>22 Bar-eyed males</td>
<td>25 Bar-eyed males</td>
</tr>
<tr>
<td>51 Bar-eyed females</td>
<td>26 Bar-eyed females</td>
</tr>
<tr>
<td>27 Wild-type males</td>
<td>27 Wild-type males</td>
</tr>
<tr>
<td>0 Wild-type females</td>
<td>25 Wild-type females</td>
</tr>
</tbody>
</table>

25. The pattern of inheritance for bar-eyed is

(A) autosomal dominant  
(B) autosomal recessive  
(C) sex-linked dominant  
(D) sex-linked recessive  
(E) cannot be determined by the information given

26. What is the most likely genotype for a bar-eyed female (underlined) in the $F_1$ generation in cross 1?

(A) BB  
(B) Bb  
(C) Wb  
(D) $X^B Y^b$  
(E) $X^B X^b$
Questions 27–28

27. Which of the following is true about the structure shown in the figure?
   (A) It is found in the small intestine.
   (B) It is part of the large intestine.
   (C) It is necessary for protein digestion.
   (D) It is part of the hepatic system.
   (E) It is a flame cell.

28. Which is true about the structure at A?
   (A) It absorbs sugars.
   (B) It is a lacteal.
   (C) It hydrolyzes vitamins.
   (D) It is a capillary.
   (E) It releases hydrolytic enzymes.

Questions 29–30

(A) Pancreas
(B) Thyroid
(C) Anterior pituitary
(D) Posterior pituitary
(E) Hypothalamus

29. Regulates blood sugar levels

30. Bridge between nervous and endocrine systems

If you are taking the Biology-E test, continue with questions 31–40.
If you are taking the Biology-M test, go to question 41 now.
Biology-E Section

31. All of the following are characteristics of populations EXCEPT
   (A) size
   (B) density
   (C) age distribution
   (D) phenotype
   (E) death rate

Questions 32–34

Students carry out an experiment to explore the effect of different environments on blood flow using small, freshwater fish. Each fish is placed into a petri dish. A wet cotton ball is placed over its gills to allow for the diffusion of oxygen, which will keep the fish alive. The students then place the petri dish onto the stage of a light microscope so that the thinnest part of the tail is directly under the objective lens and blood can be seen flowing in blood vessels. While focusing on a capillary, students count the number of red blood cells flowing through the vessel at 5-second intervals. After monitoring the normal flow of blood for 30 seconds, the environment in the petri dish is altered in one of five different ways. Students observe and record the change in blood flow, if any. After the experiment, each fish is returned to the fish tank.

Experiment 1—Nothing is added to this petri dish.
Experiment 2—Water at a temperature of 5°C is added.
Experiment 3—Water at a temperature of 30°C is added.
Experiment 4—Ethyl alcohol is added.
Experiment 5—Nicotine extracted from cigarette tobacco is added.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Initial Average Rate of Blood Flow</th>
<th>Final Average Rate of Blood Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>
32. Which graph below best describes what happened in experiment 4?

(A)  
(B)  
(C)  
(D)  
(E)  

33. All of the following statements about this experiment are correct EXCEPT

(A) alcohol is a central nervous system depressant and decreases the blood flow in the capillary
(B) nicotine is a central nervous system stimulant and increases blood flow in the capillary
(C) increasing the temperature increases the blood flow in the capillary
(D) the changes in blood flow in experiments 2 and 3 are temporary because a fish can adjust its body temperature
(E) experiment 1 is the control

34. The dependent variable in experiment 3 is

(A) the health of the individual fish
(B) temperature of the water
(C) nicotine
(D) alcohol
(E) rate of blood flow

Questions 35–37

(A) Stabilizing selection
(B) Directional selection
(C) Disruptive selection
(D) Genetic drift
(E) Convergent evolution

35. The majority of human birth weights is between 6 and 9 pounds

36. The peppered moths in England in the 20th century

37. Founder and bottleneck effect are examples
Questions 38–40

Epidemiologists concerned with the spread of the hantavirus from rats to humans conducted an experiment to explore the effectiveness of a particular pesticide. They exposed a population of 100 rats to the pesticide on day 1. After exposure, they allowed any rats that survived to reproduce. They monitored the population of rats for 100 days and plotted a graph of the data they collected.

38. The data suggest that on day 1
   (A) the female rats were sterilized by the pesticide
   (B) the male rats were sterilized by the pesticide
   (C) most of the rats were sterilized by the pesticide
   (D) all the rats were killed by the pesticide
   (E) most of the rats were killed by the pesticide

39. The best explanation for the results of this experiment is
   (A) some rats developed a resistance to the pesticide
   (B) some rats were resistant to the pesticide at the outset of the experiment
   (C) no rats were resistant to the pesticide
   (D) none of the rats were able to reproduce
   (E) the rats evolved a resistance because they needed to

40. Which of the following biological processes is illustrated by this experiment?
   (A) Biological magnification
   (B) Theory of use and disuse
   (C) Natural selection
   (D) Ecological succession
   (E) Punctuated equilibrium
Biology-M Section

Questions 41–44

Wet mounts of three living samples of elodea cells are prepared for viewing under the light microscope. Each slide is mounted with a different solution and viewed after 5 minutes.

Sample A—Elodea + 5 drops of 10% NaCl
Sample B—Elodea + 5 drops of isotonic saline
Sample C—Elodea + 5 drops of distilled water

41. The cells in sample A would
   (A) exhibit turgor pressure
   (B) undergo lysis
   (C) swell and burst
   (D) exhibit plasmolysis
   (E) remain unchanged

42. The results of the experiment illustrate which of the following processes?
   (A) Hydrolysis
   (B) Dehydration
   (C) Active transport
   (D) Polymerization
   (E) Osmosis

43. Which cell structure(s) would be visible in sample A that was not visible prior to exposure to the 10% NaCl?
   (A) Nucleus
   (B) Plasma membrane
   (C) Mitochondria
   (D) Golgi body
   (E) Chloroplasts

44. Which of the following statements about this experiment is correct?
   (A) The movement of salt is the dependent variable
   (B) The elodea cells in sample C are in a hypotonic solution
   (C) There is no passage of water in either direction in sample B
   (D) NaCl is a toxin that would destroy any cell, no matter the concentration
   (E) You cannot predict with any certainty what would happen to these cells; they are living organisms
45. Which of the following statements best explains the fact that a mutation in a cell's DNA does not always result in an error in the polypeptide produced from that DNA sequence?

(A) Some polypeptides are produced by a code other than a nucleic acid code.
(B) The nucleolus can repair damaged DNA.
(C) The Golgi body can repair damaged DNA.
(D) Different codons code for the same amino acid.
(E) Scientists have no idea why this phenomenon occurs.

46. All of the following disorders are caused by a mutation in the DNA sequence EXCEPT

(A) sickle cell anemia
(B) PKU
(C) cystic fibrosis
(D) AIDS
(E) hemophilia

47. The DNA sequence is converted into an amino acid sequence in eukaryotic cells at the

(A) ribosome
(B) cytoplasm
(C) nucleus
(D) endoplasmic reticulum
(E) peroxisome

Questions 48–50

I. Glycolysis
II. Krebs cycle
III. Chemiosmosis

48. ATP is produced by oxidative phosphorylation.

(A) I only
(B) II only
(C) III only
(D) II and III only
(E) I, II, and III
49. The ATP synthetase channel produces ATP.
   (A) I only
   (B) II only
   (C) III only
   (D) II and III only
   (E) I, II, and III

50. Takes place in mitochondria
   (A) I only
   (B) II only
   (C) III only
   (D) II and III only
   (E) I, II, and III