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EGYPTIAN
SCHOLASTIC
TEST

EST II

BIOLOGY

LEVEL

UP

2024 EDITION

PRACTICE TESTS

PEARSON

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Directions for Taking the Practice Test

In this Practice Test, you will answer various science questions. You may write in the open spaces in this book to work the questions, but remember to fill in the circle on your answer sheet that goes with the answer you choose for each question. Fill in the circle completely and make your mark heavy and dark. If you want to change an answer, erase the mark you made and make a new mark.

You will do the items in this Practice Test by yourself. Remember to read all the directions carefully. When you have finished, you may check for answers.

On your answer sheet, find Number 1. Mark your answers beginning with Number 1.

You may begin. Stop when you have finished the test.

At the end of the Practice Test, make sure that all your marks are heavy and dark and that you have completely erased any marks that you do not want.

Turn to Page 73 and locate the Answer Key. Check your answers and review those items that you marked incorrectly.

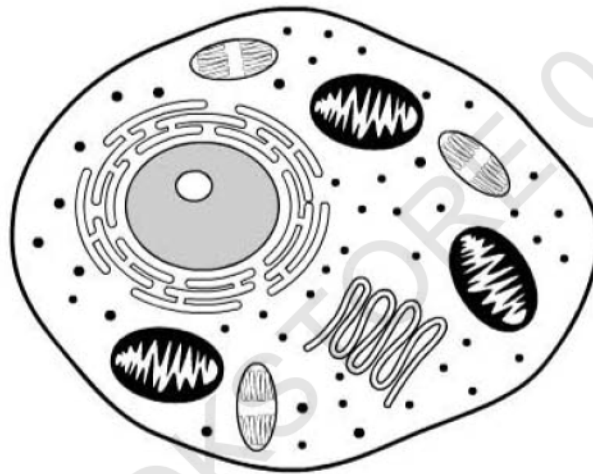
1. Why is DNA important for protein synthesis?

- A** DNA is used as a source of amino acids to produce a protein.
- B** RNA molecules build a DNA strand that synthesizes a protein.
- C** DNA interacts with the RNA to add amino acids during protein synthesis.
- D** DNA is used as a template to produce RNA that is translated to a protein.

2. What molecule is produced during both photosynthesis and cellular respiration to power chemical reactions occurring in both of these cellular events?

- A ATP
- B carbon dioxide
- C glucose
- D water

3. The diagram shows a drawing of a cell.



Which cellular component identifies the cell shown as a eukaryotic cell?

- A nucleus
- B ribosome
- C cytoplasm
- D cell membrane

4. In people, dimples are a dominantly inherited trait. If both parents are heterozygous for the dimple gene, what is the probability that their child will have dimples?

- A** 25%
- B** 50%
- C** 75%
- D** 100%

5. Tay-Sachs is a disease that occurs when lipids accumulate in cells. This lipid accumulation occurs because of the inability of the cell to break down lipids due to the lack of function of the organelle responsible for intracellular digestion. Which organelle is defective in Tay-Sachs disease?

- A** Golgi apparatus
- B** lysosome
- C** mitochondrion
- D** ribosome

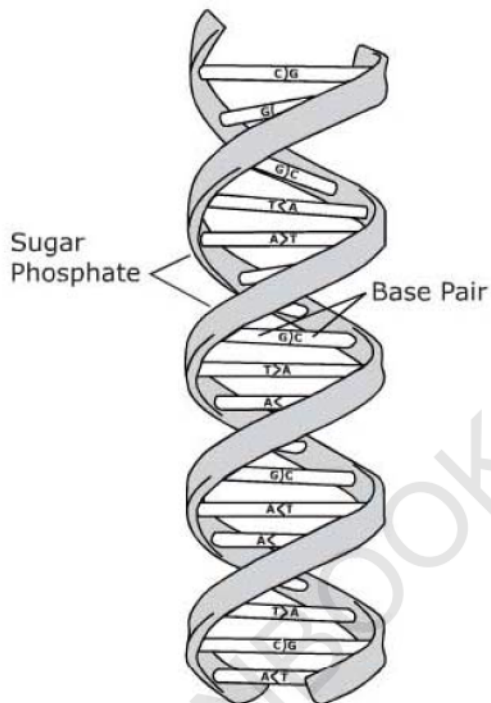
6. A forest fire adds ash minerals to the soil. The thick cover of tree leaves is reduced to scattered bare trunks and stumps. Which response to this ecosystem change is most likely?

- A reduced available sunlight
- B increased populations of predators
- C rapid growth of ground-level plants
- D increased capacity to absorb rainwater

7. Students are planning an investigation to determine the rate at which photosynthesis occurs in plants. After they did research and made observations, they included the following steps in their investigation: writing a conclusion, taking measurements, creating a hypothesis, and interpreting data. Which of these steps should be first in the investigation?

- A interpreting data
- B writing a conclusion
- C creating a hypothesis
- D taking measurements

8. This is a diagram of part of a DNA molecule:



What is the function of the structure labeled "Base Pair"?

- A storing chemical energy for protein synthesis
- B storing amino acids used for protein synthesis
- C storing information used for protein synthesis
- D storing electrical charge for protein synthesis

9. Cacti have leaves that are modified into spines. Water lilies have large, flat leaves. Why do cacti have leaves shaped differently than the leaves of water lilies?

- A** to store water
- B** to produce food
- C** to provide protection
- D** to conserve carbon dioxide

10. Francesco Redi placed raw meat in two flasks. One flask was sealed while the other flask was open, allowing flies to land on the meat. After a period of time, larvae were observed growing on the meat that was not sealed, but the meat in the sealed flask did not have larvae. Louis Pasteur boiled meat broth in a modified flask that prevented direct exposure to air. After a long period of incubation, no microorganisms were present in the meat broth. Both Francesco Redi and Louis Pasteur concluded that organisms do not directly originate from nonliving matter. How did the research of these two people help disprove the theory of spontaneous generation?

- A** They showed that by covering food, spoilage is prevented.
- B** They showed that by heating food, flies and microbes are unable to reproduce.
- C** They showed that airborne organisms are attracted to solid food instead of food in liquid form.
- D** They showed that airborne organisms are the reason that maggots and microbes appear in food.

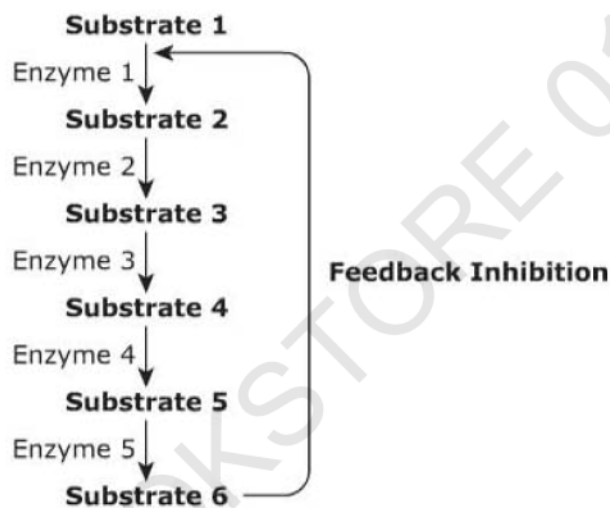
11. In a biology lab, students did an experiment to study how the mass of a piece of potato in the shape of a cube changed. They determined the mass of the cube, placed the cube in a 10% salt solution, and measured the mass of the cube again. Which piece of equipment did the students use to measure the mass of the potato cube?

- A beaker
- B balance
- C test tube
- D metric ruler

12. When iodine was added to a clear unknown solution, the solution's color changed to black. Which molecule is indicated by this change in color?

- A** a lipid
- B** a protein
- C** a complex carbohydrate
- D** a simple carbohydrate

13. The diagram represents a pathway of enzyme activity.

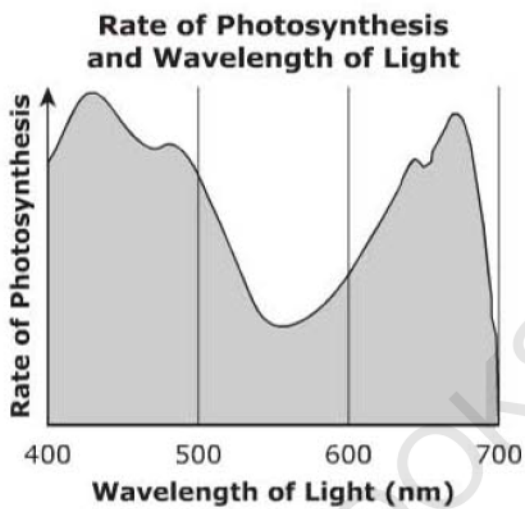


Which statement best describes the enzyme–substrate interaction?

- A The final product of the reaction regulates enzyme 1 activity.
- B The final product of the reaction regulates substrate 2 activity.
- C Different substrates react with different binding sites on one enzyme.
- D Different enzymes react with the same substrate to produce a final product.

14.

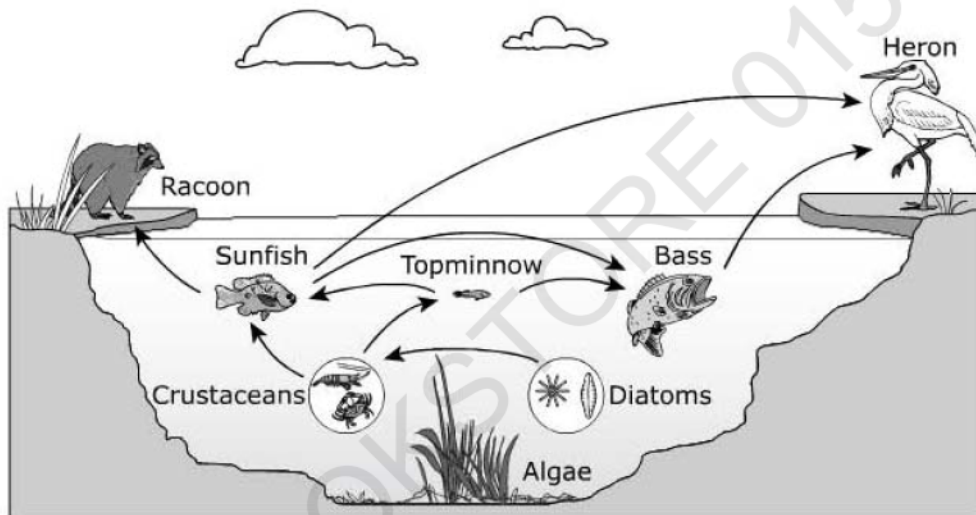
This graph illustrates the relationship between wavelength of light and rate of photosynthesis in a plant.



A plant exposed to light with a wavelength of about 430 nm will produce which substance more quickly than a plant of the same size and species exposed to equally bright light with a wavelength of about 550 nm?

- A carbon dioxide
- B nitrogen
- C sugars
- D lipids

15. The food web below shows several species in the Everglades ecosystem.



Which organism provides energy input directly to the bass in this food web?

- A heron
- B diatoms
- C sunfish
- D crustaceans

16. Which macromolecule is the main component of cell membranes?

- A carbohydrate
- B lipid
- C nucleic acid
- D protein

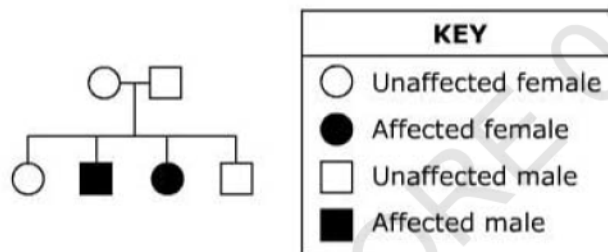
17. A student measures the mass of each of six potato cores and places one core in each of the unknown solutions. After a period of time, the student removes the potato cores and measures the mass of each one. The results are shown in the table.

Solution	Potato Core Mass
1	Increase
2	Decrease
3	No Change
4	No Change
5	Decrease
6	Increase

Which statement **best** describes a conclusion the student can make about the results?

- A Solution 1 is hypertonic because water flowed out of the cells of the potato.
- B Solution 6 is hypertonic because water flowed out of the cells of the potato.
- C Solutions 2 and 5 are hypotonic because water entered the cells of the potatoes.
- D Solutions 3 and 4 are isotonic because water flowed equally in and out of the cells of the potatoes.

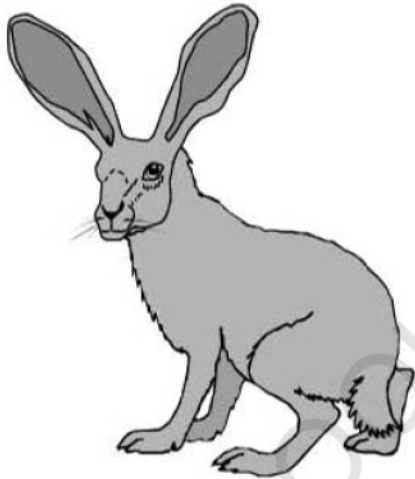
18. The figure is a pedigree showing the occurrence of a genetic trait in several generations of a family.



Which type of inheritance is illustrated in the pedigree?

- A autosomal dominant
- B autosomal recessive
- C X-linked dominant
- D X-linked recessive

19. The antelope jackrabbit lives in a desert environment with limited rainfall, sparse vegetation, and varying temperatures. When avoiding predators it can reach speeds of up to 45 miles per hour. The jackrabbit can control blood flow to its large ears, allowing it to adapt to changing environmental stimuli.



Which statement **best** explains why a jackrabbit's ability to control blood flow to its ears is important for surviving in a desert environment?

- A Controlling blood flow enables the jackrabbit to absorb water vapor in the air.
- B Controlling blood flow allows the jackrabbit to release carbon dioxide when running.
- C Controlling blood flow allows the jackrabbit to adjust its sensitivity to noise.
- D Controlling blood flow allows the jackrabbit to regulate body temperature.

20. In all organisms, substances are transported in and out of cells. What is required for the process of active transport but not for the process of passive transport?

- A concentration gradient
- B carrier proteins
- C energy
- D ions

21. The red wolf is an endangered species in the southeastern part of the United States. These animals are carnivores and eat deer, rodents, and small mammals. Which change in the environment would most likely threaten the population of red wolves?

- A release of a large number of deer into the wolf range
- B extensive loss of habitat due to deforestation
- C an abnormally wet summer
- D an abnormally warm fall

22. A student is assigned to determine whether a particular microbe is eukaryotic or prokaryotic. Which procedure is best suited to completing this assignment?

- A measuring the amount of oxygen released using a sensor
- B examining the DNA sequence of the microbes
- C measuring the microbes using a micrometer
- D examining the microbes under a microscope

23. Humans who are positive for the Rh blood type have an antigen on their red blood cells. Humans who do not have the antigen on their red blood cells are Rh negative. The Rh blood type is dominant to Rh negative. What is the probability that a child will be Rh negative if the parents are heterozygous for Rh?

- A 25%
- B 50%
- C 75%
- D 100%

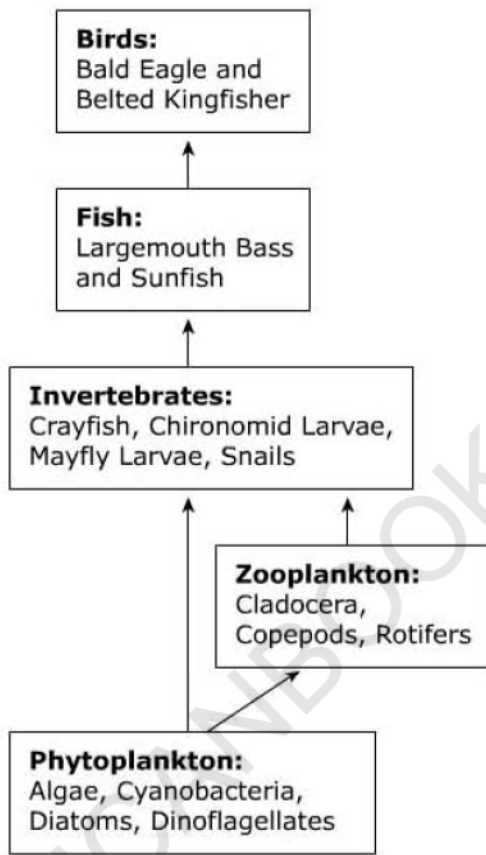
24. Protease is an enzyme involved in the digestion of proteins. How does protease interact with protein molecules?

- A** Protease manufactures new proteins.
- B** Protease blocks the activity of proteins.
- C** Protease facilitates the breakdown of proteins.
- D** Protease bonds with protein to form a new compound.

25. Genetic variation in populations arises through a number of biological processes. Which statement best describes the cause of this variation?

- A** Meiosis produces gametes that are identical to each other.
- B** Random fertilization of an egg cell by a sperm cell increases variation.
- C** Acquired characteristics caused by environmental pressures are passed from parents to offspring.
- D** Meiosis produces gametes with a genetic makeup identical to the genetic makeup of the parent.

26. The food web shows organisms that live in a wetland ecosystem.



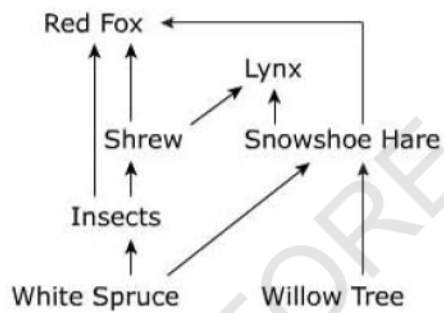
Which trophic level(s) will most likely be negatively affected by a decrease in the crayfish population?

- A producers
- B primary consumers
- C producers and primary consumers
- D secondary and tertiary consumers

27. Petroleum fuel is used for heating, industry, and transportation. What direct effect does the combustion of petroleum have on the environment?

- A** reduced air quality
- B** reduced food supply
- C** reduced water supply
- D** reduced mineral resource quality

28. The diagram shows a forest food web.



In this diagram, energy flows to which organism from multiple trophic levels?

- A shrew
- B red fox
- C willow tree
- D snowshoe hare

29. Which statement **best** describes the differences between the process of aerobic respiration and fermentation?

- A** Aerobic respiration requires oxygen and produces more ATP than fermentation.
- B** Fermentation requires water and produces the same amount of ATP as aerobic respiration.
- C** Fermentation does not require energy input and produces more ATP than aerobic respiration.
- D** Aerobic respiration breaks down glucose and produces the same amount of ATP as fermentation.

30. Photosynthesis and cellular respiration occur within a plant cell. How are the energy transformations in these two processes related?

- A** Cellular respiration traps solar energy for use in photosynthesis.
- B** Photosynthesis produces glucose that the cell uses for cellular respiration.
- C** Photosynthesis transfers solar energy to cellular respiration for glucose production.
- D** Cellular respiration occurs only during daylight and stores energy to allow photosynthesis to occur at night.

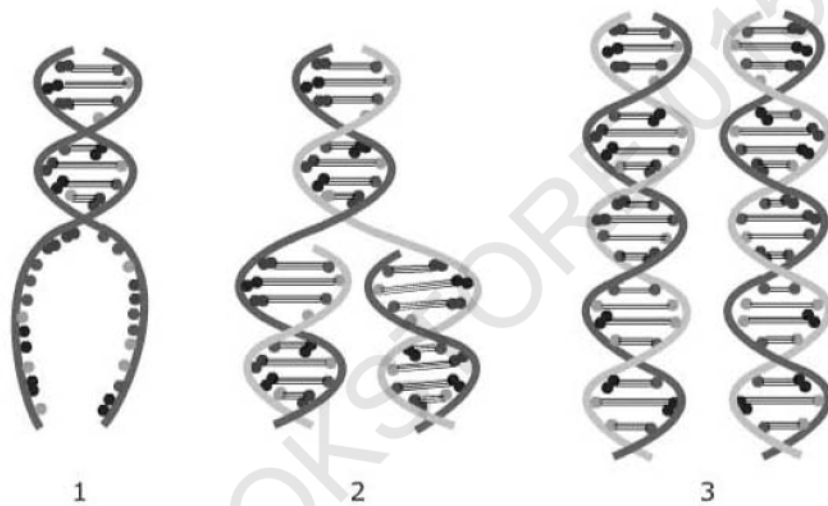
31. Four groups of organic compounds found in living organisms are proteins, carbohydrates, lipids, and nucleic acids. Which element is a main component in nucleic acids but not in the other three organic compounds?

- A** carbon
- B** oxygen
- C** nitrogen
- D** phosphorus

32. Collagen is a protein important to reconstructive surgery. Scientists have recently demonstrated the ability to grow human-compatible collagen in genetically modified maize plants. If this technology proves medically useful, it could replace transplants of collagen from natural human-compatible animals. Which is a risk of the maize-derived collagen that does not exist when using animal collagen?

- A** The number of patients requiring collagen transplants could increase as the treatment becomes simpler.
- B** Immune systems of recipients of the collagen could reject the collagen transplants.
- C** Genetically modified maize could spread in the wild and alter the maize gene pool.
- D** The collagen could become infected before transplant into human recipients.

33. The steps of DNA replication are illustrated in the diagram.



Which statement **best** describes the purpose of the process of DNA replication?

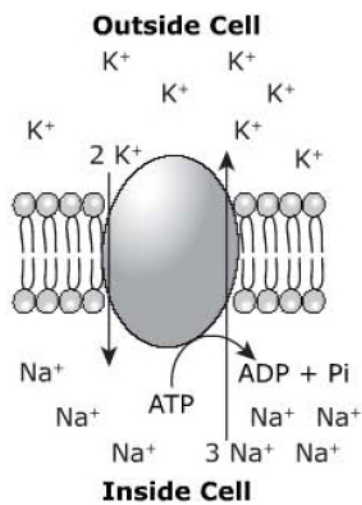
- A making a new DNA molecule that has different bases
- B producing two exact copies of the cell's original DNA
- C doubling the amount of DNA to increase the number of chromosomes
- D using enzymes to break hydrogen bonds and add nucleotides to strands

34. The process of protein synthesis requires the interaction of many different molecules. Which molecule carries the protein code to a ribosome?

- A** DNA
- B** tRNA
- C** mRNA
- D** rRNA

35.

Molecules and ions are constantly being moved across cell membranes. A student was asked to determine if illustration shows active or passive transport of potassium (K^+) and sodium (Na^+).



Which statement is the **best** description of the transport occurring in the illustration?

- A Passive transport is occurring only for sodium.
- B Active transport is occurring only for potassium.
- C Active transport is occurring for both potassium and sodium.
- D Passive transport is occurring for both potassium and sodium.

36. Nitrogen, in the form of ammonia, is returned to the soil when plants and animals die. Ammonia then has to be converted to nitrite and nitrate to make it a usable form of ammonia. A decrease of which of these organisms in a soil ecosystem could lead to an increase of ammonia?

- A bacteria
- B beetles
- C snails
- D worms

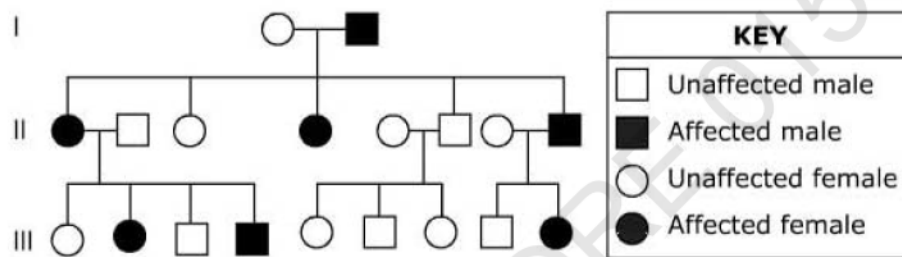
37. A woman has a single gene for hemophilia, an X-linked recessive trait. Her husband does not have any genes for hemophilia. What is the probability of their producing a child with hemophilia?

- A** 75%
- B** 50%
- C** 25%
- D** 0%

38. A researcher selects a land area recently formed by volcanic eruption for a study of succession. The measure of which factor will best indicate the progression of biological succession in the land area?

- A mean summer temperature
- B oxygen content of air
- C soil depth
- D water pH

39. A family pedigree is shown. Shaded individuals express a known genetic trait.



Which is the most likely mode of inheritance of this trait?

- A autosomal dominant
- B autosomal recessive
- C X-linked dominant
- D X-linked recessive

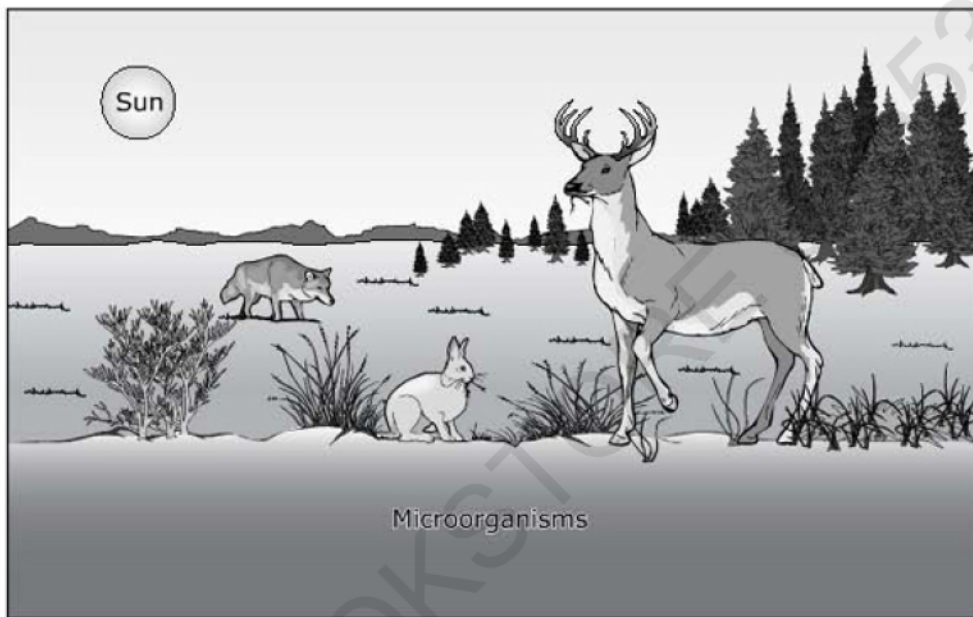
40. Bison feed on grass in a prairie ecosystem. Wolves prey on the bison. How would a drought affect the carrying capacity of bison in this ecosystem?

- A** increase, because fewer wolves would prey on bison
- B** decrease, because more wolves would prey on bison
- C** increase, because bison would have more available food
- D** decrease, because fewer plants would be available as food

41. Meiosis is an important process in sexual reproduction. Which statement **best** describes the purpose of meiosis in the formation of egg and sperm cells?

- A** Meiosis maintains the cell's original chromosome number.
- B** Meiosis reduces the cell's chromosome number by half.
- C** Meiosis divides the cytoplasm of the egg and sperm.
- D** Meiosis joins the nuclei of the egg and sperm.

42. The illustration shows a simple ecosystem.



Which two changes in an ecosystem could directly cause a drop in the population size of herbivorous deer?

- A an increase in soil sand content and an increase in average summer temperatures
- B a decrease in soil nutrient content and a decrease in average winter temperatures
- C an increase in decomposer population sizes and an increase in plant population sizes
- D a decrease in plant population sizes and an increase in carnivorous predator population sizes

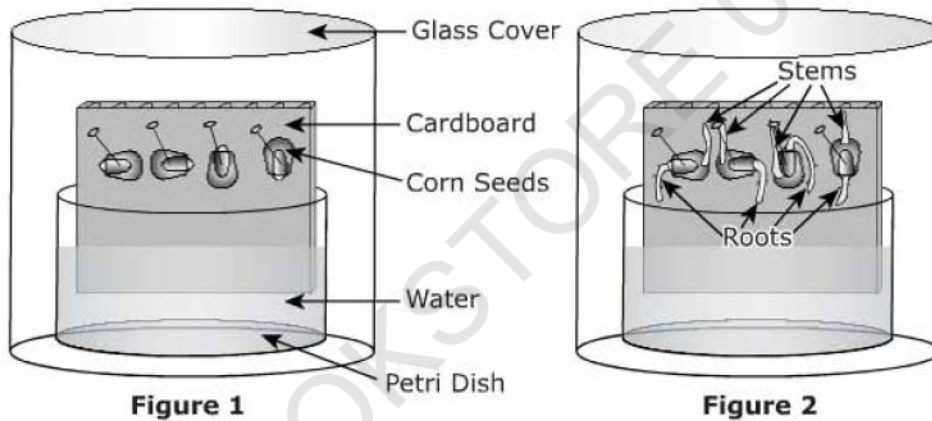
43. Organisms that reproduce sexually display a high frequency of genetic variation. Which two meiotic processes provide most of the genetic diversity of a species?

- A synapsis and separation
- B replication and condensation
- C polar migration and cytokinesis
- D independent assortment and crossing over

44. The term *cloning* in science can refer to several types of scientific technology, including therapeutic, reproductive, and recombinant DNA. Which result of reproductive cloning poses the greatest ethical issue?

- A offspring that may transmit diseases
- B cells without inherited genetic defects
- C cells that may be used to heal damaged tissues
- D offspring with a heightened risk of developing health problems

45. A student conducted an investigation about the growth of corn seeds. Figure 1 shows corn seeds pinned at different angles on a piece of cardboard and the experimental setup for seed germination. Figure 2 shows the growth of the seeds after 72 hours. The student concluded that the position of the corn seeds had no direct effect on seed growth.



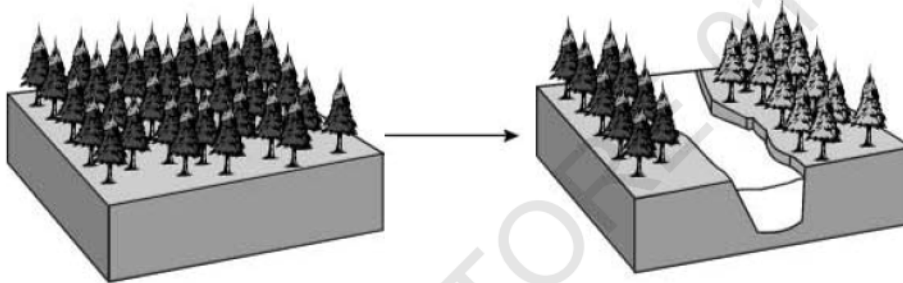
Based on the student's observations, why would this be an acceptable conclusion?

- A The roots and stems are the same lengths.
- B The corn seeds germinated at the same time.
- C The corn seeds are placed in a controlled environment.
- D The roots and stems are growing in the same direction.

46. When muscles work at their maximum ability, blood flow is often unable to provide enough oxygen to continue to produce ATP. Which process allows muscles to continue ATP production in this situation?

- A beta oxidation
- B aerobic metabolism
- C anaerobic metabolism
- D oxidative phosphorylation

47. Several factors affect the formation of a new species. One example is shown in the diagram.



Which best explains the formation of the new species of trees in the illustration?

- A A mutation resulted in a change in the chromosome number of some trees.
- B Physical separation prevented gene flow and was followed by genetic change.
- C One group of trees was better suited to the particular environment and survived.
- D Two species of trees formed a fertile hybrid by fertilization which resulted in a new species.

48. A student tests an unknown colorless solution for the presence of lipids, proteins, starches, and sugars. The results are shown in the table.

Reagent	Observation
Benedict's	Colorless to Blue
Biuret	Colorless to Purple
Lugol's	Colorless to Yellowish-Brown
Sudan IV	Colorless to Red

Based on the data in the table, the unknown solution contains which molecules?

- A sugars and starches
- B starches and lipids
- C lipids and proteins
- D proteins and sugars

49. The Northwest Atlantic loggerhead sea turtles have been listed as threatened under the Endangered Species Act. These sea turtles begin their life on beaches as hatchlings at specific nesting sites along the eastern coastline. The small hatchlings leave their nests at night and go into the ocean using the horizon and water's edge as a guide. They spend several days swimming into the open ocean. There, they drift on currents and feed until they are about the size of a dinner plate. Then, they settle on inshore feeding grounds. They grow slowly and reach sexual maturity between thirty and forty-five years of age. Breeding females return to shallow waters for mating near the beach where they were born. They lay several consecutive clutches of eggs at two weekly intervals. The adults return to sea, and the cycle begins again. How could artificial lighting contribute to the loss of the Northwest Atlantic loggerhead population?

- A** confuse hatchlings about direction as they go into the ocean
- B** confuse males about location of original breeding area
- C** increase the visibility of adult turtles to their predators
- D** increase the rate at which turtles reach sexual maturity

50. Many scientists think that the mitochondria in eukaryotic cells originated as independent prokaryotes. Which characteristic of mitochondria most strongly supports this conclusion?

- A** They are smaller than the cells that contain them.
- B** They are able to transform sunlight into chemical energy.
- C** They lack membrane-bound organelles but include their own DNA.
- D** They are able to release chemical energy from energy-storage molecules.

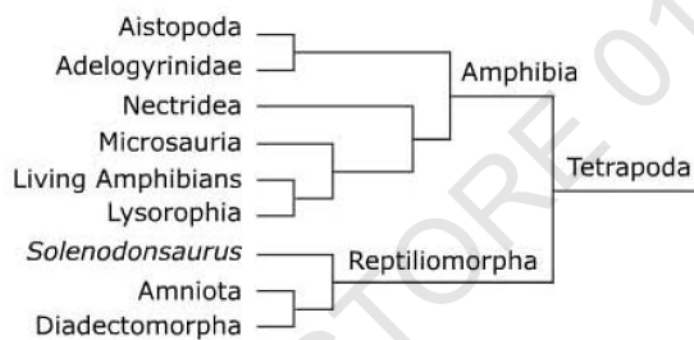
51. A scientist has identified the gene sequence 5'-ATG GGT GAT GTT GAA AAA-3' in a species. The gene sequence is compared with other species to check for relatedness. The species sequences are shown in the table.

Species	Gene Sequence
1	5'-ATC GGT GAT GTT GAA ATA-3'
2	5'-ATG GGT GAA GTT GTT AAA-3'
3	5'-ATG GGT GAA GTT GAA AAA-3'
4	5'-ATG GGC GAT GTT GAA TTT-3'

Based on the gene sequence from the four species, which species sequence is **most** closely related to the sequence identified by the scientist?

- A species 1
- B species 2
- C species 3
- D species 4

52. This diagram indicates modern classification of the relatedness of several groups of organisms.



Which two groups are **most** closely related?

- A Amniota and Diadectomorpha
- B Diadectomorpha and Solenodonsaurus
- C Lysorophia and Microsauria
- D Nectridea and Aistopoda

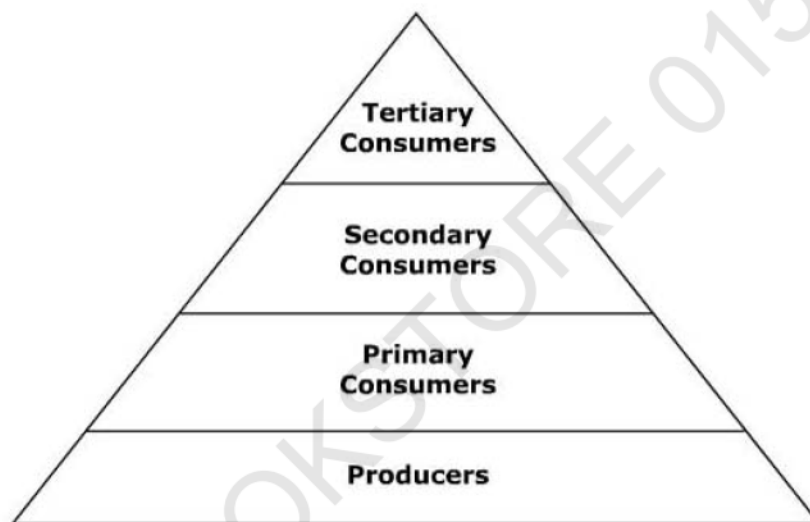
53. Which process necessary for cell reproduction occurs during cell growth?

- A** DNA replication
- B** RNA replication
- C** dissolution of the cell membrane
- D** dissolution of the nuclear membrane

54. A student uses Biuret solution to test a 1-gram sample of an organic macromolecule. The solution turns purple. What can the student conclude about the function of the macromolecule in a living organism?

- A The macromolecule encodes information.
- B The macromolecule stores energy for short periods.
- C The macromolecule stores energy for long periods.
- D The macromolecule helps cells perform actions or maintain structure.

55. A food pyramid is shown.



How does the amount of energy change at different levels in the food pyramid?

- A** Producers have the least amount of net energy.
- B** Tertiary consumers have the greatest amount of net energy.
- C** Energy flows from secondary consumers to primary consumers.
- D** Energy is lost in the flow from primary consumers to secondary consumers.

56. Researchers in a biomedical company identify that an artificial knee currently being used has to be replaced in 8-10 years. The researchers proceed development of an artificial knee using the following process:

- Brainstorm possible solutions
- Generate ideas
- Explore possibilities
- Select an approach
- Refine the design
- Market the product

Which step in the design process did the researchers neglect to perform?

- A Design a prototype knee.
- B Compare the design to other artificial knees used in the market.
- C Apply for federal approval for use of the artificial knee.
- D Evaluate the ability of the artificial knee to perform properly.

57. Which body covering is best suited for a dry, rocky environment?

- A** colorful feathers
- B** moist skin
- C** scaly skin
- D** thick fur

58. The cell membrane regulates the movement of molecules in and out of the cell. Which best describes the cellular environment that initiates the passive transport of molecules across a cell membrane?

- A** a concentration gradient across the cell membrane
- B** a concentration gradient that is equal on both sides of the cell membrane
- C** the availability of ATP to move molecules against the concentration gradient
- D** the availability of proteins to direct the movement of molecules against the concentration gradient

59. The ability of an ecosystem to support life declines sharply after a population crash among some of the organisms. A population crash among organisms with which characteristic could have caused the sharpest decline?

- A** hibernation during the winter
- B** mobility on land and in the air
- C** conversion of sunlight into food energy
- D** different fur coloring in summer and winter

60. During the process of photosynthesis, light energy is used to synthesize glucose molecules. Which product from this process is used to convert the glucose to energy during cellular respiration?

- A** water
- B** oxygen
- C** nitrogen
- D** carbon dioxide

61. The sequence of bases in an RNA strand is determined by the complementary base pairings with a DNA strand. Which base pairs with adenine on the DNA strand during transcription?

- A thymine
- B uracil
- C guanine
- D cytosine

62. As a cell grows in size, transport of materials in and out of the cell becomes more difficult. Which event helps a cell to efficiently transport material as the cell grows?

- A** The cell undergoes mitosis.
- B** The cell undergoes mutation.
- C** The cell develops a thicker cell wall.
- D** The cell stores more materials in its vacuoles.

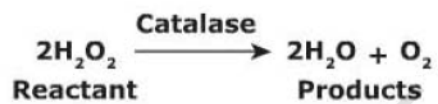
63. The genetic disorder associated with a mutation in chromosome 5 results in children who make catlike cries and have various levels of mental and physical impairments. A pair of chromosome 5 from a karyotype and a nonmutated chromosome 5 are shown.



The genetic disorder is likely caused by which type of mutation?

- A translocation
- B nondisjunction
- C insertion
- D deletion

64. Catalase is a class of enzyme which acts on the decomposition reaction of hydrogen peroxide:

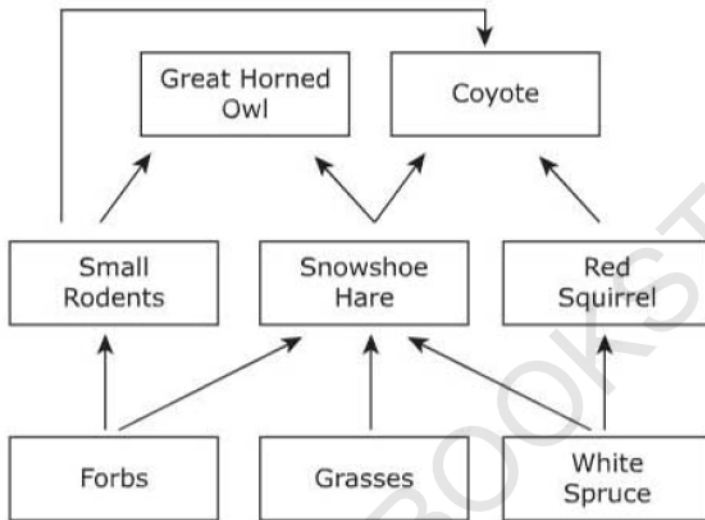


How does catalase alter this reaction?

- A Catalase decreases the mass of product per unit reactant.
- B Catalase increases the mass of product per unit reactant.
- C Catalase slows down the reaction.
- D Catalase speeds up the reaction.

65.

The food web below shows the relationships between organisms in a boreal forest biome. Snowshoe hare populations rise and fall in different years. Most other small herbivores hibernate through the winter. This affects the winter food supply for predators.



What factor in this ecosystem allows coyotes to survive in years with low snowshoe hare populations?

- A productivity of producers
- B specialization of predators
- C diversity of primary consumers
- D open niches for secondary consumers

Biology I Form 1
Answer Key

Item Number	Correct Answer	Item Number	Correct Answer	Item Number	Correct Answer
1	D	23	A	45	D
2	A	24	C	46	C
3	A	25	B	47	B
4	C	26	D	48	C
5	B	27	A	49	A
6	C	28	B	50	C
7	C	29	A	51	C
8	C	30	B	52	A
9	C	31	D	53	A
10	D	32	C	54	D
11	B	33	B	55	D
12	C	34	C	56	A
13	A	35	C	57	C
14	C	36	A	58	A
15	C	37	C	59	C
16	B	38	C	60	B
17	D	39	A	61	B
18	B	40	D	62	A
19	D	41	B	63	D
20	C	42	D	64	D
21	B	43	D	65	C
22	D	44	D		

PRACTICE TEST 1

While you have taken many standardized tests and know to blacken completely the ovals on the answer sheets and to erase completely any errors, the instructions for the EST II exam in Biology differs from the directions for other standardized tests you have taken. You need to indicate on the answer key whether you are taking the EST II Biology with Ecological Emphasis (Biology-E) or Molecular Emphasis (Biology-M).

The instructions on the answer sheet will tell you to fill out the top portion of the answer sheet exactly as shown.

1. Print *BIOLOGY-E* or *BIOLOGY-M* on the line to the right under the words *Subject Test* (*print*).

2. In the shaded box labeled *Test Code* fill in four ovals:

For **BIOLOGY-E**

- Fill in oval 1 in the row labeled V.
- Fill in oval 9 in the row labeled W.
- Fill in oval 4 in the row labeled X.

For **BIOLOGY-M**

- Fill in oval 1 in the row labeled V.
- Fill in oval 9 in the row labeled W.
- Fill in oval 4 in the row labeled X.

Test Code													
V	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD

Subject Test (print)

BIOLOGY-E

- Fill in oval B in the row labeled Y. —
- Leave the ovals in row Q blank.

Test Code													
V	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD

Subject Test (print)

BIOLOGY-M

- Fill in oval B in the row labeled Y. —
- Leave the ovals in row Q blank.

3. When everyone has completed filling in this portion of the answer sheet, the supervisor will tell you to turn the page and begin. The answer sheet has 100 numbered ovals on the sheet, but there are only 90 (or 95) multiple-choice questions in the test, so be sure to use only ovals 1 to 90 (or 95) to record your answers.

TEST 1—Continued

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

Questions 1–3 refer to the following cellular structures:

- (A) ribosome
- (B) nucleus
- (C) chloroplast
- (D) mitochondria
- (E) endoplasmic reticulum

1. Structure found in plant cells but not animal cells.
2. Structure that functions as the site of protein synthesis in cells.
3. Structure that contains the codes for the specific proteins produced by a cell.

Questions 4–6 refer to the following processes:

- (A) protein synthesis
- (B) respiration
- (C) digestion
- (D) photosynthesis
- (E) fermentation

4. The process by which both plants and animals obtain energy for cellular function.
5. The process that allows higher plants to be autotrophic (able to manufacture their own food).
6. The process that leads to the production of ethyl alcohol or lactic acid.

TEST 1—Continued

Directions: Each of the questions or statements below is accompanied by five choices. Some questions refer to a laboratory or experimental situation. For each question, select the best of the answer choices given.

7. Which of the groups below represents the correct relationship in order from smallest (or simplest) to largest (or more complex)?
- (A) matter — element — compound — electron — atom
 - (B) electron — element — atom — compound — matter
 - (C) electron — atom — element — matter — compound
 - (D) electron — atom — element — compound — matter
 - (E) atom — electron — element — compound — matter
8. Which of the following pairs does NOT represent a correct relationship?
- (A) glucose; polysaccharide
 - (B) starch; polysaccharide
 - (C) starch; carbohydrate
 - (D) glucose; carbohydrate
 - (E) glucose; monosaccharide
9. Which of the following statements is correct?
- (A) The product of transcription is DNA. (B) The product of transcription is mRNA. (C) The product of transcription is a protein.
 - (D) The product of translation is mRNA.
 - (E) The product of translation is DNA.
10. Which of the following descriptions of a DNA molecule is NOT correct?
- (A) Synthesis is semiconservative.
 - (B) Opposite strands are antiparallel.
 - (C) It contains the sugar deoxyribose.
 - (D) The number of adenines present is roughly equal to the number of thymines.
 - (E) The number of cytosines present is roughly equal to the number of uracils.
11. What defines the Sahara Desert as a desert? (A) It is characterized by very hot temperatures. (B) The growing season is very short. (C) Cacti make up the dominant form of vegetation. (D) It is very dry. (E) The average temperature fluctuates very little between winter and summer.



TEST 1—Continued

- 12.** Which of the following represents the correct sequence, from simplest to most complex?
- (A) population — organism — community — ecosystem — biosphere
- (B) organism — population — community — ecosystem — biosphere
- (C) organism — population — community — biosphere — ecosystem
- (D) population — organism — community — biosphere — ecosystem
- (E) organism — community — population — ecosystem — biosphere
- 13.** Lichens are composed of both fungal and algal (or cyanobacterial) components. The fungal component absorbs water and nutrients for both organisms, while the algal component manufactures food for both organisms through photosynthesis. This type of symbiotic relationship is referred to as
- (A) parasitism.
- (B) commensalism.
- (C) predation.
- (D) mutualism.
- (E) interspecific competition.
- 14.** In the Eastern United States, many forested areas were cleared for agricultural purposes. If cultivation was abandoned in those areas, they would eventually return to forests. This is an example of
- (A) primary succession.
- (B) secondary succession.
- (C) decomposition.
- (D) interspecific competition.
- (E) eutrophication.

Questions 15–17 refer to the food chain illustrated below:

rose bush — grasshopper — mouse — snake — hawk — earthworm

- 15.** What trophic level is represented by the snake?
- (A) producer
- (B) primary consumer
- (C) secondary consumer
- (D) tertiary consumer
- (E) detritivore
- 16.** The hawk could eat either the snake or the mouse and, thus, could represent which two different levels of the food chain?
- (A) producer and primary consumer.
- (B) primary and secondary consumer.
- (C) secondary and tertiary consumer.
- (D) tertiary and quaternary consumer.
- (E) quaternary consumer and detritivore.
- 17.** Which organism in the food chain represents a detritivore?
- (A) earthworm
- (B) hawk
- (C) snake
- (D) mouse
- (E) grasshopper

TEST 1—Continued

18. The amount of nitrogen and phosphorous cycling through an ecosystem is greatly affected by local environmental conditions, such as heavy rainfall or the removal of large numbers of plants. The amount of carbon in an ecosystem is seldom significantly affected by such factors because
- (A) plants make their own carbon compounds through photosynthesis.
 - (B) plants absorb large amounts of carbon from the soil.
 - (C) bacteria in the soil absorb large amounts of carbon.
 - (D) the primary source of carbon is the atmosphere, whereas much nitrogen and phosphorous come from the soil.
 - (E) organisms need only minute levels of carbon.
19. Which of the following represents an example of Mullerian mimicry?
- (A) The coloration of the canyon tree frog allows it to blend in with the granite rocks among which it lives.
 - (B) When disturbed, the larva of the hawkmoth puffs up its head and thorax such that it resembles the head of a small poisonous snake.
 - (C) In some orchid species, the flowers resemble female moths and attract male moths that attempt to mate with them, contributing to pollination in the process.
 - (D) The conspicuous coloration of the blue-ringed octopus, which inhabits the coastal waters off Australia, serves to warn predators that it is extremely venomous.
 - (E) Two unrelated poisonous frog species that share the same habitat also resemble each other in coloration.
20. A human cell that contains 22 autosomes and a Y chromosome must be
- (A) a zygote.
 - (B) a somatic cell of a male.
 - (C) a somatic cell of a female.
 - (D) a sperm cell.
 - (E) an egg cell.



TEST 1—Continued

21. Which of the following events does NOT lead to genetic variation in a population?
- (A) independent assortment of chromosomes during meiosis
- (B) crossing over between homologous chromosomes during meiosis I
- (C) crossing over between homologous chromosomes during meiosis II
- (D) random union of an egg with a sperm (E) random mutation

Questions 22–25 refer to the following breeding experiment, the purpose of which was to develop petunia plants with flowers expressing a new combination of form and shape: double (form) ruffled (shape) flowers.

P	plants with single ruffled flowers	x	plants with double plain flowers
F ₁	all offspring have single plain flowers	F ₂	290 plants have single plain flowers 99 plants have single ruffled flowers 101 plants have double plain flowers 32 plants have double ruffled flowers

22. The results of the cross indicate which of the following for the original parents (P-generation)?
- (A) Both were heterozygous for flower form and flower shape.
- (B) One was homozygous dominant for flower form and flower shape, whereas the other was homozygous recessive for both traits.
- (C) One was homozygous dominant for flower form and homozygous recessive for flower shape, whereas the other was homozygous recessive for form and homozygous dominant for shape.
- (D) One was homozygous dominant for both traits, whereas the other was heterozygous for both traits.
- (E) One was homozygous recessive for both traits, whereas the other was heterozygous for both traits.
23. Based on the results, how many genes control the four traits observed among the plants (single, double, plain, and ruffled)?
- (A) one
- (B) two
- (C) four
- (D) eight
- (E) sixteen
24. How many different genotypes are represented by the four phenotypic classes observed among the F₂ progeny?
- (A) four
- (B) eight
- (C) nine
- (D) thirty-two
- (E) sixty-four

TEST 1—Continued

- 25.** The results suggest that the inheritance of flower form and flower shape are controlled by
- (A) different alleles of the same gene.
 - (B) two different genes on the same chromosome.
 - (C) four different genes on the same chromosome.
 - (D) two different genes on different chromosomes.
 - (E) four different genes on different chromosomes.
- 26.** There are three alleles of the gene that controls the inheritance of the ABO blood groups; the A and B alleles are co-dominant, and O is recessive to both the A and B alleles. A man with type B blood and a woman with type A blood could have children showing which of the following phenotype(s)?
- (A) A only
 - (B) B only
 - (C) AB only
 - (D) A, B, or AB
 - (E) A, B, AB, or O
- 27.** Most recessive sex-linked traits, such as colorblindness, show up more frequently in males than females because
- (A) males have no corresponding allele on their X chromosome to mask the allele carried on their Y chromosome.
 - (B) males have no corresponding allele on their Y chromosome to mask the allele carried on their X chromosome.
 - (C) males carry all sex-linked traits on their Y chromosome.
 - (D) females always carry at least one dominant allele for sex-linked traits because they have two X chromosomes.
 - (E) females compensate by “turning” off the recessive allele through dosage compensation.
- Questions 28–32 relate to various tissue types found in the human body. For each question, choose the term that corresponds to the definition given and fill in the corresponding oval on your answer sheet.**
- 28.** A special form of loose connective tissue that pads and insulates the body and stores fuel reserves is known as
- (A) epithelial tissue.
 - (B) adipose tissue.
 - (C) fibrous connective tissue.
 - (D) nervous tissue.
 - (E) muscle tissue.



TEST 1—Continued

- 29.** The tissue that consists of long contractile cells (fibers) that are packed with microfilaments of actin and myosin is known as

(A) epithelial tissue.
(B) adipose tissue.
(C) fibrous connective tissue.
(D) nervous tissue.
(E) muscle tissue.

- 30.** Tissue that lines the outer and inner surfaces of the body in protective sheets of tightly packed cells is known as

(A) epithelial tissue.
(B) adipose tissue.
(C) fibrous connective tissue.
(D) nervous tissue.
(E) muscle tissue.

- 31.** The tissue that senses stimuli and transmits electrical signals to the brain and other parts of the body is known as

(A) epithelial tissue.
(B) adipose tissue.
(C) fibrous connective tissue.
(D) nervous tissue.
(E) muscle tissue.

- 32.** Tissue consisting of a dense arrangement of parallel collagenous fibers found in tendons and ligaments is known as

(A) epithelial tissue.
(B) adipose tissue.
(C) fibrous connective tissue.
(D) nervous tissue.
(E) muscle tissue.

- 33.** Which of the following correctly describes the relationship, from simplest to most complex, among the terms listed?

(A) cell — tissue — organ — organism
(B) organism — organ — tissue — cell
(C) cell — tissue — organism — organ
(D) tissue — cell — organ — organism
(E) tissue — organ — organism — cell

Questions 34–38 relate to various organ systems found in animals. For each question, choose the term that corresponds to the definition given and fill in the corresponding oval on your answer sheet.

- 34.** The organ system that transports materials, such as nutrients, oxygen, and hormones, to body cells and transports carbon dioxide and various waste products away from cells is known as the

(A) digestive system.
(B) respiratory system.
(C) circulatory system.
(D) endocrine system.
(E) nervous system.

- 35.** The organ system that forms a communication and coordination network throughout all parts of an animal's body is known as the

(A) digestive system.
(B) respiratory system.
(C) circulatory system.
(D) skeletal system.
(E) nervous system.

TEST 1—Continued

36. The organ system that functions in exchanging gases with the environment is known as the
- (A) digestive system.
 - (B) respiratory system.
 - (C) circulatory system.
 - (D) endocrine system.
 - (E) nervous system.
37. The organ system that takes in food, breaks it down into smaller chemical units, and absorbs the nutrient molecules is known as the
- (A) digestive system.
 - (B) respiratory system.
 - (C) circulatory system.
 - (D) endocrine system.
 - (E) nervous system.
38. The organ system that consists of ductless glands that secrete hormones and the molecular receptors on target cells that respond to the hormones is known as the (A)
- digestive system.
 - (B) respiratory system.
 - (C) circulatory system.
 - (D) endocrine system.
 - (E) nervous system.
39. Which of the following best describes how a salmon is able to regulate its internal water and salt concentrations when it is swimming in the ocean and when it migrates into fresh water to spawn?
- (A) In salt water, the salmon loses water by osmosis; it drinks salt water and disposes of excess salt through its gills. In fresh water, the salmon gains water by osmosis; its kidneys excrete large quantities of urine along with some salts, and it replenishes the lost salts through uptake by its gills and digestive system.
 - (B) In salt water, the salmon gains water by osmosis; it drinks salt water and disposes of excess salt through its gills. In fresh water, the salmon loses water by osmosis; its kidneys excrete large quantities of urine along with some salts, and it replenishes the lost salts through uptake by its gills and digestive system.
 - (C) In salt water, the salmon loses water by osmosis; it drinks salt water and stores excess salt in its body cavity. In fresh water, the salmon gains water by osmosis; its kidneys excrete large quantities of urine and salts.
 - (D) In salt water, the salmon gains water by osmosis; it drinks salt water and stores excess salt in its body cavity. In fresh water, the salmon loses water by osmosis; its kidneys excrete large quantities of urine and salt.
 - (E) In salt water, the salmon gains water by osmosis and loses salt by diffusion. In fresh water, the salmon loses water by osmosis and gains salt through diffusion.



TEST 1—Continued

Directions: Each of the lettered choices below refers to the statements immediately following it. Select the lettered choice that best fits each statement. A choice may be used once, more than once, or not at all.

Questions 40–45 refer to the following pairs of organisms:

- (A) cyanobacteria and algae
- (B) algae and fungi
- (C) mosses and ferns
- (D) ferns and gymnosperms
- (E) gymnosperms and angiosperms

40. One produces seeds, whereas the other does not.
41. One produces fruits, whereas the other does not.
42. One has vascular tissue, whereas the other does not.
43. One is a prokaryote, whereas the other is a eukaryote.
44. One photosynthesizes, whereas the other does not.

45. One produces naked seeds, whereas the other produces seeds enclosed in maternally derived tissue.

Questions 46–48 refer to the following

terms:

- (A) xylem
- (B) phloem
- (C) vascular cambium
- (D) mesophyll
- (E) pith

46. Responsible for secondary growth in woody plants.
47. Responsible for conducting water and dissolved minerals throughout the plant body.
48. Responsible for transporting food (mainly sugars) made during photosynthesis throughout the plant body.

TEST 1—Continued

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

- 49.** Which of the following statements most accurately describes the process of double fertilization in angiosperms?
- (A) Two pollen grains land on each stigma; thus, two ovules are fertilized.
 - (B) Two sperm cells produced by a single pollen grain fertilize two separate ovules, resulting in the formation of two seeds.
 - (C) One sperm cell from a single pollen grain fertilizes an egg cell to form a diploid zygote, while a second sperm cell from the same pollen grain combines with two fused nuclei in the embryo sac, resulting in the formation of a triploid endosperm nucleus.
 - (D) One sperm cell from a single pollen grain fertilizes an egg cell to form a haploid zygote, while a second sperm cell from the same pollen grain combines with a single nucleus in the embryo sac, resulting in the formation of a diploid endosperm nucleus.
 - (E) Two sperm cells from a single pollen grain fertilize the same egg cell to double the chance that fertilization will be successful.

Questions 50–51 refer to the following terms:

- (A) integument
- (B) cotyledon
- (C) ovule
- (D) ovary
- (E) endosperm

- 50.** Which of the above structures develops into the seed once fertilization has occurred?
- 51.** Which of the above structures develops into the fruit once fertilization has occurred?

Questions 52–55 refer to the following terms:

- (A) biogeography
 - (B) natural selection
 - (C) comparative anatomy
 - (D) comparative embryology
 - (E) molecular biology
- 52.** Evidence validating the theory of evolution based on the study of similarities and differences in body structure among various species is known as _____.
- 53.** Evidence validating the theory of evolution based on the study of local, regional, and global distributions of species is known as _____.
- 54.** Evidence validating the theory of evolution based on the study of structures that appear during the development of different organisms is known as _____.
- 55.** Evidence validating the theory of evolution based on the study of the genetic makeup of species at the DNA level is known as _____.



TEST 1—Continued

56. Which of the following statements is NOT part of Darwin's theory of natural selection?
- (A) Genetic variation exists among individuals in a population.
 - (B) The size of most populations remains relatively constant, despite the fact that more offspring are produced than are needed to maintain it.
 - (C) Early settlers saved seed only from the most productive crop plants to plant the following year.
 - (D) Disease, competition, and other environmental forces tend to eliminate the individuals in a population that are less adapted to their environment.
 - (E) Individuals that are best adapted to their environment tend to pass on heritable advantageous characteristics to their offspring.

57. Several accepted definitions of a species exist in the scientific literature. One of those definitions is of a biological species, defined as a population or group of populations whose members have the potential in nature to interbreed and produce fertile offspring. In other words, different species are reproductively isolated from one another. This definition can only be applied to
- (A) species that reproduce sexually.
 - (B) species that reproduce asexually only.
 - (C) species that form sterile hybrids upon mating.
 - (D) extinct forms of life, based on fossil evidence.
 - (E) species living on separate continents.

Questions 58–59 refer to the Hardy-Weinberg equation used to reflect genotypic frequencies in a population, as given below.

$$p^2 + 2pq + q^2 = 1$$

58. Which of the following is reflected by the value of p^2 ?
- (A) the frequency of individuals in the population with the dominant phenotype
 - (B) the frequency of individuals in the population with the homozygous dominant genotype
 - (C) the frequency of the dominant allele in the population
 - (D) the frequency of individuals in the population with the homozygous recessive genotype
 - (E) the frequency of individuals in the population that are heterozygous
59. The term $2pq$ indicates that
- (A) there are two alleles for that gene in the population.
 - (B) there are two genes in the population.
 - (C) there are twice as many dominant alleles as recessive alleles in the population.
 - (D) there are twice as many heterozygotes as homozygotes in the population.
 - (E) there are two separate reproductive combinations that can result in the formation of a heterozygous individual.

TEST 1—Continued

- 60.** A tetraploid individual would have
- (A) one copy of each chromosome.
 - (B) two copies of each chromosome. (C)
four copies of each chromosome. (D)
two copies of a single chromosome.
 - (E) four copies of a single chromosome.

S T O P

IF YOU ARE TAKING THE BIOLOGY-E TEST, CONTINUE WITH QUESTIONS 61-80. IF YOU ARE TAKING THE BIOLOGY-M TEST, GO TO QUESTION 81 NOW.

TEST 1—*Continued*

BIOLOGY-E TEST

Directions: Each of the questions or statements below is accompanied by five choices. Some questions refer to a laboratory or experimental situation. For each question, select the best of the answer choices given.

61. Which of the following best describes the relationship between a population and a species?
- (A) A species is one type of population. (B) A species is a local subset of a population.
- (C) A population is a group of organisms occupying a specific area.
- (D) A population encompasses many different species.
- (E) The terms population and species are interchangeable.
62. The number of individuals in a population that the environment can just maintain with no net increase or decrease from generation to generation is known as
- (A) the logistic growth curve.
- (B) the carrying capacity.
- (C) the dispersion pattern.
- (D) the habitat cap.
- (E) the exponential growth curve.
63. Which of the following pairs of figures would you need to know to determine the population density of elk living in Rocky Mountain National Park?
- (A) the birth rate of the elk population and whether population growth is logistic or exponential
- (B) the birth rate of the elk population and the area of land encompassed by the park
- (C) the number of elk living in the park and the dispersion pattern of the elk population
- (D) the number of elk living in the park and the area of land encompassed by the park
- (E) the number of elk living in the park and the birth rate of the elk population
64. A small isolated population found on a remote island is more likely to undergo speciation than a large widespread population because a small isolated population
- (A) is more susceptible to genetic drift. (B) inherently contains much greater genetic diversity.
- (C) is more readily adaptable to extreme environmental changes.
- (D) is more likely to migrate to other islands or the nearest mainland.
- (E) has a greater likelihood of containing sterile hybrid individuals.

TEST 1—Continued

65. Which of the following represents the correct order of eras, from most ancient to most recent, along the geological time scale?
- (A) paleozoic — precambrian — mesozoic — cenozoic
 (B) precambrian — cenozoic — paleozoic — mesozoic
 (C) precambrian — mesozoic — paleozoic — cenozoic
 (D) precambrian — paleozoic — mesozoic — cenozoic
 (E) cenozoic — mesozoic — paleozoic — precambrian
66. Two snails in the same class must also be in the same
- (A) order.
 (B) species.
 (C) genus.
 (D) family.
 (E) phylum.
67. As development continues to encroach on natural areas, individuals in local hawk populations must increasingly compete for a limited number of nesting sites. This type of behavior is likely to result in
- (A) a convergent dispersion pattern within the population.
 (B) a uniform dispersion pattern within the population.
 (C) a random dispersion pattern within the population.
 (D) a clumped dispersion pattern within the population.
 (E) multiple individuals simultaneously occupying the same nest.
68. Interactions among species in an ecosystem defined as +/- would be characteristic of
- (A) predation only.
 (B) parasitism only.
 (C) mutualism only.
 (D) both predation and mutualism.
 (E) both predation and parasitism.
69. Which of the following organisms would NOT be considered a primary producer?
- (A) phytoplankton
 (B) algae
 (C) moss
 (D) fungi
 (E) cyanobacteria



TEST 1—Continued

Questions 70–71 refer to the following population in Hardy-Weinberg equilibrium: Within the squirrel population at City Park, 16% show the recessive phenotype of a curled tail (tt).

- 70.** What is the frequency of the dominant allele (T) in the population?
- (A) 0.40
(B) 0.16
(C) 0.26
(D) 0.60
(E) 0.32
- 71.** What is the frequency of heterozygotes in the population?
- (A) 0.08
(B) 0.24
(C) 0.36
(D) 0.48
(E) 0.64

- 72.** Which of the following is NOT a requirement for a population to be maintained in Hardy-Weinberg equilibrium through several generations of intermating?
- (A) nonrandom mating among individuals (B) no net mutations
(C) large population size
(D) isolation from other populations (no migration into or out of the population) (E) no natural selection occurring
- 73.** Kingdom Monera in the traditional five-kingdom classification system has been divided into two separate kingdoms in the alternative eight-kingdom system of classification, the
- (A) Bacteria and Archaea.
(B) Bacteria and Protista.
(C) Archaea and Protista.
(D) Archaea and Euarchaea.
(E) Euarchaea and Protista.

TEST 1—*Continued*

Questions 74–77 refer to the diagram below that shows a hypothetical pyramid of net productivity that depicts the multiplicative loss of energy in a food chain. Each trophic level in the food chain is represented by a block in the pyramid, with primary producers forming the foundation of the pyramid. The size of each block is proportional to the productivity at each trophic level per unit of time.

74. In the above example, approximately how much energy available in each trophic level is converted into new biomass in the trophic level above it?

- (A) 1%
- (B) 5%
- (C) 10%
- (D) 50%
- (E) 100%

- 75.** The percentage of energy transferred from one trophic level to the next (the ratio of net productivity at one trophic level to net productivity at the level below) is known as
- (A) ecological efficiency.
 - (B) biomass.
 - (C) gross productivity.
 - (D) turnover.
 - (E) transformation.
- 76.** In terms of the decline in productivity with energy transfer from one trophic level to the next higher trophic level, which of the following would be the most efficient means of trapping the energy produced in photosynthesis?
- (A) a human eating beef that was raised on meat by-products
 - (B) a human eating beef that was raised on a combination of grain and meat by-products
 - (C) a human eating grain-fed beef
 - (D) a human eating grain along with grain-fed beef
 - (E) a human eating grain along with soybeans



TEST 1—*Continued*

77. Which of the following would likely remove the most energy from the food chain (so that it cannot be passed on to the next trophic level through the biomass of the organism) at the primary consumer level?
- (A) photosynthesis
 - (B) excretion
 - (C) metabolism
 - (D) growth
 - (E) respiration
78. Which of the following statements is NOT one of the principle observations upon which Darwin based his theory of natural selection?
- (A) The population size of a species would increase exponentially if all individuals that were born reproduced successfully.
 - (B) Populations tend to remain stable in size, aside from seasonal fluctuations.
 - (C) Environmental resources are limited.
 - (D) Individuals in a population vary extensively in their characteristics.
 - (E) Most of the variation observed among individuals in a population is due to environmental causes; thus, very little variation is heritable (passed on from parent to offspring).

TEST 1—Continued

Questions 79–80 refer to the series of graphs below.

- 79.** Which of the above graphs best illustrates the concept of stabilizing selection (selection that favors intermediate variants by acting against individuals with extreme phenotypes)?
- (A) Graph I only
 - (B) Graph II only
 - (C) both Graph I and Graph II
 - (D) Graph III only
 - (E) both Graph II and Graph III
- 80.** Which of the above graphs best illustrates the concept of diversifying selection (selection that favors extreme phenotypes over intermediate phenotypes)?
- (A) Graph I only
 - (B) Graph II only
 - (C) both Graph I and Graph II
 - (D) Graph III only
 - (E) both Graph II and Graph III

S T O P

If you answered the first 80 questions **STOP HERE**. If you are taking the Biology-M test **CONTINUE HERE**.

TEST 1—*Continued*

BIOLOGY-M TEST

Directions: Each of the questions or statements below is accompanied by five choices. Some questions refer to a laboratory or experimental situation. For each question, select the best of the answer choices given.

81. In human DNA, adenine (A) makes up approximately 30.9% of the bases, and guanine (G) makes up approximately 19.9% of the bases; therefore the percentage thymine (T) and cytosine (C) are
- (A) 19.8% T and 19.8% C.
(B) 19.8% T and 29.4% C.
(C) 29.4% T and 19.8% C.
(D) 29.8% T and 29.8% C.
(E) 19.9% T and 30.9% C.
82. If the chromosomes of a eukaryotic cell were lacking telomerase, the cell would
- (A) have a greater potential to become cancerous than one with telomerase.
(B) would be able to repair mismatched base pairs during replication.
(C) not produce okazaki fragments.
(D) become increasingly shorter with each cycle of replication.
(E) be unable to take up extraneous DNA from the surrounding solution.
83. Which of the following statements concerning transcription and translation in eukaryotic cells is NOT correct?
- (A) Transcription results in the production of mRNA, whereas translation results in the production of polypeptides.
(B) Transcription results in the production of polypeptides, whereas translation results in the production of mRNA.
(C) Transcription occurs in the nucleus, whereas translation occurs in the cytoplasm.
(D) Transcription uses a nucleotide “language,” whereas translation uses an amino acid “language.”
(E) Transcription uses DNA as a template, whereas translation uses mRNA as a template.
84. The open, less compacted form of DNA that is available for transcription is known as the
- (A) promoter.
(B) enhancer.
(C) operator.
(D) euchromatin.
(E) heterochromatin.

TEST 1—Continued

- 85.** A sequence on a DNA molecule that recognizes specific transcription factors that can stimulate transcription of nearby genes is known as the
- (A) promoter.
 (B) enhancer.
 (C) operator.
 (D) euchromatin.
 (E) heterochromatin.
- 86.** The tightly coiled, condensed form of DNA that is not transcribed is known as the
- (A) promoter.
 (B) enhancer.
 (C) operator.
 (D) euchromatin.
 (E) heterochromatin.
- 87.** During the stage in which insertion of eukaryotic DNA into the plasmid vector occurs, the sticky ends formed by digestion of both DNA types with the same restriction enzyme may join in a recombinant molecule because
- (A) the eukaryotic DNA and plasmid DNA will have the same sequence.
 (B) the eukaryotic DNA and plasmid DNA will have complementary sequences.
 (C) the eukaryotic DNA can join with any plasmid DNA, regardless of sequence.
 (D) the plasmid DNA can join with any eukaryotic DNA, regardless of sequence.
 (E) the plasmid DNA and the eukaryotic DNA cannot join together due to differences in the structure of their DNA molecules.

Questions 87–90 refer to the following steps involved in cloning a eukaryotic gene in a bacterial plasmid vector.

- I. Introduction of cloning vector into cells.
 II. Insertion of eukaryotic DNA into the vector.
 III. Identification of cell clones that carry the inserted eukaryotic gene.
 IV. Isolation of the vector and the eukaryotic gene-source DNA.
 V. Cloning of cells (and foreign DNA).

- 87.** Which of the following depicts the correct sequence of the steps (from first to last) involved in cloning a eukaryotic gene in a bacterial plasmid described above?
- (A) I — II — III — IV — V
 (B) V — IV — III — II — I
 (C) III — V — II — IV — I
 (D) IV — II — I — V — III
 (E) II — IV — I — III — V



TEST 1—Continued

- 89.** Which of the following statements is NOT true of restriction enzymes?
- (A) Each restriction enzyme recognizes a specific sequence of bases on the DNA molecule.
 - (B) Each restriction enzyme cuts at random locations along the DNA molecule.
 - (C) Most restriction enzymes are named after the bacterial organism from which they were first isolated.
 - (D) Restriction enzymes protect their bacterial host against intruding foreign DNA from viruses or other bacterial cells.
 - (E) When a particular sequence of DNA is digested with a specific restriction enzyme, the resulting set of restriction fragments will usually be the same.
- 90.** The uptake of naked DNA from solution by bacterial cells is known as
- (A) transpiration.
 - (B) electroporation.
 - (C) translation.
 - (D) transduction.
 - (E) transformation.
- 91.** The classification of organisms into kingdoms has come under debate in recent years, with most of the debate focused on the
- (A) algae and fungi.
 - (B) algae and plants.
 - (C) fungi and plants.
 - (D) fungi and animals.
 - (E) prokaryotes and simple eukaryotes.
- 92.** In the steps leading up to the origin of life on earth, early protobionts could not have evolved into living cells without both
- (A) a semipermeable membrane and a nucleus.
 - (B) competition for resources and the development of hereditary mechanisms.
 - (C) a semipermeable membrane and the ability to catalyze chemical reactions.
 - (D) a nucleus and the ability to catalyze chemical reactions.
 - (E) a mechanism for growth and a mechanism for asexual reproduction.

TEST 1—Continued

- 93.** One goal of phylogenetic systematics is to make classification of organisms more objective and consistent with evolutionary history. Which of the following statements regarding this important area of study is NOT correct?

- (A) The two main analytical approaches to the study of phylogenetic systematics are phenetics and cladistics.
- (B) Phenetic analysis compares as many characters as possible without distinguishing between homologous and analogous characters.
- (C) Cladistic analysis classifies organisms according to the order in time that branches arose along a dichotomous phylogenetic tree.
- (D) Cladistic analysis relies on analogous characters among organisms while ignoring novel homologies unique to the various organisms on a branch.
- (E) The most accurate phylogenetic trees are those in which molecular data agree with other forms of evidence for phylogenetic relationships (such as morphology, fossil records, and biochemical analysis)

Questions 94–95 refer to the genetic codon table below:

- 94.** Which of the following partial polypeptides is coded for by the series of codons below? — UUC — CCA — CAG — GGU — ACA —
- (A) Start — Thr — Phe — Ala — Stop
 - (B) Met — Thr — Phe — Ala — Stop
 - (C) Leu — Lys — Ser — Arg — Val
 - (D) Phe — Pro — Gln — Gly — Thr
 - (E) Phe — Ser — Pro — Trp — Stop

TEST 1—Continued

- 95.** Which of the following base substitution mutations in the mRNA above would have the least effect on the resulting polypeptide?
- (A) substitution of UCC for UUC in Phe (B) substitution of CAA for CCA in Pro (C) substitution of CAC for CAG in Gln (D) substitution of GGA for GGU in Gly (E) substitution of CCA for ACA in Thr

- 96.** The pattern of DNA fragments resulting from restriction enzyme digestion of genomic DNA from two species of skunk with EcoRI show extensive similarities. This suggests that
- (A) the two skunks must be the same species, not different species.
- (B) most of the restriction sites recognized by EcoRI are found at approximately the same distances apart in the DNA from both skunk species.
- (C) restriction enzyme digestion with EcoRI produces the same pattern of DNA fragments in all organisms.
- (D) restriction enzyme digestion with EcoRI produces the same pattern of DNA fragments in all species of skunks.
- (E) the genetic makeup of the two skunk species is identical.

Questions 97–98 refer to the hypothetical phylogenetic tree below:

- 97.** Which organism depicted on the phylogenetic tree above represents the outgroup?

- (A) Z
(B) A
(C) B
(D) C
(E) D

- 98.** Which pair of organisms on the phylogenetic tree depicted above represents the most closely related taxa?

- (A) Z and A
(B) A and B
(C) B and C
(D) C and D
(E) Z and D

TEST 1—Continued

- 99.** Restriction enzyme digestion with HindIII of genomic DNA from three toad species (A, B, and C) revealed that species A and B each produced unique fragment patterns, whereas species C shared fragments with both species A and species B. These results suggest that
- (A) species C served as an outgroup for the study.
 - (B) restriction enzyme analysis should not be used in the comparison of more than two species simultaneously.
 - (C) species C is the most recent living ancestor of both species A and species B.
 - (D) the DNA sample from species C must have been contaminated.
 - (E) species C is a hybrid between species A and species B.
- 100.** One of the earliest theories pertaining to the origin of life on earth suggested that life began in shallow pools. Recent studies have led to extensive debate regarding the origin of life, with some researchers suggesting that life may have originated
- (A) near deep sea vents.
 - (B) as viral particles.
 - (C) in mudflats.
 - (D) from debris left behind when meteorites crashed to earth.
 - (E) from naked strands of RNA.

**S T O
P**

If you finish before the hour is up, you may review your work on this test only. You may not turn to any other test in this book.

ANSWERS AND EXPLANATIONS

QUICK-SCORE ANSWERS

1. C 11. D 21. C 31. D 41. E 51. D 61. C 71. D 81. C 91. E
2. A 12. B 22. C 32. C 42. C 52. C 62. B 72. A 82. D 92. B
3. B 13. D 23. B 33. A 43. A 53. A 63. D 73. A 83. B 93. D
4. B 14. B 24. C 34. C 44. B 54. D 64. A 74. C 84. D 94. D
5. D 15. D 25. D 35. E 45. E 55. E 65. D 75. A 85. B 95. D
6. E 16. D 26. E 36. B 46. C 56. C 66. E 76. E 86. E 96. B
7. D 17. A 27. B 37. A 47. A 57. A 67. B 77. E 87. D 97. A
8. A 18. D 28. B 38. D 48. B 58. B 68. E 78. E 88. B 98. D
9. B 19. E 29. E 39. A 49. C 59. E 69. D 79. A 89. B 99. E
10. E 20. D 30. A 40. D 50. C 60. C 70. D 80. D 90. E 100. A

- 1. The correct answer is (C).** Chloroplasts are the site of photosynthesis, a process that occurs in plants but not in animals.
- 2. The correct answer is (A).** Ribosomes function as the sites for protein synthesis.
- 3. The correct answer is (B).** The nucleus contains DNA, which is packaged into chromosomes. The base sequence on the DNA molecule provides the code for the specific proteins to be manufactured by the cell.
- 4. The correct answer is (B).** Respiration utilizes oxygen in the breakdown of organic compounds (such as glucose) to produce energy (in the form of ATP) for the function of cellular processes.
- 5. The correct answer is (D).** Photosynthesis utilizes carbon dioxide and water from the atmosphere and light energy produced by the sun in the formation of chemical energy that is stored as glucose, starch, or other organic compounds in plant cells.
- 6. The correct answer is (E).** Fermentation (sometimes referred to as anaerobic respiration) allows for the production of ATP in the absence of oxygen. Certain fungi and bacteria (for example, brewer's yeast) produce alcohol as a result of fermentation, while human muscle cells produce lactic acid.
- 7. The correct answer is (D).** An electron is a subatomic particle with a negative charge; an atom (composed of electrons, protons, and neutrons) is the smallest part of an element that retains the properties of that element; a compound is a substance

ANSWERS AND EXPLANATIONS

composed of two or more elements in a fixed ratio; matter is anything that takes up space and has mass.

8. The correct answer is (A). Glucose is a monosaccharide—a simple, single-unit sugar molecule. Starch is a polysaccharide composed of numerous glucose molecules. Both starch and glucose are classified as carbohydrates.

9. The correct answer is (B). Transcription involves the synthesis of mRNA from a DNA template. Translation involves the synthesis of proteins encoded on mRNA molecules.

10. The correct answer is (E). The number of cytosines is equal to the number of guanines. Uracil is found in RNA, not DNA.

11. The correct answer is (D). Desert regions are defined by their dryness, usually the result of a minimal amount of rainfall combined with rapid evaporation.

12. The correct answer is (B). The biosphere consists of the global ecosystem—all life on earth and where it lives. An ecosystem consists of all the organisms in a given area along with all nonliving (abiotic) factors with which they may interact. A community is an assemblage of populations of different species living close enough together for potential interaction among them. A population is a group of individuals of a single species that live in a particular area. An organism is an individual living entity.

13. The correct answer is (D). Mutualism involves a symbiotic relationship in which both organisms benefit from their association. In commensalism, one organism benefits while the other is not significantly affected by the relationship. Neither parasitism nor predation are symbiotic relationships; in both cases, the association is detrimental to one of the organisms involved.

14. The correct answer is (B). The example illustrates secondary succession, in which a disturbance (clearing the forest for agriculture) destroys the existing community (forest) but leaves the soil intact. Primary succession takes place when a community arises in a virtually lifeless area with little or no soil, such as the colonization of newly formed volcanic islands.

15. The correct answer is (D).

16. The correct answer is (D).

17. The correct answer is (A). This set of questions involves the trophic structure (a pattern of feeding relationships with multiple levels) of a terrestrial ecosystem. The base of most food chains consists of autotrophic organisms referred to as producers (the rose bush). Primary consumers are herbivores that feed directly on the producers (the grasshopper). Secondary consumers are

PRACTICE TEST 1

carnivores that feed on organisms in the trophic level below (the mouse). Tertiary consumers (the snake) typically feed on secondary consumers, and quaternary consumers (the hawk) feed on tertiary consumers. An organism can occupy more than one trophic level in an ecosystem. In the above example, if the hawk consumed the mouse, it would be considered a tertiary consumer rather than a quaternary consumer. Detritivores derive their energy from detritus, the dead material left behind by the other trophic levels. The earthworm might feed on decaying matter from the hawk when it dies or from any of the other organisms in the food chain.

- 18. The correct answer is (D).** The primary source of carbon in an ecosystem comes from CO_2 in the atmosphere. The return of CO_2 to the atmosphere through respiration is largely balanced by its removal through photosynthesis; thus, carbon is less subject to large fluctuations in quantity as a result of changes in local environmental conditions than other nutrients, such as nitrogen and phosphorus.
- 19. The correct answer is (E).** Mullerian mimicry involves a mutual mimicry between two unpalatable or venomous species. Choice (A) is an example of cryptic coloration; choice (B) is an example of Batesian mimicry; choice (C) is an example of plant-pollinator interaction; and choice (D) is an example of aposematic coloration.
- 20. The correct answer is (D).** The normal chromosomal complement of a human being is 46 chromosomes—22 pairs of autosomes plus a pair of sex chromosomes (either XX or XY). Thus, a cell with 22 autosomes and one sex chromosome must be a gamete. Females can only produce gametes (eggs) containing the 'X' sex chromosome, whereas, males can produce gametes (sperm cells) containing either of the sex chromosomes—'X' or 'Y'.
- 21. The correct answer is (C).** Crossing over occurs during meiosis I only; it does not occur during meiosis II. All of the other events contribute to genetic variation in a population.
- 22. The correct answer is (C).** First, you should observe that the only traits occurring in the F_1 generation are single flower form and ruffled flower shape, whereas all four traits show up among the F_2 progeny. This suggests that single flower form and plain flower shape are dominant over double flower form and ruffled flower shape, respectively. The parents must have been homozygous for each trait, as only the dominant traits were present among their offspring. Thus, the parent with single ruffled flowers must have been homozygous dominant for flower form

ANSWERS AND EXPLANATIONS

and homozygous recessive for flower shape, whereas the other parent with double plain flowers must have been homozygous recessive for flower form and homozygous dominant for flower shape.

- 23. The correct answer is (B).** The ratios produced in the F_2 could have occurred only if two different genes control the inheritance of flower form and flower shape; and those genes reside on separate chromosomes (i.e., they are not linked). A simple Punnett square derived from intermating the F_1 generation would reveal the 9 genotypes represented by the four phenotypic classes found among the F_2 progeny.
- 24. The correct answer is (C).** See the explanation for question 23. **25. The correct answer is (D).** See the explanation for question 23.
- 26. The correct answer is (E).** If the father with type B blood is heterozygous (BO) and the mother with type A blood is also heterozygous (AO), their children could inherit the B allele from the father and the O allele from the mother, producing type B blood; they could inherit the O allele from the father and the A allele from the mother, producing type A blood; they could inherit the B allele from the father and the A allele from the mother, producing type AB blood; or they could inherit an O allele from each parent, resulting in type O blood.
- 27. The correct answer is (B).** Females have two X chromosomes, whereas males have one X and one Y chromosome. The Y chromosome typically lacks alleles for the corresponding genes along the X chromosome. Therefore, when a recessive allele is present on the X chromosome, it will automatically be expressed in males, while females have a high probability of masking a recessive allele on one X chromosome with a dominant allele on the other X chromosome.
- 28. The correct answer is (B).**
- 29. The correct answer is (E).**
- 30. The correct answer is (A).**
- 31. The correct answer is (D).**
- 32. The correct answer is (C).**
- 33. The correct answer is (A).** Tissues are collections of cells with a common structure and function (e.g., muscle tissue is composed of muscle cells), organs are made up of several types of tissue (e.g., the heart contains muscle tissue, nervous tissue, and connective tissue), and organisms have multiple organs (e.g., humans have a heart, liver, and kidneys).
- 34. The correct answer is (C).**

PRACTICE TEST 1

35. The correct answer is (E).
36. The correct answer is (B).
37. The correct answer is (A).
38. The correct answer is (D).
39. The correct answer is (A). In salt water, the concentration of water inside the salmon is greater than that of the surrounding water; therefore, it loses water by osmosis (the movement of water from a region of high concentration to a region of low concentration). Because it must drink salt water, it disposes of salt through its gills while the kidneys conserve water and excrete excess salts. In fresh water, the salmon will gain water by osmosis, resulting in an increase in urine production by the kidneys. Salt lost through the urine is replenished by increasing the uptake of salts through both the gills and the digestive system.
40. The correct answer is (D). This question asks you to distinguish between plants that reproduce by spores (ferns) and those that reproduce by seeds (gymnosperms), which are thus more advanced on an evolutionary scale.
41. The correct answer is (E). The distinction is made between plants that produce exposed (“naked”) seeds (gymnosperms) and those that produce seeds enclosed in a protective covering of maternal tissue—the fruit (angiosperms).
42. The correct answer is (C). Question 42 asks you to recognize the difference between plants lacking vascular tissue (xylem and phloem) and which are, thus, quite restricted in size (mosses) and those that contain vascular tissue and can obtain considerable height (ferns).
43. The correct answer is (A). This question asks you to make the distinction between prokaryotic photosynthetic organisms lacking a distinct nucleus (cyanobacteria—kingdom Monera) and eukaryotic photosynthetic organisms having a distinct nucleus and other cellular organelles (algae—kingdom Protista).
44. The correct answer is (B). Question 44 asks you to recognize the difference between two organisms that were once thought to be members of the plant kingdom but that are now classified separately. The algae (in kingdom Protista) contain chlorophyll and various accessory pigments and are able to carry out photosynthesis. Fungi are currently classified in their own kingdom (kingdom Fungi). These organisms lack photosynthetic pigments and are typically saprobic (absorbing nutrients from nonliving material) or parasitic (absorbing nutrients from a living host organism).

ANSWERS AND EXPLANATIONS

- 45. The correct answer is (E).** The distinction is made between plants that produce exposed (“naked”) seeds (gymnosperms) and those that produce seeds enclosed in a protective covering of maternal tissue—the fruit (angiosperms).
- 46. The correct answer is (C).** The vascular cambium consists of meristematic tissue that divides laterally to increase growth in width of woody plants (secondary growth).
- 47. The correct answer is (A).** Xylem tissue consists of several cell types, most of which are nonliving at maturity, and is responsible for conducting water and dissolved minerals upward from the roots where they are absorbed.
- 48. The correct answer is (B).** Phloem tissue consists of several types of food-conducting cells and is responsible for transporting sugars made in the leaves during photosynthesis, along with those stored in other parts of the plant body, to regions of the plant that require energy.
- 49. The correct answer is (C).** When a pollen grain lands on the stigma of a compatible flower, it germinates to form a pollen tube that grows down through the style until it reaches the ovary. Two (haploid) sperm cells travel down the pollen tube and enter the ovule through an opening called the micropyle. One sperm cell fuses with the (haploid) egg cell to form a diploid zygote that divides mitotically and grows into the embryo. The other sperm cell fuses with the central cell of the embryo sac. The central cell is formed by the fusion of two haploid nuclei and is, therefore, diploid. Fusion of a sperm cell with the central cell results in the formation of a triploid cell, referred to as the endosperm nucleus, that divides mitotically to form triploid endosperm tissue, which serves as a nutritive source for the developing embryo.
- 50. The correct answer is (C).** Following double fertilization, the ovule containing the fertilized egg cell (now a zygote) and the fertilized central cell (now the endosperm nucleus) divide mitotically to form the embryo and endosperm, respectively. The tissue surrounding the ovule hardens to form a seed coat.
- 51. The correct answer is (D).** Once fertilization has taken place and the seed begins developing, the tissues of the ovary swell and develop into a fruit. Some fruits are fleshy upon maturity (e.g., a tomato) while others are dry at maturity (e.g., a peanut). In some fruits (e.g., apples), other tissues in addition to the ovary tissue develop into part of the fruit; these are often referred to as accessory fruits.
- 52. The correct answer is (C).**

PRACTICE TEST 1

53. The correct answer is (A).
54. The correct answer is (D).
55. The correct answer is (E).
56. The correct answer is (C). This would be an example of artificial selection, not natural selection. Selecting only the most productive plants leads to the favoring of characteristics desired by those individuals making the selection, but these characteristics may not be the most beneficial to the species as a whole in its natural environment. Choosing only those plants that are most productive often leads to loss of other favorable characteristics, such as disease resistance and drought tolerance.
57. The correct answer is (A). The biological species concept requires that individuals can mate with others of the same species (reproduce sexually) and produce fertile offspring. For species that reproduce only by asexual means, it cannot be determined whether reproductive isolation would occur upon mating with other individuals, and reproductive isolation is a key component of the biological species concept. If an organism is extinct, existing only in the fossil record, its reproductive potential upon intermating cannot be determined. Species living on separate continents also cannot intermate in nature unless one or both are artificially moved, such that they share a common habitat.
58. The correct answer is (B). By definition, p is used to reflect the frequency of the dominant allele for a given gene in a population, whereas q is used to reflect the frequency of the corresponding recessive allele. Thus, p^2 reflects the union of two gametes, each carrying the dominant allele and, thus, reflects the frequency of the homozygous dominant genotype in the population. If the trait in question is governed by codominance or incomplete dominance, such that heterozygotes can be distinguished phenotypically from homozygous dominant individuals, then, by default, p^2 may also reflect the frequency of individuals in the population with the dominant phenotype; however, that is not always the case.
59. The correct answer is (E). A heterozygous individual may result from the union of a dominant allele from the maternal parent and a recessive allele from the paternal parent, or it may result from the union of a recessive allele from the maternal parent and a dominant allele from the paternal parent. Both possibilities must be considered when determining the frequency with which a heterozygous individual could be produced in a given population.

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60. The correct answer is (C). An individual with multiple copies of its entire set of chromosomes is referred to as polyploid: three sets = triploid; four sets = tetraploid; 5 sets = pentaploid, etc. An individual with extra copies of a single chromosome is referred to as aneuploid.

BIOLOGY-E TEST

- 61. The correct answer is (C).** A population refers to an interacting group of individuals of the same species occupying the same habitat and, therefore, could be thought of as a local subset of a species with a much wider distribution.
- 62. The correct answer is (B).**
- 63. The correct answer is (D).** Population density refers to the number of individuals of a species per unit area or volume.
- 64. The correct answer is (A).** Genetic drift refers to a change in the gene pool of a population by chance. The smaller the population, the more likely it will lose alleles simply by random chance.
- 65. The correct answer is (D).** Precambrian is the division of geologic time from the formation of the earth 4,600 million years ago (mya) to approximately 570 mya. Paleozoic (ancient animal) is the era from approximately 570 mya to 245 mya. Mesozoic (middle animal) is the era from approximately 245 mya to 65 mya. Cenozoic (recent animal) is the era beginning approximately 65 mya and continuing to modern times.
- 66. The correct answer is (E).** The correct hierarchical classification of organisms is: kingdom — phylum — class — order — family — genus — species
- 67. The correct answer is (B).** A uniform, evenly spaced pattern of dispersion is characteristic of direct competition among individuals within a population for a limited supply of one or more resources.
- 68. The correct answer is (E).** A +/- interaction indicates that one organism benefits from the interaction while the relationship is detrimental to the other organism. Predation is where one organism, the predator, seeks out and usually destroys another organism, the prey. Parasitism is where one organism, the parasite, lives on or in another organism, the host, from which it obtains its nutrients, usually with some degree of damage to the host. Both are examples of +/- relationships.
- 69. The correct answer is (D).** Fungi are detritivores, feeding on decaying matter. All of the other organisms listed are photosyn-

PRACTICE TEST 1

thetic autotrophs and, therefore, make up the base of the food chain—the producers.

- 70. The correct answer is (D).** If 16 percent (.16) of the population shows the recessive phenotype (q^2), then the square root of .16 (0.40) would equal the frequency of the recessive allele, q . Because $p + q = 1$, then $p = 1 - q = 0.60$.
- 71. The correct answer is (D).** The frequency of heterozygotes in the population is equal to two times the product of the frequencies of the recessive (q) and dominant (p) alleles. Thus, the frequency of heterozygotes is $2pq = 2(0.6)(0.4) = 0.48$.
- 72. The correct answer is (A).** For a population to remain in Hardy-Weinberg equilibrium, the individuals must be randomly mating; nonrandom mating (e.g., positive or negative assortative mating) leads to changes in allelic and genotypic frequencies within the population. All of the other conditions listed above must be met for Hardy-Weinberg equilibrium to be maintained in a population. Failure to meet any of the conditions leads to microevolution and changes in allelic and genotypic frequencies in the population.
- 73. The correct answer is (A).** Also in the eight-kingdom system, the kingdom Protista, of the traditional five-kingdom system, has been divided into three separate kingdoms (Archaezoa, Protista, Chromista); the remaining kingdoms (Plantae, Fungi, Animalia) are the same in both the five- and eight-kingdom systems. Another system of classification, the three-domain system, uses a “domain” as a superkingdom taxa to emphasize the significance to the evolutionary split between the Bacteria and Archaea. In this system, the Bacteria and Archaea are each assigned a domain, with the third domain (Eukarya) encompassing all eukaryotic organisms. Also, the three-domain system further subdivides the kingdom Protista into five separate groups (Archaezoa, Euglenozoa, Alveolata, Stramenopila, and Rhodophyta).
- 74. The correct answer is (C).** In this example, 10 percent of the energy is transferred from each trophic level to the next higher level. In actual ecosystems, the decline in productivity with the transfer of energy between trophic levels varies according to the species present, usually ranging from approximately 5 to 20 percent.
- 75. The correct answer is (A).**
- 76. The correct answer is (E).** The consumption of primary producers is the most energy-efficient form of consumption. The higher up on the food chain consumption takes place, the less energy-efficient it becomes.

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- 77. The correct answer is (E).** Primary consumers do not photosynthesize (only producers carry out photosynthesis). Excretion provides some metabolic waste materials that can be utilized by detritivores and, thus, are not lost from the ecosystem. Energy that goes into the metabolism and growth of an organism contributes to the biomass of the organism and is subsequently passed on to the next higher trophic level. The energy used in respiration results in the production of inorganic molecules and heat; it is largely lost from the flow of energy in the ecosystem.
- 78. The correct answer is (E).** The heritability of variation is a key component to the theory of natural selection and is necessary for evolution to occur. Those individuals that are most adapted to their environment are most likely to survive and successfully reproduce, passing on favorable genes to their offspring. As long as the selection forces remain in place, the number of individuals in the population with favorable genes will continue to increase, possibly leading to the development of a new species after many generations.
- 79. The correct answer is (A).**
- 80. The correct answer is (D).**

BIOLOGY-M TEST

- 81. The correct answer is (C).** In the DNA molecule, base pairing occurs between adenine and thymine, which are held together by two hydrogen bonds, and base pairing occurs between guanine and cytosine, which are held together by three hydrogen bonds.
- 82. The correct answer is (D).** Under normal conditions of DNA replication, telomeres that are present on the end of each chromosome in eukaryotic cells become shorter and shorter with each cycle of replication. The length of the telomeres typically predetermines the life span of the cell by controlling the number of possible cycles of DNA replication. Telomerase, an enzyme that catalyzes the lengthening of telomeres, is not present in the cells of most multicellular organisms other than those giving rise to gametes. Telomerase has been found to occur in cells that become cancerous, suggesting a possible link between “uncontrolled” cell division and the cancerous nature of the cell.
- 83. The correct answer is (B).** The process of transcription takes place in the nucleus of eukaryotic cells. The nucleotide sequence on the DNA molecule is transcribed into an RNA replica (messenger RNA, or mRNA). The mRNA transcript moves out of the nucleus through pores in the nuclear envelope and attaches to a ribosome

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complex. The mRNA is then translated into a polypeptide chain consisting of amino acids in the sequence that is coded for by the sequence of base triplets on the mRNA molecule.

- 84.** The correct answer is (D).
- 85.** The correct answer is (B).
- 86.** The correct answer is (E).
- 87.** The correct answer is (D). First, one must isolate the bacterial plasmid that is to be the cloning vector from its bacterial host and isolate the region of DNA that contains the gene of interest to be cloned from eukaryotic tissue cells. Next, both the plasmid and the eukaryotic DNA are digested with the same restriction enzyme, creating sticky ends. When the two cell types are mixed together in the presence of DNA ligase, the plasmid DNA and eukaryotic DNA may bind together (also, the eukaryotic DNA may reassociate and the plasmid DNA may reassociate; thus, the mixture will contain both recombinant molecules and molecules like the originals). Bacteria that are bathed in a solution of the naked DNA mixture will take up the plasmid vector by transformation. As the bacterial cells replicate, so, too, will any plasmids that they contain. If the plasmid(s) are recombinant, the eukaryotic gene of interest also will be replicated many times. Finally, the eukaryotic gene insert can be detected using either nucleic acid hybridization or a similar method.
- 88.** The correct answer is (B). The union of the sticky ends of eukaryotic DNA and plasmid DNA is similar to the formation of the DNA double helix, relying on pairing between complementary bases (A with T; G with C).
- 89.** The correct answer is (B). Each restriction enzyme recognizes a specific sequence of bases (usually four to six nucleotides in length), known as the restriction site (or target site), on a DNA molecule; it does not cleave DNA at random sites.
- 90.** The correct answer is (E). Transpiration, choice (A), is the loss of water vapor by plants to the atmosphere. Electroporation, choice (B), is the application of electrical impulses to animal cells or plant protoplasts. This increases the permeability of their membranes that aid the uptake of foreign DNA by transformation, choice (E), the uptake by cells of soluble fragments of foreign DNA in solution. Translation, choice (C), is the process by which the genetic information in living cells encoded in the form of base triplets in mRNA is converted to a sequence of amino acids in a polypeptide chain. Transduction, choice (D), is the transfer of genetic material from one bacterial cell to another using a phage as a vector.

ANSWERS AND EXPLANATIONS

- 91. The correct answer is (E).** Evidence from molecular genetic studies suggests earlier evolutionary splits among prokaryotic organisms and relatively simple eukaryotic organisms (primarily those organisms classified as Protists in the five-kingdom system) than was previously thought. Such evidence has led many researchers to further subdivide these groups of organisms into separate kingdoms, based on their ancient evolutionary lineages.
- 92. The correct answer is (B).** Competition for a limited supply of resources and a mechanism for passing on traits that confer an advantage for adaptation to environmental conditions from parents to offspring are necessary for evolution to occur at any level. Protobionts (aggregates of abiotic molecules that maintain an internal environment that is different from their surroundings) could not have evolved into early living cells (with semipermeable membranes, the ability to reproduce, the ability to catalyze chemical reactions, or any other characteristics typically associated with living cells) without competition among individuals for limited resources and the ability to pass favorable traits on to offspring.
- 93. The correct answer is (D).** Cladistic analysis relies on homology (similarity of characteristics among species due to a shared ancestry) in the construction of phylogenetic trees while avoiding analogous characters (similarity of characteristics among species that are not closely related; these characteristics are usually attributed to convergent evolution).
- 94. The correct answer is (D).** Each triplet of bases on the mRNA molecule (codon) codes for a specific amino acid. The code has been deciphered and is represented in the table of genetic codons, with the first base along the left side, the second base across the top, and the third base along the right side of the table. More than one codon may code for the same amino acid. The codon AUG may code for methionine or it may code for a start site, signaling ribosomes to begin translating the mRNA at that site. Three “stop” codons (UAA, UAG, UGA), when present within a genetic message, signal the end of the message and termination of translation in that region.
- 95. The correct answer is (D).** The substitution of an “A” for a “U” in the third base position of the codon for Gly results in a codon that also codes for Gly; thus, the resulting polypeptide should function normally. All of the other substitutions described above result in the replacement of the ‘correct’ amino acid with an ‘incorrect’ amino acid in the polypeptide chain produced in translation. The relative effects of such substitutions on an individual depend on the degree to which the incorrect amino acid changes the function of the polypeptide. For example, a single base substitution (U for A)

PRACTICE TEST 1

results in the incorporation of Val in place of Glu in the sixth position of the polypeptide coding for the primary structure of hemoglobin, resulting in the abnormally shaped cells that are characteristic of sickle cell anemia.

- 96. The correct answer is (B).** Restriction enzymes recognize specific base sequences along the DNA molecule (usually 4 to 6 bases long) and cleave the molecule at each of these sites. When the fragments of DNA that are produced are separated electrophoretically, a characteristic pattern is produced. If two species share a similar pattern, they must share a similar number of restriction sites at equivalent distances along the DNA molecule. This suggests that the genomes of the two species are similar and that they most likely diverged in relatively recent history.
- 97. The correct answer is (A).** In the figure, taxon Z represents the outgroup—a species or group of species that is closely related to the other taxa being studied, but not as closely related as each of the study taxa are to each other. The position of taxon Z on the phylogenetic tree suggests that it possesses the primitive condition shared by all of the taxa depicted and from which the other taxa have diverged.
- 98. The correct answer is (D).** The change from a primitive to a derived state of character I separates taxon Z (the outgroup) from the remaining species. Taxa B, C, and D share two derived characters and, thus, are more closely related to each other than each is to taxon A. Following this reasoning, taxa C and D appear to be the most closely related pair of taxa depicted. These two taxa share three derived characters (I, II, and III), suggesting that they are more closely related to each other than either is to taxon B.
- 99. The correct answer is (E).** The results suggest that species C shares genetic information with species A as well as with species B, whereas species A and B are genetically distinct from one another. The most likely explanation is that species C inherited genetic material from both species A and B, suggesting that it is a hybrid between the two.
- 100. The correct answer is (A).** Some scientists suggest that the earth's surface was inhospitable during the period in which life began. Recent molecular studies suggest that the ancestors of modern-day prokaryotes thrived in very hot conditions and possibly utilized inorganic sulfur compounds. These conditions are common in deep sea vent environments, and the location also would have reduced exposure of early life forms to the inhospitable conditions that were present on the earth's surface.

PRACTICE TEST 2

While you have taken many standardized tests and know to blacken completely the ovals on the answer sheets and to erase completely any errors, the instructions for the EST II exam in Biology differs from the directions for other standardized tests you have taken. You need to indicate on the answer key whether you are taking the EST II Biology with Ecological Emphasis (Biology-E) or Molecular Emphasis (Biology-M).

The instructions on the answer sheet will tell you to fill out the top portion of the answer sheet exactly as shown.

1. Print *BIOLOGY-E* or *BIOLOGY-M* on the line to the right under the words *Subject Test* (*print*).

2. In the shaded box labeled *Test Code* fill in four ovals:

For **BIOLOGY-E**

—Fill in oval 1 in the row labeled V.

—Fill in oval 9 in the row labeled W.

—Fill in oval 4 in the row labeled X.

For **BIOLOGY-M**

—Fill in oval 1 in the row labeled V.

—Fill in oval 9 in the row labeled W.

—Fill in oval 4 in the row labeled X.

	Test Code									
V	1	2	3	4	5	6	7	8	9	0
W	1	2	3	4	5	6	7	8	9	0
X	1	2	3	4	5	6	7	8	9	0
Y	1	2	3	4	5	6	7	8	9	0
Q	1	2	3	4	5	6	7	8	9	0

Subject Test (print)

BIOLOGY-E

—Fill in oval B in the row labeled Y.—

Leave the ovals in row Q blank.

	Test Code									
V	1	2	3	4	5	6	7	8	9	0
W	1	2	3	4	5	6	7	8	9	0
X	1	2	3	4	5	6	7	8	9	0
Y	1	2	3	4	5	6	7	8	9	0
Q	1	2	3	4	5	6	7	8	9	0

Subject Test (print)

BIOLOGY-M

—Fill in oval B in the row labeled Y.—

—Leave the ovals in row Q blank.

3. When everyone has completed filling in this portion of the answer sheet, the supervisor will tell you to turn the page and begin. The answer sheet has 100 numbered ovals on the sheet, but there are only 90 (or 95) multiple-choice questions in the test, so be sure to use only ovals 1 to 90 (or 95) to record your answers.

TEST 2—Continued

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

1. All of the following ideas are essential to Charles Darwin's theory of natural selection EXCEPT
- (A) individuals tend to produce more offspring than can survive.
 - (B) variation is present in all populations.
 - (C) characteristics acquired by one parent can be passed on to their offspring.
 - (D) resources are usually limited.
 - (E) those individuals who produce the most fertile offspring are the most fit.
2. Consider a solution whose pH has a value of 4. Choose the correct statement from the following:
- (A) It has a hydrogen ion concentration of 1×10^{-4} .
 - (B) It has a hydroxide ion concentration of 1×10^{-10} .
 - (C) It contains a thousand times more hydrogen ions than a neutral solution.
 - (D) It is acidic in nature.
 - (E) All of the above are true.
3. The secondary structure of proteins whose conformation may be an alpha helix is due to
- (A) the hydrogen bonds between a carbonyl group of one amino acid and the amino group of another.
 - (B) the hydrogen bonds between variable groups.
 - (C) the interactions between hydrophobic and hydrophilic variable groups.
 - (D) the interactions between the positively and negatively charged variable groups.
 - (E) all of the above.
4. A student cut a 2 cm³ block out of a potato and massed the block. She then placed the block in distilled water and waited an hour. If she remassed the block she could expect which of the following?
- (A) the mass to increase due to plasmolysis
 - (B) the mass to increase because the potato is hypertonic to the water
 - (C) the mass to decrease because the potato will lose its water
 - (D) the mass to decrease because of the higher water potential in the potato
 - (E) the mass to remain the same because there are no living components in this system

TEST 2—Continued

5. Radioactively labeled amino acids introduced into a growing cell culture would be incorporated by the cells. If the cells were involved in protein synthesis and secretion, the labeled amino acids would appear in the following organelles in which order over a given time period?
- (A) smooth endoplasmic reticulum — rough endoplasmic reticulum — golgi apparatus — nucleus
- (B) rough endoplasmic reticulum — smooth endoplasmic reticulum — golgi apparatus — plasma membrane
- (C) rough endoplasmic reticulum — golgi apparatus — smooth endoplasmic reticulum — plasma membrane
- (D) smooth endoplasmic reticulum — rough endoplasmic reticulum — golgi apparatus — plasma membrane
- (E) smooth endoplasmic reticulum — rough endoplasmic reticulum — golgi apparatus — lysosome
6. A student using a compound microscope with a 10× ocular lens and a 4× objective lens measured his field of view with a plastic ruler and found it to be 4 mm. He then placed some of his cheek cells on a slide, found them using the 4× objective lens and switched to the 40× objective lens. He counted twelve cells, side by side, that stretched from one side of the field of view to the other. What is the best estimate for the diameter of a cheek cell?
- (A) 0.033 mm
- (B) 0.132 mm
- (C) 0.0132 mm
- (D) 0.0033 mm
- (E) 1.32 mm
7. In fruit flies, the gray body color is dominant to the black, and long wings are dominant to short. If you crossed a gray, short-winged fly to a black, long-winged fly and got 25 percent gray, long wing; 25 percent gray, short wing; 25 percent black, short wing; and 25 percent black, long wing, what were the genotypes of the parental flies?
- (A) Ggll and GgLl
- (B) Ggll and ggLl
- (C) GGll and ggll
- (D) GGll and GgLl
- (E) Ggll and ggLL
8. In fruit flies, red eyes are dominant to green eyes. In a cross between a short-winged, green-eyed fly and a long-winged, red-eyed fly, the results were as follows:
- 40 percent short winged and red eyed
- 10 percent short winged and green eyed
- 10 percent long winged and red eyed
- 40 percent long winged and green eyed
- Which of the following reflects the chromosome makeup of the parents?
- (A) LIRr × Llrr
- (B) Llrr × llrr
- (C) LIRr × llrr
- (D) LLRR × llrr
- (E) LIRR × llRr

TEST 2—Continued

9. In the above example the red-eyed, long-winged fly had chromosomes best represented as
- (A) L R
l r
- (B) l L
R r
- (C) L l
R r
- (D) L R
l r
- (E) l r
R L
10. One can find naturally occurring plasmids in
- (A) viruses.
- (B) bacteria.
- (C) algae.
- (D) people.
- (E) all of the above.
11. A group of students tried to insert a small gene into a plasmid that was 4,500 bp in size. They then attempted to insert the plasmids into bacteria by transformation. Several days later, they chose four small colonies and grew them up in a broth culture. They extracted the DNA from the bacteria in each tube and loaded them onto a gel (lanes 1 to 4).
- The plasmids shown in lanes 2 and 3 are the same size as the original plasmid. Which of the following statements is (are) true?
- (A) The plasmids in lane 1 could be the result of cutting the original plasmid with restriction enzymes.
- (B) The plasmids in lane 1 can be the same size but different configurations.
- (C) The plasmids in lane 4 are smaller than the original plasmids.
- (D) The students were probably successful in their genetic engineering attempt.
- (E) Both (B) and (D) are correct.
12. The plasmids were separated according to
- (A) their size.
- (B) their charge.
- (C) their A-T:G-C composition.
- (D) both (A) and (B).
- (E) all of the above.

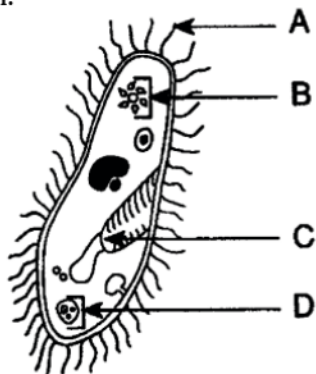
TEST 2—Continued

13. Red-green colorblindness in humans is a sex-linked trait. If a woman with normal vision, whose father was colorblind, married a man whose mother was colorblind, what would be the probability of their first child being a colorblind girl?
- (A) 0 percent
 (B) 12.5 percent
 (C) 25 percent
 (D) 50 percent
 (E) 100 percent
14. What are the number of different types of gametes that can be produced by an organism whose genotype is $AaBbCcDd$?
- (A) 4
 (B) 8
 (C) 12
 (D) 16
 (E) 20
15. The number of chromosomes in normal humans is 46. After meiosis in sperm production, the number of chromosomes I would be _____ and the number of resulting cells would be _____.
- (A) 46, 2
 (B) 23, 2
 (C) 46, 1
 (D) 23, 1
 (E) 23, 4
16. Which of the following statements about mitochondria is (are) true?
- (A) Mitochondria exist in all eukaryotes. (B) Mitochondria exist in bacteria and plants.
 (C) Mitochondria exist in animals, plants, and fungi.
 (D) Both (B) and (C) are true.
 (E) Both (A) and (C) are true.
17. The flowing cytoplasm of an active amoeba is
- (A) propelled by microfilaments for lipid synthesis.
 (B) an adaptation for extracellular digestion.
 (C) composed of microtubules and extracellular matrix.
 (D) dependent on microfilaments for intracellular circulation.
 (E) required for nerve transmission.



TEST 2—Continued

1. Questions 18–19 refer to the following diagram.



2. The diagram above represents a freshwater protist. Which letter indicates a structure that prevents the accumulation of excess water?
- (A) A
(B) B
(C) C
(D) D
(E) none of the above
3. The organism depicted above is both a
- (A) ciliate and a prokaryote.
(B) flagellate and a protozoan.
(C) ciliate and a protozoan.
(D) sporozoan and a ciliate.
(E) zoospore and a sporozoan.
4. In chordates, locomotion is accomplished by the action of
- (A) jointed chitinous appendages attached to muscles.
(B) muscles attached to an exoskeleton.
(C) paired muscles attached to an endoskeleton.
(D) all of the above.
(E) none of the above.
5. In the earthworm, the efficiency of food absorption is increased by the presence of
- (A) the liver, which stores extra food in addition to making metabolic enzymes.
(B) the cecum, which stores unsuitable intake for excretion.
(C) infolds, which add surface area to the intestine.
(D) malphigian tubules, which increase the density of the food.
(E) the liver, which absorbs excess sugar and stores it as glycogen.
6. Which statement is NOT true of ferns?
- (A) The gametophyte is larger than the sporophyte.
(B) The sori give rise to the gametophytes.
(C) Eggs are fertilized by sperm in the archegonia.
(D) Ferns possess vascular tissue for the transport of water and minerals.
(E) Male gametes depend on water for fertilization.

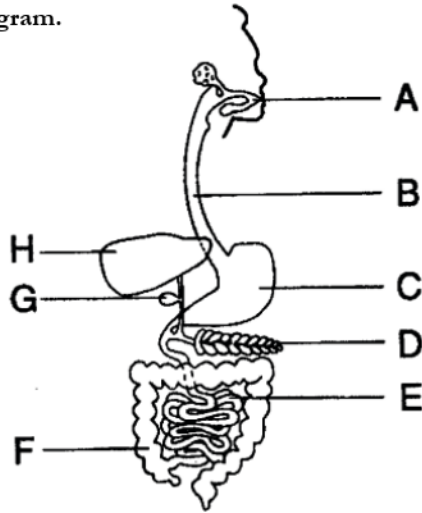
TEST 2—Continued

7. Monocotyledons and dicotyledons are the two subdivisions of flowering plants. Monocotyledons are distinguished from dicotyledons because monocots possess
- (A) floral structures in multiples of fours and fives.
 - (B) long taproots and parallel venation in their leaves.
 - (C) netted leaf venation and floral structures in multiples of three.
 - (D) parallel leaf venation and fibrous roots.
 - (E) floral structures in multiples of three and long taproots.
8. Which of the following statements is true concerning plants that utilize C4 photosynthesis?
- (A) They only open their stomates at night. (B) They use bundle sheath cells to separate the Calvin cycle from the atmosphere.
 - (C) They use rubisco (ribulose biphosphate carboxylase oxygenase) to capture carbon dioxide from the atmosphere.
 - (D) They use lenticels exclusively for gaseous exchange in order to conserve water.
 - (E) All of the above are true.
9. Neurotransmitters have as their effectors cells such as
- (A) nerves.
 - (B) muscles.
 - (C) glands.
 - (D) all of the above.
 - (E) none of the above.
10. Neurotransmitters cross the synapse after being released from the
- (A) dendrites.
 - (B) axons.
 - (C) cell bodies.
 - (D) all of the above.
 - (E) none of the above.
11. Insulin is an important hormone that serves to decrease one's blood sugar. Glucagon has the opposite effect through
- (A) the conversion of glycogen to glucose. (B) the secretion of glucose by cells.
 - (C) causing gluconeogenesis.
 - (D) all of the above.
 - (E) none of the above.
12. In humans, the structure that receives blood from the lungs is the
- (A) aorta.
 - (B) pulmonary artery.
 - (C) pulmonary vein.
 - (D) renal vein.
 - (E) femoral artery.



TEST 2—Continued

1. Questions 29–30 refer to the following diagram.



2. The initial digestion of carbohydrates takes place in
- (A) A.
 (B) C.
 (C) D.
 (D) F.
 (E) H.
3. Glucose is normally absorbed by structure _____, and protein is mostly digested in _____.
- (A) A,
 (B) A,
 (C) C,
 (D) E,
 (E) E, A
4. Which of the following statements about antibodies is false?
- (A) Antibodies are produced by different combinations of soluble proteins in the blood called complement.
 (B) When antibodies bind to a bacterial cell, it may keep that cell from adhering to host cells.
 (C) The specific receptors on T cells that would interact with a specific antigen are the same shape as antibodies that will interact with that antigen.
 (D) By binding to antigens, antibodies mark those antigens for destruction by macrophages.
 (E) By binding to an invader, antibodies attract proteins that lyse the target membrane.
5. Which of the following statements about the menstrual cycle is false?
- (A) Luteinizing hormone is produced by the pituitary in response to GNRH from the hypothalamus.
 (B) Luteinizing hormone acts on the follicle, causing ovulation.
 (C) Birth control pills that contain estrogen and progesterone would inhibit the secretion of FSH by the pituitary.
 (D) The endometrium builds up to its maximum thickness soon after the release of FSH.
 (E) Progesterone helps maintain the corpus luteum after ovulation.

C
E
E
C

TEST 2—Continued

6. Which of the following statements about muscle contraction is (are) true?
- (A) Calcium ions combine with troponin to cause a conformational change in tropomyosin.
- (B) Myosin and actin slide together because of the binding and contraction of actin filaments.
- (C) Tropomyosin wraps around myosin and blocks the binding sites between actin and myosin.
- (D) Both (A) and (B) are true.
- (E) Both (B) and (C) are true.
7. Viruses are an exception to the cell theory because they
- (A) normally reproduce by binary fission. (B) normally reproduce by forming spores. (C) lack either DNA or RNA.
- (D) have no cell organelles.
- (E) normally reproduce only in host cells.
8. Classification relies on arranging organisms that are most alike into groups. Choose from the lists below the correct arrangement of groups, from most to least inclusive.
- (A) kingdom — class — phylum — order — family — genus
- (B) kingdom — phylum — class — order — family — genus
- (C) domain — kingdom — class — family — genus — phylum
- (D) domain — kingdom — class — phylum — family — genus
- (E) species — family — phylum — class — kingdom
9. Which of the following factors does not favor a change in gene frequency and, therefore, evolution?
- (A) large populations
- (B) mutations
- (C) emigration
- (D) genetic drift
- (E) all of the above
10. The number of people in certain regions of Africa that suffer from sickle cell anemia is 16 percent. This genetic disorder is caused by a mutation in which homozygous recessive results in sickle cell anemia, but in the heterozygote condition causes the sickle cell trait. The gene frequency for that allele is _____, and the percentage of people that are heterozygotes is _____.
- (A) 0.6, 24
- (B) 0.4, 24
- (C) 0.6, 48
- (D) 0.4, 48
- (E) 0.6, 72
11. All of the following could be considered evidences of evolution EXCEPT
- (A) the structural homology between the forearms of bats and humans.
- (B) the DNA sequence of the cytochrome-*c* gene for bats and birds.
- (C) the dorsal nerve chord of crayfish and birds.
- (D) fossils of dinosaurs.
- (E) a wasp embedded in amber.



TEST 2—Continued

12. In symbiotic relationships, groups of two or more organisms live in physical proximity. Which of the following types of symbiosis depicts commensalism?
- (A) An egret riding on the back of a cow, looking for food in cow patties.
 - (B) A little bird riding on the back of a rhino, picking parasites off the back of the rhino.
 - (C) Undertaker bees removing dead bees from the hive of worker bees.
 - (D) A wrasse cleaning the parasites off the gills of a bigger fish.
 - (E) All of the above are commensalistic.
13. Competition between members of a prairie dog population could be expected to increase as a result of an increase in the
- (A) prairie dog intrinsic reproductive rate.
 - (B) spread of disease among the prairie dogs.
 - (C) mortality rate of prairie dogs.
 - (D) natality rate of prairie dog predators.
 - (E) number of secondary consumers.
14. The rain shadow effect is used to describe rainfall around certain mountain ranges. Which of the following statements is true?
- (A) The northern hemisphere and the southern hemisphere have the same prevailing winds.
 - (B) Cool air can hold more moisture than warm air.
 - (C) In the northern hemisphere, there is more rainfall on the eastern slopes.
 - (D) You would expect deserts to form on the western side of mountain ranges in the northern hemisphere.
 - (E) None of the above statements are true.
15. Which of the following biomes is correctly paired with its description?
- (A) tundra—coniferous trees in a cold, dry climate
 - (B) taiga—cold areas with low, mat-like vegetation
 - (C) tropical deciduous forests—the biome with the most precipitation
 - (D) savanna—grassland with three distinct climates, based mainly on rain
 - (E) chaparral—wetlands with many shrubs and ruminants
16. Mimicry always involves a model and a mimic as well as a dupe or signal receiver (the organism the mimic is trying to fool). Which of the following depicts Batesian mimicry?
- (A) a walking stick (a herbivore) sitting on a branch of a tree
 - (B) a rat snake (nonpoisonous) that looks like a poisonous species
 - (C) an opossum playing possum
 - (D) a spider that looks like an ant
 - (E) a flounder that blends in with the bottom to avoid being eaten
17. Two organisms that occupy many of the same niches are most likely
- (A) mutualistic partners.
 - (B) predator–prey.
 - (C) host–parasite.
 - (D) competitors.
 - (E) commensalistic partners.

TEST 2—Continued

1. Questions 45–47 refer to the following graph.

2. The carrying capacity of the population is

- (A) I.
- (B) II.
- (C) III.
- (D) I, II, and III.
- (E) not shown.

3. The exponential growth phase is

- (A) I.
- (B) II.
- (C) III.
- (D) I, II, and III.
- (E) not shown.

4. The formula for the line would best be written as

- (A) $dN/dT = r (N-K/N) N.$
- (B) $dN/dT = r (K-N/N) K.$
- (C) $dN/dT = r (N-K/K) N.$
- (D) $dN/dT = r (K-N/K) N.$
- (E) $dN/dT = r (K-N/K) K.$

5. Which of the following statements about succession is correct?

- (A) All farm ponds will eventually fill in and dry up.
- (B) Secondary succession involves the formation of dirt and soil.
- (C) Climax communities are not subject to change.
- (D) Random events play little, if any, part in succession.
- (E) In temperate deciduous forests, oaks and hickories are replaced by pines and furs.



TEST 2—Continued

1.

Questions 49–50 refer to the following information.

Three sets of parents in the hospital had babies whose blood types are given.

Parents	Children
Mr. & Mrs. White Type B and O	BABY 1 Type A
Mr. & Mrs. Black Type AB and O	BABY 2 Type B
Mr. & Mrs. Brown Type A and B	BABY 3 Type O
	BABY 4 Type AB

2. The parents of Baby 4 could have been

- (A) the Whites.
- (B) the Blacks.
- (C) the Browns.
- (D) the Browns or the Whites.
- (E) the Blacks or the Whites.

3. The Blacks could be the parents of

- (A) Baby 1.
- (B) Baby 2.
- (C) Baby 4.
- (D) Babies 1 and 2.
- (E) any of the babies.

4. The gas that was least present in the atmosphere of the Earth over 2 billion years ago was

- (A) methane.
- (B) oxygen.
- (C) nitrogen.
- (D) carbon dioxide.
- (E) carbon monoxide.

5. Prokaryotes, like bacteria, are very different from eukaryotes, like amoeba. The similarities they share are

- (A) they both have endoplasmic reticulum.
- (B) they both have DNA.
- (C) they both have ribosomes.
- (D) they have both endoplasmic reticulum and ribosomes.
- (E) they have both DNA and ribosomes.

TEST 2—Continued

1.

Questions 53–54 refer to the following chart and information.

	SAND	SILT	CORAL
Daylight	15	10	13
Night	5	30	3

- A student wanted to know where a particular type of fish was most likely to be found during a 24-hour period. He observed a total of 76 fish over several days.
- He could rightly conclude that
 - the fish don't have a preference for substrate.
 - the fish are more active at night.
 - the fish prefer coral to silt during the day.
 - the fish prefer silt at night.
 - all of the above are true.
- The student wanted to present the data to his fishing club. The data would best be presented as
 - a line graph, with time of day on the independent axis.
 - a line graph, with type of substrate on the dependent axis.
 - a bar graph, with one bar for sand, one for silt, and one for coral, each subdivided by daylight versus night.
 - a bar graph, with one bar for daylight and one for night, each subdivided by substrate type.
 - two different graphs, with light/dark on one axis and substrate on the other.

- Choose the correct letter from among the following. One or more advantages of social dominance hierarchies is that they

- I. keep those lower on the pecking order from being abused.
 - II. reduce interference competition.
 - III. keep organisms that are closely related closer together.
- I is true.
 - II is true.
 - III is true.
 - I and II are both true.
 - I and III are both true.
- Glucose levels in the human body are under the influence of
 - insulin produced in the liver.
 - glucagon produced in the kidneys.
 - insulin produced in the kidneys.
 - both insulin and glucagon.
 - parathyroid hormone.



TEST 2—Continued

6. Lynn Margulis's endosymbiont theory is supported by the fact(s) that
- (A) mitochondrial DNA is more like that of bacteria than the nuclear DNA in human cells.
 - (B) chloroplasts replicate on their own time schedule, not under nuclear control.
 - (C) mitochondria and chloroplasts are about the same size as prokaryotes.
 - (D) all of the above.
 - (E) none of the above.
7. Bryophytes, like mosses, are small because they
- (A) I. lack vascular tissue.
 - (B) II. depend on water as a medium for their sperm transfer.
 - (C) III. evolved before other land plants.
- (A) I is true.
 - (B) II is true.
 - (C) III is true.
 - (D) I and II are both true.
 - (E) I and III are both true.
8. People who suffer from meningitis are having an inflammation around their
- (A) coronary arteries.
 - (B) pleural cavities.
 - (C) kidneys.
 - (D) membranes of the spinal cord.
 - (E) vas deferens.
9. Which is the correct sequence of events during embryonic development?
- (A) cleavage — differentiation — fertilization — gastrulation
 - (B) differentiation — fertilization — gastrulation — cleavage
 - (C) fertilization — cleavage — gastrulation — differentiation
 - (D) fertilization — differentiation — cleavage — gastrulation
 - (E) fertilization — gastrulation — differentiation — cleavage

1.

1.

S T O P

1. IF YOU ARE TAKING THE BIOLOGY-E TEST, CONTINUE WITH QUESTIONS 61–80.

IF YOU ARE TAKING THE BIOLOGY-M TEST, GO TO QUESTION 81 NOW.

TEST 2—Continued

BIOLOGY-E TEST

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

2. Among social birds, like the Florida scrub jay, there are more male helpers at the nest than female because
- (A) males are more numerous than females.
 - (B) males make better helpers than females.
 - (C) males are better foragers than females.
 - (D) males need to wait for a territory to become available elsewhere.
 - (E) all of the above.
3. A larger, more aggressive blackbird sees a younger, smaller blackbird discover a food resource. He flies down, taking the food from the younger bird. This is an example of
- (A) a selfish act.
 - (B) an altruistic act.
 - (C) a spiteful act.
 - (D) a cooperative act.
 - (E) an unsocial act.
4. Two dogs fighting for one bone would be an example of
- (A) exploitative and interspecific competition.
 - (B) interference and intraspecific competition.
 - (C) exploitative and intraspecific competition.
 - (D) exploitative and interference competition.
 - (E) interference and interspecific competition.
5. The difference between gross primary production and net primary production is
- (A) respiration.
 - (B) the difference in photosynthetic rates between morning and afternoon.
 - (C) the amount of energy transferred between trophic levels.
 - (D) negligible in C4 plants.
 - (E) none of the above.



TEST 2—Continued

6. The most pressing ecological problem facing the world today is
- (A) the greenhouse effect.
 - (B) human population growth.
 - (C) the ozone problem.
 - (D) limited resources to feed, clothe, and house individuals.
 - (E) the amount of garbage created daily.
1. Questions 66–69 refer to the following diagram.
2. The primary consumers in this pyramid are the
- (A) phytoplankton.
 - (B) small fish.
 - (C) large fish.
 - (D) seals.
 - (E) polar bears.
3. The build-up of DDT in this system would most likely affect the
- (A) phytoplankton.
 - (B) small fish.
 - (C) large fish.
 - (D) seals.
 - (E) polar bears.
4. The reduction in the number of polar bears would probably cause
- (A) an increase in the number of large fish. (B) a decrease in the number of large fish. (C) phytoplankton to reproduce more rapidly.
 - (D) a decrease in the biomass of the community.
 - (E) none of the above.
5. If the amount of biomass in the phytoplankton was 1,500 kg/hectare, the amount of seal biomass would be
- (A) indeterminable from the data given.
 - (B) 150 kg/hectare.
 - (C) 100 kg/hectare.
 - (D) 15 kg/hectare.
 - (E) 1.5 kg/hectare.

TEST 2—Continued

6. Which of the following is true for freshwater ecosystems?
- (A) I. There is a seasonal mixing of materials.
 - (B) II. During the year, oxygen concentrations are vertically uniform.
 - (C) III. Materials are recycled more quickly than in ocean ecosystems.
- (A) I only
(B) II only
(C) III only
(D) I and III are both true.
(E) II and III are both true.
7. Midlatitude lakes undergo mixing more than equatorial lakes because
- (A) the midlatitude lakes turn over twice a year.
 - (B) midlatitude lakes develop a thermocline.
 - (C) water is densest at 4°C.
 - (D) all of the above.
 - (E) they don't—equatorial lakes have more mixing.
8. Which of the following statements about eutrophication is NOT true?
- (A) It is caused by acid rain.
 - (B) It is caused by the addition of nutrients to a water system.
 - (C) It is most harmful when there is little flow through in the system.
 - (D) Phosphorus is the main causal agent.
 - (E) Humans are responsible for most eutrophication.
9. Which of the following statements about acid rain is true?
- (A) I. Acid rain is caused by nitric acid and sulfuric acid.
 - (B) II. Acid rain can damage plants directly.
 - (C) III. Acid rain can cause magnesium and calcium to be leached from the soil.
- (A) I only
(B) II only
(C) III only
(D) II and III are both true.
(E) I, II, and III are all true.
10. Which of the following statements about the carbon cycle is NOT true?
- (A) Carbon dioxide levels fluctuate during the year.
 - (B) Carbon dioxide levels are rising because of consumption of fossil fuels. (C) Atmospheric carbon dioxide will eventually be transferred to the oceans. (D) Carbon dioxide levels are up because of the burning of forests.
 - (E) Carbon dioxide levels can be reduced by cleaning the gases that leave the smokestacks of power generating facilities.

TEST 2—Continued

11. Consider the following diagram, illustrative of the species richness equilibrium.

1. Questions 77–79 refer to the diagram below, which shows the general location of some major biomes of the Western Hemisphere



1. Circle number 3 represents the equilibrium of
- (A) a small island far from the mainland. (B) a small island close to the mainland. (C) a large island far from the mainland. (D) a large island close to the mainland. (E) the natality and mortality rates on any island.
2. A fungus living on a dead tree is a
- (A) saprophyte. (B) heterotroph. (C) consumer. (D) all of the above. (E) none of the above.
2. The most stable biome is represented by letter
- (A) A. (B) B. (C) C. (D) D. (E) E.
3. Which type of biome is indicated by letter E?
- (A) tundra (B) taiga (C) grassland (D) deciduous forest (E) chaparral

TEST 2—Continued

4. The biome indicated by letter F is characterized by
- (A) heavy rainfall, broad-leaved plants, and monkeys.
 - (B) sparse rainfall, grasses, and leopards.
 - (C) variable rainfall, mosses, and caribou.
 - (D) heavy rainfall, conifers, and snakes.
 - (E) variable rainfall, moderate temperatures, and low humidity.
5. The return of salmon to their own birthplace to breed is an example of
- (A) habituation.
 - (B) a stimulus.
 - (C) operant conditioning.
 - (D) reasoned behavior.
 - (E) imprinting.
- 1.

If you answered the first 80 questions STOP HERE. If you are taking the Biology-M test CONTINUE HERE.

TEST 2—Continued

BIOLOGY-M TEST

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

2. Alfred Hershey and Martha Chase performed a famous experiment that has been dubbed the “blender experiment.” In it, they attempted to prove that the hereditary material was DNA. It is named the blender experiment because
- (A) I. they blended viruses and bacteria into agar slants.
 - (B) II. they blended bacteria and viruses together after infection to rid the bacteria of their virus coats.
 - (C) III. they found that by blending viruses and bacteria together, the viruses could be trapped on the sides of the blender.
- (A) I only
 - (B) II only
 - (C) III only
 - (D) II and III are both true.
 - (E) I, II, and III are all true.
3. Which of the following statements about the “blender experiment” is NOT true?
- (A) The experiment preceded Watson’s and Crick’s elucidation of DNA structure.
 - (B) Hershey and Chase used radioactive sulfur to follow the protein in their experiment.
 - (C) Hershey and Chase used radioactive phosphorus to follow the nucleotides in their experiment.
 - (D) It was discovered by them that while different strains of bacteria have different percentages of nitrogen bases, the percent of adenine and the percent of thymine are equal, as are the percents of guanine and cytosine.
 - (E) Hershey and Chase’s experiment lent strong credence to the idea that DNA is the hereditary material, at least for viruses.
4. The number of base pairs in a typical bacterium is about _____, while the number in human cells is around _____.
- (A) 3 million, 3 billion
 - (B) 1 million, 1 billion
 - (C) 3,000, 3 million
 - (D) 1,000, 1 million
 - (E) 1 billion, 12 trillion

TEST 2—Continued

5. The proteins around which human DNA is wound are
- (A) cyclins.
 - (B) cyclin-dependent kinases.
 - (C) histones.
 - (D) heat-shock proteins.
 - (E) G proteins.
6. The proteins that come together to form “maturation promoting factors,” or “M phase factors,” are
- (A) cyclins.
 - (B) cyclin-dependent kinases.
 - (C) G proteins.
 - (D) cyclins and cyclin-dependent kinases. (E) cyclin-dependent kinases and G proteins.
7. Restriction enzymes were originally isolated from
- (A) viruses, which use them to cut bacterial DNA.
 - (B) bacteria, which use them to cut viral DNA.
 - (C) viruses, which use them to turn off their host bacterial DNA.
 - (D) protists, which use them to organize themselves into colonial life-forms.
 - (E) injured tissue, where they restrict the movement of molecules across the plasma membrane.
8. If a restriction enzyme has as its recognition sequence “ATCCTA,” how many restriction sites would appear in the lambda genome, which is approximately 54,000 bp?
- (A) 13
 - (B) 9,000
 - (C) 2,250
 - (D) 7
 - (E) 10,000



TEST 2—Continued

1. Questions 88–90 refer to the following information about genetic engineering.

1. Bacterial plasmid sequence: ATCCCA...1000 more nucleotides..... ..ATTAAGGCCTTACAG
GACCCCGGAATGAGAGTA ATGGGCTAT-
TCAGGTA... 2000 more nucleotides

Human DNA sequence: ATATCGTAATGT-
TGGTG..500 more nucleotides.. ..GTGT-
CAGGACGGGTGAAAGCCAGGACGC-
CGAATCG...5000 more nucleotides

The underlined DNA signifies the gene of interest we're trying to clone

Restriction enzyme sequences:

ERA I GTAATG
CRO I CAGGAC
MEM II GCCG

2. How many restriction sites appear in the bacterial plasmid sequence?

- (A) none
- (B) 1
- (C) 2
- (D) 3
- (E) more than 3

3. Which enzyme(s) should be used to insert the human sequence into the plasmid?

- (A) ERA I
- (B) CRO I
- (C) MEM II
- (D) CRO I and ERA I
- (E) ERA I, CRO I, and MEM II

4. How many bands would show up on a 1 percent agarose gel if the plasmid was cut with both ERA I and CRO I?

- (A) 1
- (B) 2
- (C) 3
- (D) 100
- (E) 1,000

5. A gene that is 1,500 nucleotides long codes for a metabolic protein that is composed of 400 amino acids. The number of nucleotides in exons are _____ and the number of nucleotides in introns are _____.

- (A) 1,200; 300
- (B) 300; 1,200
- (C) 1,500; 0
- (D) 0; 1,500
- (E) 400; 1,100

6. Which of the following statement(s) about RNA polymerases is (are) true?

- (A) I. pry the two strands of DNA apart
- (B) II. add RNA nucleotides together
- (C) III. bind to promoter regions of the DNA to begin transcription

- (A) I only
- (B) II only
- (C) III only
- (D) II and III are both true.
- (E) All of the above are true.

TEST 2—Continued

7. Which of the following statements about the *lac* operon is NOT true?
- (A) RNA polymerase can be blocked by an active repressor protein attached to the operator.
 - (B) RNA polymerase attaches at a site on the DNA strand, known as the promoter.
 - (C) There is a regulatory gene that is downstream from the structural genes that can inhibit transcription.
 - (D) The regulatory gene produces the active repressor.
 - (E) The repressor protein can be activated by a substance like lactose, called the inducer.
8. Which of the following statements about the HIV virus is NOT true?
- (A) The viral nucleotides contain ribose. (B) HIV contains uracil, not thymine.
 - (C) HIV infection begins with the entrance of the virus into the host when the gp 120 and gp 41 function to pull the virus across the plasma membrane.
 - (D) HIV makes the host cell produce reverse transcriptase.
 - (E) Immunization against HIV has proven difficult because the virus mutates so rapidly.
9. All of the following are means of post-transcriptional control in eukaryotes EXCEPT
- (A) the capping of the 5' end with a modified guanosine triphosphate.
 - (B) the addition of a poly-A tail to the 3' end.
 - (C) the cutting out of introns by a spliceosome.
 - (D) the ligation of exons by DNA polymerase.
 - (E) the attachment of signal sequences for direction to specific destinations.
10. Which of the following statements is NOT true concerning restriction fragment length polymorphisms (RFLPs)?
- (A) Suspects whose fragments do not match any other fragments at a crime scene can be vindicated.
 - (B) The polymerase chain reaction can be used to produce more copies of DNA obtained at a crime scene before RFLP analysis.
 - (C) Most RFLPs use radioactive probes.
 - (D) Most RFLPs occur because of the repetitive nature of DNA.
 - (E) With the advent of PCR technology, restriction enzymes are no longer needed to perform RFLP analysis.



TEST 2—Continued

1. Questions 97–100 refer to the following diagram.

2. Consider the following DNA nucleotides, where A, C, G, and T represent adenine, cytosine, guanine, and thymine:

TAC TTT TTG CTC ATC

The mRNA that would be transcribed from that would be

- (A) TUC TTT TTG CTC ATC.
- (B) CGT CCC CCA TCT GCT.
- (C) ATG AAA AAC GAG TAG.
- (D) AUG AAA AAC GAG UAG.
- (E) CGU CCC CCA UCU GCU.

3. The amino acids coded for are, in order,

- (A) tyrosine, phenylalanine, leucine, leucine, isoleucine.
- (B) histidine, phenylalanine, valine, leucine, leucine.
- (C) leucine, phenylalanine, methionine, leucine, stop.
- (D) arginine, proline, proline, serine, alanine.
- (E) methionine, lysine, asparagine, glutamic acid, stop.

4. Below is a list of the DNA coding sequence for a metabolic enzyme. Which of the four is most closely related to the first?

TAC TTT TTG CTC ATC

- (A) ATC TTT TTG CTC ATC
- (B) TAC TTC TTA CTT ATC
- (C) TAC TTC TTG CTG ATC
- (D) TAC TTC TAG CTC ATC
- (E) Not enough information is given.

5. The number of tRNA molecules required by eukaryotic organisms to ferry around the amino acids is

- (A) 64.
- (B) 63.
- (C) 45.
- (D) 23.
- (E) 20

**S T O
P**

If you finish before the hour is up, you may review your work on this test only. You may not turn to any other test in this book.

ANSWERS AND EXPLANATIONS

QUICK-SCORE ANSWERS

1. C 11. D 21. C 31. A 41. E 51. B 61. D 71. C 81. B 91. A
2. E 12. D 22. A 32. D 42. D 52. E 62. A 72. A 82. D 92. E
3. A 13. C 23. D 33. A 43. B 53. D 63. B 73. E 83. A 93. C
4. B 14. D 24. B 34. E 44. D 54. D 64. A 74. E 84. C 94. D
5. A 15. A 25. D 35. B 45. C 55. B 65. B 75. B 85. D 95. D
6. A 16. E 26. B 36. A 46. A 56. D 66. B 76. D 86. B 96. E
7. B 17. D 27. D 37. D 47. D 57. D 67. E 77. C 87. A 97. D
8. C 18. B 28. C 38. C 48. A 58. D 68. B 78. D 88. C 98. E
9. B 19. C 29. A 39. A 49. C 59. D 69. E 79. A 89. A 99. B
10. B 20. C 30. D 40. A 50. D 60. D 70. D 80. E 90. A 100. C

1. **The correct answer is (C).** The theory of acquired characteristics, proposed by Lamarck, plays no part in the theory of natural selection. It is not an accepted theory in biology.

2. **The correct answer is (E).** pH is defined as the negative log of the hydrogen ion concentration. Therefore, the negative log, choice (A), is 4. The pH and the pOH always add up to 14. And since it is a logarithmic scale, the difference in concentration between 4 and 7 is 1,000 times as strong.

3. **The correct answer is (A).** While the other interactions are important, they give rise to tertiary structure.

4. **The correct answer is (B).** The water molecules will move from a greater to a lesser concentration. The potato is hypertonic to the water because it has a greater solute concentration. Plasmolysis is the loss of water.

5. **The correct answer is (A).** Review the endomembrane system, which is responsible for packaging molecules for transport. The SER comes before the RER, and the golgi apparatus usually attaches a carbohydrate or modifies the protein in some manner.

6. **The correct answer is (A).** The field of view is 4 mm at 40 magnifications (ocular lens \times objective lens gives total magnification). If he went to 400 magnifications, he would be looking at $\frac{1}{10}$ as much, or 0.4mm. If 12 cells line up and cover 0.4mm, then by division we get 0.033mm/cell.

7. **The correct answer is (B).** When doing dihybrid genetics problems, think about the traits as a monohybrid cross. The only way to have half gray and half black is hybrid \times homozygous

PRACTICE TEST 2

recessive. Since the first fly is gray, he must be Gg. The second fly must be hybrid for wing length.

8. **The correct answer is (C).** The short-winged, green-eyed fly is llrr, and the other parent is LlRr. Being hybrid for both traits is necessary to produce the offspring that are non-parental types and are the result of crossing over during meiosis.
9. **The correct answer is (B).** The question relates to question 8 and the recombinants produced by the LlRr fly. The diagram below shows the results of crossing over that produced the short-winged, green-eyed flies and the long-winged, red-eyed flies.

$$\begin{array}{c} l \quad L \\ R \quad r \end{array}$$

10. **The correct answer is (B).** One of the major differences between prokaryotes and eukaryotes is the presence of plasmids.
11. **The correct answer is (D).** Choices (A) and (C) are incorrect because there are larger bands present than the original plasmid. While the same size plasmids can travel at different rates based on their conformation (relaxed, coiled, or supercoiled), there is no reason to believe one would not see the band shown in lanes 2 and 3 in lane 1.
12. **The correct answer is (D).** Gel electrophoresis draws negatively charged DNA to the positive pole. The smaller molecules will migrate faster through the gel.
13. **The correct answer is (C).** The mother is a carrier, and the father is colorblind. Their genotypes could be represented as $X^c X^c$ and $X^c Y$.
14. **The correct answer is (D).** 2^4 is 16, AaBb could make 4, or CcDd could make 4, so by multiplication, the probability of both events is the product of their individual probabilities.
15. **The correct answer is (A).** Meiosis I results in two cells, but there is no chromosome reduction at this point. During inter-phase, the DNA had been synthesized, doubling the amount of chromosomes. When divided into two cells, the number is 2N.
16. **The correct answer is (E).** Mitochondria are membrane-bound organelles and, as such, exist in all eukaryotic cells but not in prokaryotic (bacteria) cells.
17. **The correct answer is (D).** Actin and myosin are used for movement in many cells.
18. **The correct answer is (B).** The contractile vacuole is used to regulate water or tonicity.
19. **The correct answer is (C).** The protozoans are divided into groups relative to their mode of locomotion. The paramecia are

ANSWERS AND EXPLANATIONS

- ciliates. Sporozoans do not move about by cilia, flagella, or pseudopods but are parasitic and move from host to host.
- 20. The correct answer is (C).** Chordates lack both chitin (a substance found in fungal cell walls and the exoskeletons of arthropods) and an exoskeleton.
- 21. The correct answer is (C).** The increase of surface area increases many physiological responses, including food absorption. Earthworms lack livers, ceca, and malpighian tubules.
- 22. The correct answer is (A).** The gametophyte, large in both mosses and liverworts, is much reduced in the fern (and all other vascular plants).
- 23. The correct answer is (D).** Monocots have parallel leaf venation, floral structures in multiples of 3, and fibrous taproots. **24. The correct answer is (B).** CAM plants open their stomates at night. C₄ plants use PEP carboxylase to capture carbon dioxide from the atmosphere.
- 25. The correct answer is (D).** Effectors are the cells that neurons act upon.
- 26. The correct answer is (B).** Dendrites are the receptors for nerves. The neurotransmitters are produced in the cell bodies. **27. The correct answer is (D).** Insulin lowers blood sugar by making cells more permeable to glucose.
- 28. The correct answer is (C).** Structures that carry blood toward the heart are veins, and those that carry it away are arteries. Blood circulation is divided into the pulmonary system (lungs) and the systemic system (everything else).
- 29. The correct answer is (A).** Salivary amylase begins the digestion of carbohydrates in the mouth.
- 30. The correct answer is (D).** Most food is absorbed in the small intestine. Protein digestion begins in the stomach and continues in the small intestine.
- 31. The correct answer is (A).** Antibodies are produced by plasma cells and are released (as receptors) from the membranes of white blood cells.
- 32. The correct answer is (D).** FSH is secreted early in the cycle. The endometrium builds to its thickest around the third week of the cycle.
- 33. The correct answer is (A).** Myosin, not actin, is the filament that binds and contracts. Tropomyosin wraps around actin, not myosin.
- 34. The correct answer is (E).** Not only are viruses not cellular, but they can not reproduce without being in a host cell.

PRACTICE TEST 2

- 35. The correct answer is (B).** Some people use the following mnemonic to help them remember the order: King Phillip Came Over For Good Spaghetti.
- 36. The correct answer is (A).** Small populations would favor a change in the gene frequency.
- 37. The correct answer is (D).** The frequency of two alleles in the population (p and q) must add up to 1. The gene frequency is the square root of the homozygous recessive genotypic frequency. If 0.16 are homozygous recessive (q^2), 0.4 is the gene frequency (q). The carriers are the heterozygotes or $2pq$ ($2 \times 0.6 \times 0.4$).
- 38. The correct answer is (C).** The first two are considered homologies. The last two are physical evidences of evolution. Crayfish have ventral nerve chords, not dorsal; nor are the nerve chords homologous.
- 39. The correct answer is (A).** The commensalistic relationship depicts the egret benefiting from his relationship with the cow, but the cow is neither harmed nor helped by this relationship. On the other hand, the relationships in choices (B), (C), and (D) are mutualistic because both parties benefit.
- 40. The correct answer is (A).** The reproductive rate will make more dogs, while the other factors will decrease both the number of dogs and the competition.
- 41. The correct answer is (E).** The prevailing winds in the northern hemisphere are westerlies, which drive moisture-laden warm air up mountain sides until the air cools, reducing its ability to hold as much moisture. Precipitation falls on the eastern side, frequently creating deserts on the western sides.
- 42. The correct answer is (D).** The taiga is coniferous forests; the temperate deciduous forests lose their leaves due to lack of moisture; and the chaparral is represented by coastal California, with few ruminants.
- 43. The correct answer is (B).** By mimicking a dangerous or unpalatable prey, the rat snake hopes not to be viewed as easy prey. Other types of mimicry are crypsis, choices (A) and (E), and aggressive mimicry, choice (D).
- 44. The correct answer is (D).** Niches are not only where an organism lives (habitat) but are multidimensional descriptions of everything about organisms.
- 45. The correct answer is (C).** The carrying capacity is the number of organisms that can be supported in an environment.
- 46. The correct answer is (A).** The early growth is exponential, followed by logistic growth. During exponential growth, the

ANSWERS AND EXPLANATIONS

- factors that determine the carrying capacity are not yet influential.
- 47. The correct answer is (D).** K is the carrying capacity, and each generation depends on the previous generation (N).
- 48. The correct answer is (A).** The organisms that line the edge of the pond eventually die and displace the water from the outside toward the middle. Run-off and erosion help speed the process.
- 49. The correct answer is (C).** By Mendel's Law of Segregation, the principles of meiosis, each parent gives one of their two alleles for blood type. Therefore, neither the Whites nor the Blacks could provide an A from one parent and a B from the other.
- 50. The correct answer is (D).** As above, the Blacks can offer either an A or a B from the AB parent, and the other parent will give an O (nothing).
- 51. The correct answer is (B).** Oxygen, produced by photosynthetic organisms, was not prevalent in the atmosphere until 2 billion years ago.
- 52. The correct answer is (E).** Prokaryotes lack membrane-bound organelles (like ER) but do have ribosomes, which lack membranes. Don't forget to read all the choices in a multiple-choice test!
- 53. The correct answer is (D).** While the fish don't have a preference for substrate during the day, they certainly do at night.
- 54. The correct answer is (D).** The resulting graph has six bars, 2 groups of three. The other choice is 3 groups of two, which is harder to read and doesn't portray the information as clearly.
- 55. The correct answer is (B).** Interference competition is direct aggression toward another, which is costly to both parties.
- 56. The correct answer is (D).** Both insulin and glucagon are produced in the pancreas.
- 57. The correct answer is (D).** The endosymbiont theory states that eukaryotic cells evolved from the inclusion of one prokaryotic cell in another. Those early cells supplied energy to the other cells and were protected from the environment. The DNA evidence strongly supports the theory.
- 58. The correct answer is (D).** Bryophytes lack vascular tissue and the ability to send water up long stems. The sperm must actually swim from the antheridia to the archegonia to fertilize the egg. It is a common misconception that vascular plants evolved from bryophytes.

PRACTICE TEST 2

59. The correct answer is (D). The meninges are the linings of the central nervous system.
60. The correct answer is (D). Gastrulation is the last event, which is an invagination of the blastula, creating three cell layers.

BIOLOGY-E TEST

61. The correct answer is (D). There is no indication that males are better at any of those tasks, but more importantly, it is to their selective advantage to mate if they can or help their own fitness through kin selection if they can't.
62. The correct answer is (A). It is selfish because it helps him at some cost to the younger bird. If it helped neither it would be considered a spiteful act. An altruistic act would help the young bird at some cost to the older bird, an event that must be viewed skeptically in the animal world.
63. The correct answer is (B). Interference competition is direct contact, as opposed to exploitative, an example of which would be the changing beak shapes on Darwin's finches. Intraspecific means "within the species," while interspecific means "between species."
64. The correct answer is (A). Respiration includes the costs of metabolism that plants, as well as animals, must meet.
65. The correct answer is (B). Human population growth exacerbates the other problems.
66. The correct answer is (B). Primary consumers eat producers, the phytoplankton.
67. The correct answer is (E). Biological magnification is the name given to this process, wherein a poison that is not metabolized but is stored builds up in the tissues of organisms. Those that feed at the top of the food chain are most at risk.
68. The correct answer is (B). We know that the biomass is supported by the number of producers, which will remain relatively constant with respect to upper-level consumers. We know that the number of seals will increase as the polar bears' numbers decrease. Therefore, the number of large fish will go down.
69. The correct answer is (E). The amount of biomass that can be supported in a system is approximately 10 percent of the preceding trophic level biomass, or 90 percent of the preceding level is lost—therefore, 150 in the small fish, 15 in the large fish, and 1.5 in the seals.

ANSWERS AND EXPLANATIONS

- 70. The correct answer is (D).** The spring and fall turnover that occurs in most lakes mixes both nutrients and oxygen into the water column uniformly. At other times, the oxygen concentration falls as depth increases.
- 71. The correct answer is (C).** Because water is densest at 4 degrees, there is a point (the thermocline) below which water temperature will not decline. This characteristic property of water enables the mixing that lakes go through. In the spring, as the water warms, the whole water column will be 4 degrees, enabling even slight winds to mix the water.
- 72. The correct answer is (A).** Eutrophication is the loss of oxygen in a freshwater system to the decomposers in that system. It is caused by too much productivity.
- 73. The correct answer is (E).** The acidic gases mix with moisture in the air to make nitric and sulfuric acids.
- 74. The correct answer is (E).** The reason that carbon dioxide levels fluctuate is photosynthetic activity.
- 75. The correct answer is (B).** Small islands have the highest extinction rates. The highest arrival rates occur closest to the mainlands.
- 76. The correct answer is (D).** All fungi are heterotrophs and, as such, are consumers. The dead tree makes it a saprophyte, as opposed to a parasite.
- 77. The correct answer is (C).** Oceans are the most stable biome. **78. The correct answer is (D).** The temperate deciduous forest covers much of the eastern United States. There are regions like the Smokies and upstate New York that are much like taiga, with their coniferous trees, because of the altitude.
- 79. The correct answer is (A).** The tropical evergreen forest is represented by choice (A).
- 80. The correct answer is (E).** Imprinting is an event that takes place early in the life of an organism and that fixes a certain place or organism in its memory. There is a short-lived time or window in which these events can take place. Konrad Lorenz had some greylag geese imprint on him as their mother, and as such, they followed him around daily.

BIOLOGY-M TEST

- 81. The correct answer is (B).** The viruses were labeled with both radioactive sulfur and radioactive phosphorus. The sulfur would stay with the protein coat on the virus and the phosphorus with

PRACTICE TEST 2

the viral DNA. The blender knocked off the virus particles from the bacteria.

- 82. The correct answer is (D).** See above.
- 83. The correct answer is (A).** In addition, a typical plasmid would contain 3,000 DNA bp.
- 84. The correct answer is (C).** While both prokaryotes and eukaryotes have proteins associated with their DNA, only eukaryotes use histones. Some people use a thread and spool analogy for DNA that is wound around the histones.
- 85. The correct answer is (D).** Cyclins (as their name implies) cycle up and down during the cell cycle. There are several different types of combinations between cyclins and other cdk's.
- 86. The correct answer is (B).** While these enzymes were originally found in bacteria, almost all are synthetically produced today.
- 87. The correct answer is (A).** The calculation depends on the number of times that any base will be encountered. The probability that an A will be first is $\frac{1}{4}$, then $\frac{1}{4}$ for the T, etc. or $(\frac{1}{4})^6$ or $\frac{1}{4096}$. Since there are 54,000 bases, $54,000 \times \frac{1}{4096}$ or 13.
- 88. The correct answer is (C).** There is one site that CRO I will cut and one that ERA I will cut.
- 89. The correct answer is (A).** One should use the same restriction endonuclease to cut both the human gene and the bacterial plasmid. Since there is not a site for MEM II in the plasmid, it is not a suitable candidate. Since CRO I cuts within the gene of interest, it is unsuitable. The ERA I cuts both.
- 90. The correct answer is (A).** When a bacterial plasmid, which is circular, is cut once, the result is one linear band. This plasmid will be cut twice, resulting in 2 bands, but one is so small (12 nucleotides) that it can not be seen (it will run off the gel).
- 91. The correct answer is (A).** 400 amino acids require 1,200 nucleotides. The 300 leftover are introns.
- 92. The correct answer is (E).** There may be other molecules involved, but most texts give those functions to RNA polymerase. **93.**
- The correct answer is (C).** The regulatory gene is upstream, making the active repressor.
- 94. The correct answer is (D).** HIV, and all retroviruses, have to carry their own reverse transcriptase with them since the host cell does not produce it or code for it.
- 95. The correct answer is (D).** The spliceosome does the ligating. **96.**
- The correct answer is (E).** One can't produce a restriction fragment without using a restriction enzyme.

ANSWERS AND EXPLANATIONS

- 97. The correct answer is (D).** Use Watson-Crick base-pairing rules and remember that RNA uses uracil, not thymine.
- 98. The correct answer is (E).** The table is a messenger RNA codon table. Read from left to top to right.
- 99. The correct answer is (B).** The answer cannot be obtained by examination of just the DNA nucleotides. One must transcribe and translate the sequences. By doing so, silent mutations, those which do not change the amino acid sequence, are not nearly important as missense mutations, choices (C) or (D), which change an amino acid, or nonsense mutations, which introduce a stop codon, choice (A).
- 100. The correct answer is (C).** Because of wobble, only about 45 different tRNAs are required. The relaxation is at the third base, with the use of inosine.

PRACTICE TEST 3

While you have taken many standardized tests and know to blacken completely the ovals on the answer sheets and to erase completely any errors, the instructions for the EST II exam in Biology differs from the directions for other standardized tests you have taken. You need to indicate on the answer key whether you are taking the EST II Biology with Ecological Emphasis (Biology-E) or Molecular Emphasis (Biology-M).

The instructions on the answer sheet will tell you to fill out the top portion of the answer sheet exactly as shown.

1. Print *BIOLOGY-E* or *BIOLOGY-M* on the line to the right under the words *Subject Test* (*print*).

2. In the shaded box labeled *Test Code* fill in four ovals:

For **BIOLOGY-E**

- Fill in oval 1 in the row labeled V.
- Fill in oval 9 in the row labeled W.
- Fill in oval 4 in the row labeled X.

For **BIOLOGY-M**

- Fill in oval 1 in the row labeled V.
- Fill in oval 9 in the row labeled W.
- Fill in oval 4 in the row labeled X.

		Test Code									
V		1	2	3	4	5	6	7	8	9	0
W		1	2	3	4	5	6	7	8	9	0
X		1	2	3	4	5	6	7	8	9	0
Y		1	2	3	4	5	6	7	8	9	0
Q		1	2	3	4	5	6	7	8	9	0

Subject Test (print)

BIOLOGY-E

- Fill in oval B in the row labeled Y. —
- Leave the ovals in row Q blank.

		Test Code									
V		1	2	3	4	5	6	7	8	9	0
W		1	2	3	4	5	6	7	8	9	0
X		1	2	3	4	5	6	7	8	9	0
Y		1	2	3	4	5	6	7	8	9	0
Q		1	2	3	4	5	6	7	8	9	0

Subject Test (print)

BIOLOGY-M

- Fill in oval B in the row labeled Y. —
- Leave the ovals in row Q blank.

3. When everyone has completed filling in this portion of the answer sheet, the supervisor will tell you to turn the page and begin. The answer sheet has 100 numbered ovals on the sheet, but there are only 90 (or 95) multiple-choice questions in the test, so be sure to use only ovals 1 to 90 (or 95) to record your answers.

TEST 3—Continued

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

Questions 1–4 refer to the following information.

A student studying respiration decided to test the following hypothesis: “If yeasts use glucose for energy, then the more glucose I add to their medium, the more the population will grow.”

To test this hypothesis, she filled four tubes with 5 ml of minimal growth media and added no glucose to the first, 5 ml to the second, 10 ml to the third, and 20 ml to the fourth. After 1 day she recorded the following data:

tube # 1	tube # 2	tube # 3	tube # 4
yeasts/mm ³	200 yeasts/mm ³	60 yeasts/mm ³	0 yeasts/mm ³
pH = 7.0	pH = 6.5	pH = 6.8	pH = 7.2

- The data suggest which of the following?
 - Yeasts need glucose to grow.
 - The more glucose given to yeasts, the better they will grow.
 - pH can be used to measure the rate of growth.
 - Yeasts give off hydrochloric acid when they grow.
 - None of the above
- If she wanted to graph the data, she should put
 - # of yeast on the *X* or independent axis and pH on the *Y* or dependent axis.
 - pH on the *Y* axis and time on the *X* axis.
 - # of yeasts on the *Y* axis and amount of glucose on the *X* axis.
 - # of yeasts on the *Y* axis and pH on the *X* axis.
 - (C) on one graph and (D) on another.
- Reasons why the last tube didn't grow any yeast could be
 - that the yeasts lost water through osmosis.
 - that the mitochondria of the yeasts were overwhelmed.
 - that fermentation killed the yeasts.
 - that the high pH was bad for the yeasts.
 - all of the above.
- The student added no glucose to the first tube because
 - she was testing the minimal media.
 - she was using it for a control.
 - she had to prove that yeasts need glucose to survive.
 - all of the above.
 - none of the above.

TEST 3—Continued

5. The hydrogen bonds in water are a result of
 (A) the hydrogen of one molecule bonding to the hydrogen of another molecule. (B) the oxygen of one molecule bonding to one of the hydrogens of that molecule. (C) the hydrogen of a water molecule bonding to the nitrogen of another. (D) the hydrogen of one molecule bonding to the oxygen of another molecule. (E) none of the above.
6. Which of the following describe the physical dimensions for DNA?
 I. The nitrogen bases are 0.34 nm from one another, moving 58 to 38
 II. The diameter of the strand is 20 nm.
 III. The two strands run antiparallel.
 (A) I only
 (B) II only
 (C) III only
 (D) I and II
 (E) I and III
7. Which of the following DNA sequences would code for the polypeptide glutamine, lysine, histidine?
 (A) CAG AAA CAU
 (B) ACT CCC ACG
 (C) GUC UUU GUA
 (D) GTC TTT GTA
 (E) none of the above
8. If a DNA strand contained the sequence ATG AGT CGT, what one base substitution could keep the translation from being completed?
 (A) A to G
 (B) T to A
 (C) G to C
 (D) C to G
 (E) G to A

Questions 7–8 refer to the following table.

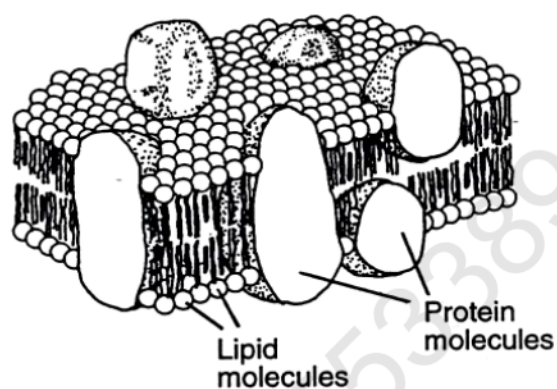


TEST 3—Continued

9. A consensus sequence is associated with _____, while a signal sequence is part of _____.
- (A) translation, hnRNAs
 (B) DNA, translation
 (C) transcription, a snurp
 (D) hnRNA, a snurp
 (E) spliceosomes, translation

10. Plants produce energy in their

- I. cytosol.
 II. mitochondria.
 III. chloroplasts.
- (A) I only
 (B) II only
 (C) III only
 (D) II and III
 (E) I, II, and III



11. Which cell structure is represented in the drawing above?
- (A) plasma membrane
 (B) chloroplast
 (C) endoplasmic reticulum
 (D) golgi apparatus
 (E) mitochondrion
12. One would expect to find steroid hormone receptors in the
- (A) plasma membrane.
 (B) endoplasmic reticulum.
 (C) nucleus.
 (D) cytosol.
 (E) none of the above.

TEST 3—Continued

18. Which molecule is an amino acid?

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

19. What molecule is a product of the Krebs's cycle?

- (A) B
- (B) C
- (C) D
- (D) E
- (E) F

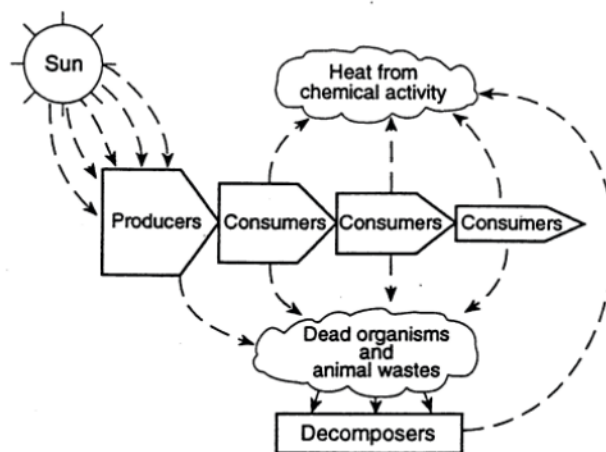
20. The separation of plant pigments using paper chromatography is based on

- (A) the non-polarity of the solvents and pigments.
- (B) the polarity of the paper.
- (C) the polarity of the pigments.
- (D) all of the above.
- (E) none of the above.

21. The enzyme that charges tRNA molecules has as its substrate(s)

- I. an amino acid.
 - II. ATP.
 - III. tRNA.
 - IV. snRNA.
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I, II, and III
 - (E) I, II, III, and IV

Questions 22–23 refer to the following diagram.



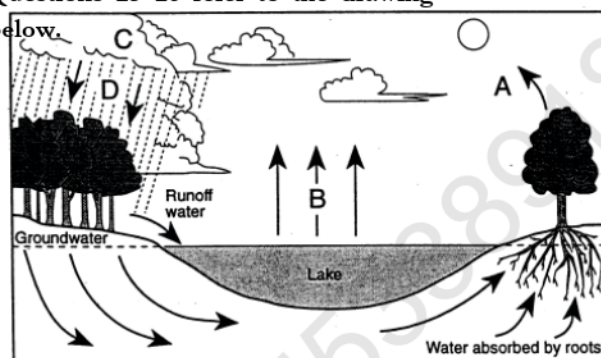
TEST 3—Continued

22. The diagram above illustrates _____ and shows that most energy is lost as _____.
- (A) the first law of thermodynamics, fast as it arrives
 - (B) the second law of thermodynamics, heat
 - (C) the second law of thermodynamics, fast as it arrives
 - (D) the first law of thermodynamics, decomposition
 - (E) the second law of thermodynamics, decomposition

23. The amount of energy bound up in the second consumer's level is approximately _____ of the radiant energy falling on the system.
- (A) 5 percent
 - (B) 0.5 percent
 - (C) 0.1 percent
 - (D) 0.01 percent
 - (E) 0.05 percent

24. Organisms are placed in different trophic levels according to how they obtain their energy. Another name for primary consumer is
- (A) green plant.
 - (B) herbivore.
 - (C) carnivore.
 - (D) omnivore.
 - (E) decomposer.

Questions 25–26 refer to the drawing below.



25. Which letter represents the process of transpiration?
- (A) A
 - (B) B
 - (C) C
 - (D) D
 - (E) none of the above
26. Over time, according to the theories of succession,
- (A) the lake will get deeper and the trees more numerous.
 - (B) the lake will get shallower and the trees will be replaced by grass.
 - (C) the lake will dry up.
 - (D) the trees will become coniferous types.
 - (E) there is no fixed order to the replacement of species.

J

TEST 3—Continued

- 27.** Some organisms living in a vacant lot include grass, dandelions, mice, grasshoppers, and slugs. Collectively these organisms represent
- (A) an ecosystem.
 - (B) a community.
 - (C) a population.
 - (D) a mutualism.
 - (E) a biome.
- 28.** Darwin's finches are a group of about twelve species of birds that live on the Galapagos Islands. The fact that they have different size beaks is regarded as a consequence of
- (A) genetic drift.
 - (B) coevolution.
 - (C) competition.
 - (D) chance.
 - (E) behavioral modification.
- 29.** Predators in an ecosystem
- (A) help the community by keeping the number of prey from outstripping their resources.
 - (B) help the prey population by removing the sick and less fit individuals.
 - (C) enhance species diversity.
 - (D) reduce the possibility of competitive exclusion.
 - (E) all of the above.
- 30.** A walking stick, a type of insect that is a primary consumer, is an example of an organism using
- (A) aggressive mimicry.
 - (B) Batesian mimicry.
 - (C) camouflage.
 - (D) Mullerian mimicry.
 - (E) none of the above.
- 31.** The buildup of pesticides in ospreys is known as
- (A) biological magnification.
 - (B) food web dynamics.
 - (C) succession.
 - (D) keystone predation.
 - (E) none of the above.
- 32.** An organism with the genotype AaVv can produce how many different types of gametes?
- (A) 1
 - (B) 2
 - (C) 4
 - (D) 6
 - (E) 8

TEST 3—Continued

Questions 33–34 refer to the following diagram.

33. A cell has four chromosomes, which are represented in the original cell drawing. At the end of meiosis I, which of the other four drawings represents a possible out-come?

- (A) I only
 (B) II only
 (C) III only
 (D) IV only
 (E) none of the above

34. At the end of meiosis II, which of the drawings represent(s) possible outcomes?

- (A) I only
 (B) II only
 (C) II and III
 (D) III and IV
 (E) IV only

35. In minks, the gene for brown fur (B) is dominant to the gene for silver fur (b). Which set of genotypes represents a cross that could produce offspring with silver fur from parents that both have brown fur?

- (A) Bb × Bb
 (B) BB × Bb
 (C) BB × bb
 (D) Bb × bb
 (E) none of the above

36. In four-o'clocks, pink flowers are the result of a red allele and a white allele for the color gene. If you crossed a white with a pink, what would be the most likely result?

- (A) 20 red and 20 pink
 (B) 40 pink
 (C) 20 pink and 20 white
 (D) 20 red and 20 white
 (E) 40 white

J

TEST 3—Continued

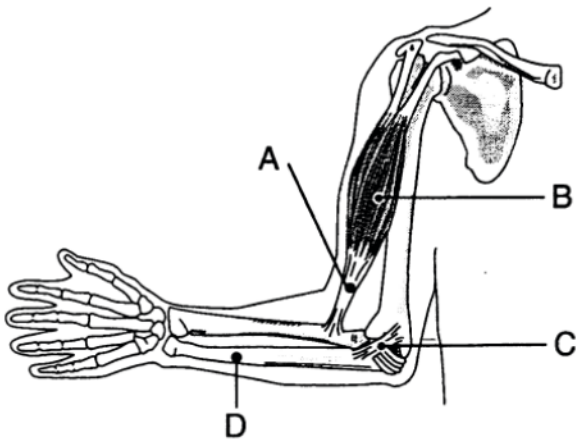
37. In four-o'clocks, in addition to the flower color above, some plants may be tall (dominant) while others are short (recessive), based on a gene that is not on the same chromosome as the gene for flower color. A pure bred tall, red four-o'clock was bred to a pure bred white, short four-o'clock. Then the resulting F1 was crossed to get the F2. Approximately how many of the F2 will be short and pink?
- (A) $\frac{1}{16}$
 (B) $\frac{2}{16}$
 (C) $\frac{3}{16}$
 (D) $\frac{4}{16}$
 (E) $\frac{5}{16}$
38. A colorblind man married a woman who wasn't colorblind, but her father had been. What is the possibility that their first child will be a colorblind girl?
- (A) 0 percent
 (B) 25 percent
 (C) 50 percent
 (D) 75 percent
 (E) 100 percent
39. A man with type O positive blood married a woman with type B negative blood. What is (are) the types of blood that their children can have?
- (A) B positive
 (B) O positive
 (C) B negative and B positive
 (D) O negative and O positive
 (E) B negative and positive and O negative and positive
40. People who have an extra X chromosome could have gotten it through
- (A) nondisjunction.
 (B) transposition.
 (C) transduction.
 (D) crossing over.
 (E) all of the above.
41. The HIV virus infects mostly
- (A) complement cells.
 (B) red blood cells.
 (C) T-killer cells.
 (D) T-helper cells.
 (E) all of the above.
42. Select the correct order of events in a person's response to a bacterial infection:
- (A) macrophage ingestion Helper T cell activation B cell activation clonal formation
 (B) clonal formation Helper T cell activation B cell activation macrophage ingestion
 (C) macrophage ingestion B cell activation T helper cell activation clonal formation
 (D) Helper T cell activation B cell activation macrophage ingestion clonal formation
 (E) B cell activation T helper cell activation clonal formation macrophage ingestion

TEST 3—Continued

- 43.** Blood entering the dorsal aorta has most recently been in the
- (A) right atria.
 - (B) right ventricle.
 - (C) left atria.
 - (D) left ventricle.
 - (E) pulmonary vein.
- 44.** Carbon dioxide that is leaving the body is carried in
- I. the plasma.
 - II. erythrocytes.
 - III. hemoglobin molecules.
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) I, II, and III
- 45.** Carbohydrate digestion begins in the _____ with the action of the enzyme _____.
- (A) mouth, amylase
 - (B) stomach, pepsin
 - (C) stomach, chymotrypsin
 - (D) small intestine, amylase
 - (E) small intestine, cholecystokinin (CCK)
- 46.** The function of ATP in voluntary muscle movement is to supply the energy for
- (A) myosin to bind to actin.
 - (B) myosin to become separated from actin.
 - (C) tropomyosin to bind to troponin.
 - (D) tropomyosin to become separated from troponin.
 - (E) tropomyosin to become separated from actin.



TEST 3—Continued



Question 47 refers to the above drawing.

47. Choose the one correct statement from the following.

- (A) A = muscle; B = tendon; C = ligament; D = ulna
- (B) A = ligament; B = muscle; C = radius; D = tendon
- (C) A = ligament; B = muscle; C = tendon; D = radius
- (D) A = tendon; B = muscle; C = ligament; D = radius
- (E) A = tendon; B = muscle; C = ligament; D = ulna

48. Curare acts on the same receptors as acetylcholine but does not cause the effect of acetylcholine, nor is it easily decomposed or cleaved by cholinesterases. Injection of curare into a person could result in

- I. epileptic seizures.
- II. muscle relaxation.
- III. suffocation.

- (A) I only
- (B) II only
- (C) III only
- (D) I and II
- (E) II and III

49. The undershoot during an action potential is the result of

- (A) the sodium gates being closed and the potassium gate open.
- (B) the sodium gates being closed and the potassium gate closed.
- (C) the sodium gates being open and the potassium gate closed.
- (D) the sodium gates being open and the potassium gate open.
- (E) one of the sodium gates being open, one closed, and the potassium gate open.

50. In the development of a frog embryo, Speman's primary organizer was found to be the

- (A) dorsal ectoderm.
- (B) dorsal lip of the blastopore.
- (C) archenteron.
- (D) neural tube.
- (E) notochord.

TEST 3—Continued

51. Choose the one statement that is true from among the following.
- (A) FSH is produced in the ovaries and causes maturation of the follicle.
 - (B) LH is produced in the pituitary gland and causes ovulation.
 - (C) Estrogen is produced in the anterior pituitary gland and causes the endometrium to thicken.
 - (D) Progesterone is produced in the posterior pituitary gland and causes the endometrium to thicken.
 - (E) None of the above statements are true.
52. If 9 percent of all cicadas exhibit the homozygous recessive condition known as “flippant wings,” what is the gene frequency for that gene in the general population?
- (A) cannot be determined
 - (B) 91 percent
 - (C) 0.9
 - (D) 0.3
 - (E) 0.03
53. The wings of a bird and those of an insect are a good example of
- (A) adaptive radiation.
 - (B) coevolution.
 - (C) convergent evolution.
 - (D) all of the above.
 - (E) none of the above.
54. Which one of the following lists contains an organism that does NOT belong in that phylum?
- (A) jellyfish, coral, anemone, starfish
 - (B) tunicates, birds, sharks, man
 - (C) bats, dogs, cats, sloths
 - (D) liver fluke, planaria, tapeworm, flatworms
 - (E) clam, squid, nautilus, snail
55. Choose the most Darwinian reason to describe how camels came to have flat, broad hooves.
- (A) The camels that ventured further into the desert acquired broader feet, which were passed along to their offspring.
 - (B) Those animals that had the broadest hooves were the most attractive to the opposite sex.
 - (C) The animals that had the broadest hooves were able to travel farther and find water more easily than those that couldn't and subsequently perished.
 - (D) Those animals with the broadest feet are descended from the camels that got broad feet from stomping out the forest fires that created the desert in the first place.
 - (E) In the game of life, random events will move evolution toward the most successful adaptations possible.



TEST 3—Continued

56. The age of the Earth is about _____ years, and life has existed on the Earth for _____ years.
- (A) 3.5 billion, 2.5 billion
 (B) 3.5 billion, 1.5 billion
 (C) 15 billion, 3.5 billion
 (D) 4.5 billion, 600 million
 (E) 4.5 billion, 3.5 billion
57. Which of the following could be used to study evolution?
- (A) DNA hybridization
 (B) RFLPs
 (C) structural homologies
 (D) fossils
 (E) all of the above
58. Which of the following is (are) a domain(s)?
- I. Eukaryota
 II. Archaeobacteria
 III. Eubacteria
- (A) I only
 (B) II only
 (C) III only
 (D) I and III
 (E) I, II, and III
59. Which of the following organisms lacks a coelom?
- (A) roundworms
 (B) segmented worms
 (C) clams
 (D) grasshoppers
 (E) people
60. Donald Johanson, Tom Gray, and others discovered a hominid that lived in East Africa _____ million years ago and nicknamed her Lucy, whose scientific name they gave as _____.
- (A) 35, *Homo habilis*
 (B) 3.5, *Homo africanus*
 (C) 5.5, *Australopithecus africanus*
 (D) 3.0, *Australopithecus afarensis*
 (E) 5.5, *Australopithecus boisei*

S T O P

IF YOU ARE TAKING THE BIOLOGY-E TEST, CONTINUE WITH QUESTIONS 61–80. IF YOU ARE TAKING THE BIOLOGY-M TEST, GO TO QUESTION 81 NOW.

TEST 3—Continued

BIOLOGY-E TEST

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

61. Ammonia is released from dead plants by

- (A) denitrifying bacteria.
- (B) nitrogen-fixing bacteria.
- (C) bacteria of decay.
- (D) nitrifying bacteria.
- (E) none of the above.

Questions 62–65 refer to the following information.

62. Which statement correctly describes a relationship between the species of columns 1 and 2?

- (A) The species in column 1 help to determine which species are in column 2.
- (B) The species in column 2 help to determine which species are in column 1.
- (C) The species in column 1 are dependent on the species in column 2.
- (D) The species in both columns 1 and 2 help to determine the climate of the area.
- (E) None of the above is true.

63. Letter A most likely represents

- (A) a biosphere.
- (B) a biome.
- (C) a bathysphere.
- (D) an ecosystem.
- (E) a community.

64. Letter B most likely represents

- (A) black bears.
- (B) beavers.
- (C) sugar maples.
- (D) conifers.
- (E) foxes.

65. Letter C most likely represents

- (A) squirrels and deer.
- (B) antelope and bison.
- (C) monkeys and leopards.
- (D) caribou and snowy owls.
- (E) fungi and algae.



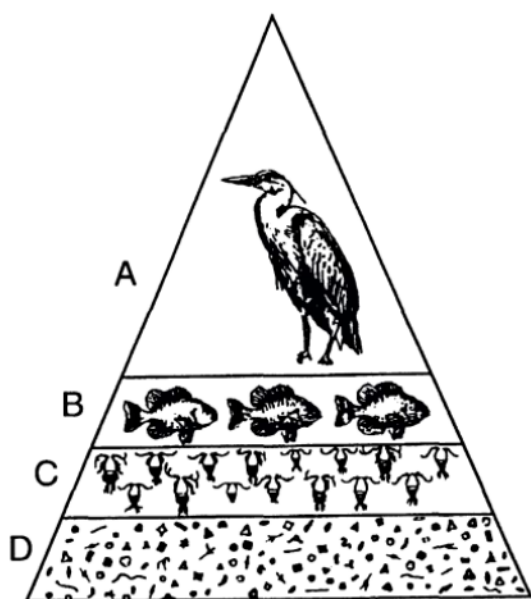
TEST 3—Continued

Questions 66–68 refer to the following information.

An investigator went to Central America to study oropendulas, which are communal nesting birds. Another species of bird, the cowbird, sometimes lay its eggs in the nests of oropendulas. Some of the populations of oropendulas throw the cowbird eggs out of the nest, and some don't. The investigator was interested in finding out why some birds would raise other species as their own but others would toss them out. By watching the nests closely, he found that blowflies lay their eggs in the nests of oropendulas, and that the young larvae, maggots, feed on the young birds. If young cowbirds are in the nest, the precocious cowbirds eat the blowfly larvae, protecting the young oropendulas. In colonies of oropendulas that discriminate against cowbirds, throwing them from the nest, the blowflies are not eaten by cowbirds. These colonies of oropendulas build their nests close to a particular wasp colony, and the wasps eat the blowflies.

- 66.** The relationship between the oropendulas that don't discriminate against cowbirds and the cowbirds is one of
- (A) commensalism.
 - (B) predation.
 - (C) mutualism.
 - (D) competition.
 - (E) annihilation.
- 67.** The relationship between the blowfly and the cowbirds that are associated with the non-discriminating oropendulas is one of
- (A) commensalism.
 - (B) predation.
 - (C) mutualism.
 - (D) competition.
 - (E) annihilation.
- 68.** The relationship between the oropendulas that discriminate against cowbirds and the cowbirds is one of
- (A) commensalism.
 - (B) predation.
 - (C) mutualism.
 - (D) competition.
 - (E) annihilation.

TEST 3—Continued



Questions 69–70 refer to the above drawing.

69. Which statement best describes one of the levels of this pyramid?
- (A) Level A contains the largest producers in the pyramid.
 - (B) The organisms in level B obtain food directly from level A.
 - (C) Level C contains the largest group of consumers in the pyramid.
 - (D) Level D contains the greatest number of heterotrophs in the pyramid.
 - (E) Levels C and D both contain producers.

70. Which of these levels would be most susceptible to biological magnification?

- (A) A
- (B) B
- (C) C
- (D) D
- (E) They would all be equally affected.

71. In a natural community, all the living things that directly or indirectly affect the environment are known as

- (A) pioneer organisms.
- (B) keystone species.
- (C) secondary consumers.
- (D) climatic factors.
- (E) biotic factors.

72. In order to preserve the biosphere for future generations, humans must

- (A) make use of technology to develop new herbicides.
- (B) put all wild animals in game preserves.
- (C) explore ways to drain and fill wetlands along the seacoast.
- (D) understand how living things interact with their environment.
- (E) settle more people inland, away from the coasts.



TEST 3—Continued

73. Which group can best be described as a population?
- (A) all the honeybees in an orchard in one spring
 - (B) all the plants and animals in a forest
 - (C) the living and nonliving factors in a meadow
 - (D) the life in Earth's atmosphere
 - (E) all the buffalo in 1840

Questions 74–75 refer to the following graph.

74. Assume first that the graph above shows the changes in two populations of herbivores in a grassy field. A possible reason for these changes is that
- (A) all of the plant populations in this habitat decreased.
 - (B) population B competed more successfully for food than did population A.
 - (C) population A produced more offspring than population B did.
 - (D) population A consumed the members of population B.
 - (E) over time, both populations will have the same average number.

75. Assume now that the graph above shows the changes in any two populations in a grassy field. Choose which of the following statements are true.

- I. A could represent predators and B prey.
 - II. A could represent prey and B predators.
 - III. A could be a host infested by the pathogen B.
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) II and III

76. Competition between the members of a woodchuck population in a large field could be expected to increase as a result of an increase in the
- (A) woodchuck reproduction rate.
 - (B) spread of disease among the woodchucks.
 - (C) number of woodchucks killed by cars.
 - (D) number of secondary consumers.
 - (E) natality rate of their predators.

77. Let r stand for the intrinsic rate of growth, N for the number of organisms in a population, and K for the carrying capacity. A good formula for logistic growth would be
- (A) rN $(N-K)/K$
 - (B) rN $(N-r)/rK$
 - (C) $rK (K-N)/rN$
 - (D) $rK (r-N)/K$
 - (E) $rN (K-N)/K$

TEST 3—Continued

- 78.** Mimicry is an important biotic factor in communities all over the world. For instance, viceroy butterflies closely resemble (mimic) monarch butterflies. Birds that eat viceroys enjoy a good meal, but those that eat monarchs retch right away. What type of mimicry does this describe?
- (A) Mullerian
 - (B) aggressive
 - (C) crypsis
 - (D) Batesian
 - (E) deflection
- 79.** Probably the world's most pressing ecological problem is
- (A) destruction of the rain forests.
 - (B) global warming.
 - (C) depletion of natural resources.
 - (D) over-fishing the oceans.
 - (E) human overpopulation.
- 80.** Predators are beneficial to communities because
- (A) they control the prey population growth.
 - (B) they practice predation harvest.
 - (C) predators enhance species diversity.
 - (D) Both (A) and (B).
 - (E) (A), (B), and (C).

S T O P

If you answered the first 80 questions **STOP HERE**. If you are taking the Biology-M test **CONTINUE HERE**.

TEST 3—Continued

BIOLOGY-M TEST

Directions: Each of the questions or statements below is accompanied by five choices. For each question, select the best of the answer choices given.

Questions 81–82 refer to the following table.

Messenger RNA (mRNA) Codes for Selected Amino Acids	
Amino Acid	mRNA Code
Leucine	C–C–A
Arginine	C–G–A
Phenylalanine	U–U–U
Valine	G–U–U
Lysine	A–A–A

81. What would be the DNA triplet that would code for the addition of arginine to a polypeptide?
- (A) C–G–A
(B) G–C–T
(C) C–C–T
(D) T–A–C
(E) G–C–U
82. Which amino acid would be attached to a polypeptide chain if the amino acid was attached to the anticodon A–A–A?
- (A) phenylalanine
(B) lysine
(C) valine
(D) a stop codon
(E) cannot be determined from the information given
83. Which of the following functions can be attributed to DNA polymerase?
- (A) It replaces RNA nucleotides with DNA nucleotides.
(B) It fixes errors in the replication of DNA.
(C) It adds nucleotides to the growing chain at the 3' end.
(D) It is used in the polymerase chain reaction.
(E) All of the above are true.
84. During translation, the first amino acid
- (A) occupies the aminyl site first, then the peptidyl site.
(B) occupies the aminyl site before the attachment of the large portion of the ribosome.
(C) of the polypeptide chain is methionine.
(D) all of the above
(E) none of the above

TEST 3—Continued

85. A signal sequence
- (A) is a sequence of DNA that begins transcription.
 - (B) is a sequence of RNA that is spliced out in the nucleus.
 - (C) is a sequence of DNA that directs a protein to certain organelles.
 - (D) is a sequence of DNA that attracts transcription factors.
 - (E) is the sequence of tRNA that bonds with the codon of mRNA at the ribosome.
86. Which of the following substances would NOT be present in a typical procedure for separating proteins by gel electrophoresis?
- (A) water
 - (B) bromophenol blue
 - (C) Tris buffer
 - (D) agarose
 - (E) polyacrylamide
87. Northern blotting is used with
- (A) DNA.
 - (B) RNA.
 - (C) hnRNA.
 - (D) ssDNA.
 - (E) all of the above.
88. You are trying to measure mRNA synthesis with animal cells growing in a tissue culture. Which radioactive nucleotide should you provide to the cells to measure RNA synthesis?
- (A) adenine
 - (B) cytosine
 - (C) guanine
 - (D) thymine
 - (E) uracil
89. Splicing of hnRNA is done in the nucleus by “snurps.” Of what are these “snurps” composed?
- (A) RNA
 - (B) DNA
 - (C) proteins
 - (D) RNA and proteins
 - (E) DNA and proteins
90. Peter Mitchell was able to demonstrate chemiosmosis by getting _____ to go down their concentration gradient by using two different _____.
- (A) potassium ions, light frequencies
 - (B) hydrogen ions, light frequencies
 - (C) potassium ions, pH solutions
 - (D) hydrogen ions, pH solutions
 - (E) potassium ions, electromagnetic frequencies



TEST 3—Continued

91. One would expect to find reverse transcriptase in
- (A) the plasmids of competent cells.
 - (B) retroviruses.
 - (C) purple sulfur bacteria.
 - (D) plasmodia.
 - (E) archaeobacteria.
92. The target tissue for parathyroid hormone is (are) the
- (A) kidneys.
 - (B) bones.
 - (C) small intestine.
 - (D) all of the above.
 - (E) none of the above.
93. The products of oxidative phosphorylation are
- (A) oxygen and water.
 - (B) NADH and ATP.
 - (C) pyruvate and NADPH.
 - (D) water and ATP.
 - (E) oxygen and NADH.
94. A major difference between gram positive and gram negative bacteria is that the former has
- (A) a liposaccharide outer covering with a small peptidoglycan component in the cell wall.
 - (B) a small peptidoglycan component covering a large liposaccharide base.
 - (C) a large peptidoglycan component in the cell wall.
 - (D) a cell wall composed of liposaccharide and chitin.
 - (E) a cell wall composed of chitin over peptidoglycan.
95. Let X represent an atom and X^* its radioactive isotope. Assume both are taken up by living organisms. If the half-life of X^* is 4,000 years, how much X^* will be present in the remains of an organism that is 16,000 years old?
- (A) as much as a living organism
 - (B) 4 times as much
 - (C) $\frac{1}{4}$ as much
 - (D) $\frac{1}{16}$
 - (E) indeterminate given the lack of climatic data

TEST 3—Continued

96. All of our cells contain protooncogenes that may turn into oncogenes, which are cancer genes. The best explanation for proto-oncogenes is that they
- (A) came into our cells from a viral infection of our ancestors.
 - (B) arose from plasmids that have been inserted into bacteria and now reside in us.
 - (C) are DNA “junk” with no known function.
 - (D) turn into oncogenes as we age.
 - (E) help regulate cell division.
97. In genetic engineering, it is necessary to cut DNA out of bacteria and eukaryotes. To insert the human insulin gene into a bacteria, one should use
- (A) two different restriction enzymes so that the pieces won't reanneal.
 - (B) the same restriction enzyme so that both pieces will have the same sticky ends.
 - (C) methylated bacterial DNA so that only some of it will be spliced.
 - (D) two different ligases to reanneal the DNA.
 - (E) a hot water bath at 55 degrees centigrade so that the reaction will happen faster.
98. Watson and Crick used all of the following information in elucidating the physical structure of DNA EXCEPT
- (A) X-ray crystallography.
 - (B) the Meselson-Stahl experiment.
 - (C) Chargoff's rules.
 - (D) the different sizes of purines and pyrimidines.
 - (E) the transforming principle of Avery *et al.*
99. Which of the following organelles is out of order from an endomembrane point of view?
- (A) nucleus
 - (B) vesicles
 - (C) golgi apparatus
 - (D) endoplasmic reticulum
 - (E) plasma membrane
100. The products of the light reactions, or photophosphorylation, in photosynthesis are
- (A) oxygen and water.
 - (B) oxygen and ATP.
 - (C) oxygen, ATP, and NADPH.
 - (D) water, ATP, and NADPH.
 - (E) water, ATP, and $\text{NADP}^+ + \text{H}^+$.

S T O
P

If you finish before the hour is up, you may review your work on this test only. You may not turn to any other test in this book.

ANSWERS AND EXPLANATIONS

QUICK-SCORE ANSWERS

1. C 11. A 21. D 31. A 41. D 51. B 61. C 71. E 81. B 91. B
2. C 12. C 22. B 32. C 42. A 52. D 62. A 72. D 82. A 92. D
3. A 13. D 23. D 33. B 43. D 53. C 63. B 73. A 83. E 93. D
4. B 14. B 24. B 34. E 44. E 54. A 64. D 74. B 84. C 94. C
5. D 15. A 25. A 35. A 45. A 55. C 65. D 75. E 85. C 95. D
6. E 16. C 26. C 36. C 46. B 56. E 66. C 76. A 86. D 96. E
7. D 17. A 27. B 37. B 47. E 57. E 67. B 77. E 87. B 97. B
8. C 18. D 28. C 38. B 48. E 58. E 68. D 78. D 88. E 98. B
9. E 19. E 29. E 39. E 49. A 59. A 69. C 79. E 89. D 99. D
10. E 20. D 30. C 40. A 50. B 60. D 70. A 80. E 90. D 100. C

- 1. The correct answer is (C).** While the data may not be linear, the pH does go down as the number of yeasts goes up.
- 2. The correct answer is (C).** The number of yeasts was related to the amount of glucose. It can't be choice (D); the pH changed in response to the yeast because the minimal media with the addition of glucose would have had the same pH in the beginning.
- 3. The correct answer is (A).** The yeasts would be expected to lose water in such a difference of water potential.
- 4. The correct answer is (B).** A control can be thought of as the experiment without the independent variable.
- 5. The correct answer is (D).** Choice (B) is incorrect because the bonds between hydrogen and oxygen of the same water molecule are polar covalent bonds. Hydrogen bonds can form between the hydrogen of one molecule and any more electronegative atom of another molecule, such as oxygen.
- 6. The correct answer is (E).** The diameter of the strand is 2 nm. **7. The correct answer is (D).** Use the codon table to get the mRNA code and take the complement of each codon. Remember that uracil (U) is the RNA complement to adenine (A). Choices (A) and (C) are not DNA sequences because they contain uracil.
- 8. The correct answer is (C).** In the first triplet, G goes to C, resulting in the RNA codon UAG, one of three stop codons. The second triplet would also give the stop codon if G goes to C.

ANSWERS AND EXPLANATIONS

9. **The correct answer is (E).** Spliceosomes attach at the consensus sequences. Blobel won the 1999 Nobel Prize in Physiology for his discovery of signal sequences.
10. **The correct answer is (E).** Plants use cellular respiration and, as such, produce energy in the cytosol. They have both mitochondria and chloroplasts for energy production.
11. **The correct answer is (A).** The model of the PM is a phospholipid bilayer containing proteins and modified proteins.
12. **The correct answer is (C).** Steroid hormone receptors are in the nucleus and respond to steroid hormones that penetrate the cell membrane (because of their lipid nature).
13. **The correct answer is (D).** The picture denotes a mitochondrion. Cellular respiration culminates in oxidative phosphorylation, resulting in the formation of water when oxygen accepts the hydrogen ions and electrons at the end.
14. **The correct answer is (B).** The other structures are associated with chloroplasts.
15. **The correct answer is (A).** Rubisco is another name for ribulose biphosphate carboxylase-oxygenase. No wonder people use acronyms!
16. **The correct answer is (C).** See question 13.
17. **The correct answer is (A).** Choice (A) represents a glucose molecule.
18. **The correct answer is (D).** Amino acids are composed of an amine (NH_2), a central carbon with a variable group (in this case a methyl, CH_3), and a carboxyl group (COOH).
19. **The correct answer is (E).** Two carbon dioxide molecules are given off for each turn of the Krebs's cycle.
20. **The correct answer is (D).** The polar paper attracts the polar substances, and they travel less slowly than the nonpolar substances dissolved in the nonpolar solvents.
21. **The correct answer is (D).** The ATP molecule is actually a participant in the joining of the amino acid to the tRNA molecule.
22. **The correct answer is (B).** Ninety percent of the energy coming into a typical system is dissipated, much of it as heat.
23. **The correct answer is (D).** Plants capture about 1 percent of the radiant energy available to them. Consumers capture, on the average, 10 percent from what is available in the preceding trophic level. Therefore $(0.01)(0.1)(0.1) = 0.0001$ or 0.01 percent.

PRACTICE TEST 3

- 24. The correct answer is (B).** All primary consumers are herbivores, and all secondary consumers are carnivores (because they eat the primary consumers). Omnivores can be either, depending on where they are feeding on the food chain.
- 25. The correct answer is (A).** Transpiration is the loss of water by plants. Choice (B) illustrates evaporation.
- 26. The correct answer is (C).** Ponds and lakes will dry up over time because plant detritus will fill in and replace some of the water, and solid matter (from run-off and dead organisms) will go to the bottom and displace water.
- 27. The correct answer is (B).** A community is made up only of organisms. An ecosystem is the organisms and their abiotic surroundings.
- 28. The correct answer is (C).** Competition for food sources has been shown to cause the beak sizes to diverge when the animals live sympatrically (together) versus allopatrically (apart).
- 29. The correct answer is (E).** Predators can increase biodiversity by keeping one species from dominating competitors. For instance, assume that there are three types of mice living in the same area. One might be a superior competitor and drive the others to extinction if owls didn't feed on that particular type of mouse.
- 30. The correct answer is (C).** The walking stick, as a herbivore, uses camouflage to avoid predation. His relative, the preying mantis, as a consumer, uses aggressive mimicry to capture its prey.
- 31. The correct answer is (A).** Biological magnification is the buildup of a nonbiodegradable poison in the tissues of organisms. It is magnified because those organisms that feed higher on the food chain eat more organisms that have these poisons stored in their tissues.
- 32. The correct answer is (C).** The types would be AV, Av, aV, and av.
- 33. The correct answer is (B).** At the end of meiosis I, there will be two cells formed from the original 2N cell. It must be II, not III, because the distribution requires homologous pairs to separate.
- 34. The correct answer is (E).** Meiosis takes an original 2N cell and makes it N. In this case, $2N = 4$; therefore, each gamete would be N or have two chromosomes. In addition, the number of cells produced in meiosis is four.

ANSWERS AND EXPLANATIONS

- 35. The correct answer is (A).** One fourth of their offspring, on the average, will have silver fur. Choice (D) is not a possibility because the parents don't both have brown fur.
- 36. The correct answer is (C).** The pink plant will give the red allele to half of its gametes and the white to the other half. Therefore, since the white will always contribute white, the ratio is half white and half pink.
- 37. The correct answer is (B).** Dihybrid crosses, involving two traits, should be solved one trait at a time. Since the F1 is $Tt \times Tt$, $\frac{1}{4}$ of all offspring will be short. The F1 color cross is $rw \times rw$, resulting in $\frac{1}{2}$ pink. The number of offspring that will be short and pink is therefore the product of $\frac{1}{2}$ and $\frac{1}{4}$ or $\frac{1}{8}$, the same as $\frac{1}{16}$.
- 38. The correct answer is (B).** The woman is a carrier for color-blindness, meaning that she has an allele for it, but it is not expressed. The man is colorblind and will give all his daughters the colorblind gene.
- 39. The correct answer is (E).** A person who has the B phenotype can be heterozygous (BO) or homozygous (BB). A person who has the O phenotype has only one genotype (OO). Therefore, their children, assuming the heterozygote condition, could be either B or O. The positive and negative refer to the Rhesus factor, a simple dominant trait reflecting the presence of a particular marker on some people's blood. If one assumes the man is a heterozygote (Pos/neg), then half of their children will be positive and half negative, on average.
- 40. The correct answer is (A).** Nondisjunction results from an incomplete separation of chromosomes or chromatids during meiosis.
- 41. The correct answer is (D).** While the HIV virus is known to infect nerve tissue, most of the time the T-helper (T4) cells are the ones infected.
- 42. The correct answer is (A).** The first event is macrophage ingestion. Helper T cells act almost as the brain of the immune system, turning other cells off and on.
- 43. The correct answer is (D).** The left side of the heart serves the systemic portion, the right side, the pulmonary. Blood is received in the atria and pumped out of the ventricles.
- 44. The correct answer is (E).** About 7 percent of the carbon dioxide molecules are carried in the plasma as bicarbonate ions. The remainder is carried by erythrocytes, either bound to hemoglobin molecules carried therein as carbonic acid or bicarbonate ions.

PRACTICE TEST 3

- 45. The correct answer is (A).** Salivary amylase breaks starches into sugars, which is why holding a cracker in your mouth for a short time makes it seem sweeter.
- 46. The correct answer is (B).** Without this ATP, rigor mortis sets in.
- 47. The correct answer is (E).** The bone above D is the radius, which one can feel rotate over the more stationary ulna. The letter C represents the connective tissue that holds bones together, which is a ligament. Muscles are held to bone by tendons.
- 48. The correct answer is (E).** Since there will be fewer contractions, the diaphragm (the muscle that causes the chest cavity to increase) will not move as much, so suffocation is a possibility. **49.** The correct answer is (A). The undershoot is a lower negative potential than the resting state. This occurs because the sodium gates are closed, keeping sodium from passing in, and the potassium channels, which are slower, are still open from the repolarizing phase, allowing potassium to move out of the cell.
- 50. The correct answer is (B).** The gray crescent, which moves early in development, becomes the dorsal lip of the blastopore and is responsible, in part, for gastrulation.
- 51. The correct answer is (B).** FSH and LH are produced in the pituitary. Estrogen and progesterone are produced in the ovaries. **52.** The correct answer is (D). Using Hardy-Weinberg equilibrium conditions, the frequency for the recessive allele (q) can be found by taking the square root of q^2 . The square root of 0.09 is 0.3.
- 53. The correct answer is (C).** Convergent evolution describes conditions where organisms appear to have homologous structures that are, in fact, analogous. They are analogous because the organisms are not closely related, and the wings evolved from different basal structures.
- 54. The correct answer is (A).** All the organisms here are Cnidarians, with the exception of the Echinoderm starfish.
- 55. The correct answer is (C).** Darwinian selection is about reproductive success, not the Lamarckian reasons cited in choices (A) and (D).
- 56. The correct answer is (E).** The earliest prokaryotic fossils date to about 3.5 billion years ago. The 600 million date refers to the Cambrian explosion, which refers to the rapid evolution of animal forms.
- 57. The correct answer is (E).** The more data that can be collected about a time period or taxon, the better.

ANSWERS AND EXPLANATIONS

- 58. The correct answer is (E).** These three groups have been proposed as domains based on the rRNA analysis of Carl Woese.
- 59. The correct answer is (A).** Roundworms lack a true coelom. **60. The correct answer is (D).** Currently, there are no hominids that date back to 5.5 million years ago. *A. afarensis* was a newly described species.

BIOLOGY-E TEST

- 61. The correct answer is (C).** Nitrifying bacteria convert ammonium to nitrites and nitrates. Denitrifying bacteria convert nitrates to atmospheric nitrogen.
- 62. The correct answer is (A).** Consumers usually are associated with certain types of producers or vegetation.
- 63. The correct answer is (B).** Biomes are listed in the first column.
- 64. The correct answer is (D).** Coniferous trees are the dominant life forms in the taiga.
- 65. The correct answer is (D).** See question 62. Fungi and algae won't work here, even though they exist there, because they are not consumers.
- 66. The correct answer is (C).** Mutualistic relationships are good for both parties (+ +). The cowbirds are being raised by the oropendulas (which have no genetic stake in cowbirds), which is positive for them. The oropendulas are being helped by the cowbirds as they rid them of their parasites.
- 67. The correct answer is (B).** The cowbirds prey on the blowflies.
- 68. The correct answer is (D).** Competition relationships are bad for both parties (—). The cowbird parents are wasting their resources as they lay in the discriminating nests, and the oropendulas are wasting their resources as they have less space and take time and energy to remove the cowbirds. It can't be predation because one would have to eat the other.
- 69. The correct answer is (C).** Level D is producers. Organisms in level B obtain food directly from level C. Level A contains the largest consumer in the pyramid.
- 70. The correct answer is (A).** Since poisons build up in the tissues of organisms in the food chain, and since each successive trophic level feeds on the one beneath it, most nonbiodegradable poisons will be found in the organisms at the top of the food chain.

PRACTICE TEST 3

71. The correct answer is (E). Biotic factors include symbiotic relationships, disease, mimicry, food, and the like.
72. The correct answer is (D). Education is the key to preserving the biosphere and is required for good decision making.
73. The correct answer is (A). A population must be a particular group of like individuals in a particular place at a particular time. 74. The correct answer is (B). Populations that are competitors either coexist or one goes extinct. This coextinction can take several forms, including resource partitioning, or character displacement.
75. The correct answer is (E). Predators cannot outnumber prey in normal situations. In this case, the predators and pathogen would both have to have switched to another prey or host species when population A crashed.
76. The correct answer is (A). All other effects would decrease the number of woodchucks and, therefore, reduce competition.
77. The correct answer is (E). As N approaches K , the numerator will become smaller.
78. The correct answer is (D). Batesian mimicry has the mimic fooling the predator (signal receiver) by mimicking an undesirable model.
79. The correct answer is (E). The world's human population is causing most of the other items in the list.
80. The correct answer is (E). This is especially true for keystone predators.

BIOLOGY-M TEST

81. The correct answer is (B). The table is mRNA codons, therefore the DNA that would be complementary to C-G-A would be G-C-T using Watson-Crick base-pairing rules (A with T and G with C).
82. The correct answer is (A). Phenylalanine is the amino acid attached to the tRNA molecule with AAA as its anticodon. Using Watson-Crick base-pairing rules, U bonds with A. Because anticodons are complementary to mRNA codons, which are complementary to DNA triplets, the anticodons are essentially the DNA triplet sequence, with the exception that uracil (U) is the RNA base that substitutes for thymine (T).
83. The correct answer is (E). DNA polymerase exists in three different forms in eukaryotic cells and performs all those functions as well as adding nucleotides to the lagging strand.

ANSWERS AND EXPLANATIONS

- 84. The correct answer is (C).** The initiator tRNA is in the P site. The large portion of the ribosome joins after the initiator tRNA is docked on the mRNA with the small ribosomal subunit.
- 85. The correct answer is (C).** Signal sequences are used to code for polypeptides that will be attracted to receptor sites on organelles.
- 86. The correct answer is (D).** Agarose is the gel matrix normally used to separate DNA, while polyacrylamide is used for proteins.
- 87. The correct answer is (B).** The original transfer of DNA from agarose gel to nitrocellulose or paper was named after its originator, Southern. The Northern blot, which uses RNA, is a take-off on both the procedure and his name. Western blots use proteins.
- 88. The correct answer is (E).** Uracil is the only nucleotide found in RNA but not in DNA.
- 89. The correct answer is (D).** Snurps are small nuclear riboproteins. When combined with other proteins, they form the spliceosome.
- 90. The correct answer is (D).** Hydrogen ions are normally concentrated in either the thylakoid space in chloroplasts or the inner membrane space in mitochondria by the electromotive force of electron transport and transfer. He mimicked this action by using different acidic conditions, causing the hydrogen ions to flow from inside (placed there by a pH 4 solution) to the outside (moved to a pH 8 solution).
- 91. The correct answer is (B).** Retroviruses carry RNA as their nucleic acid component. In order to successfully infect a cell, they must (reverse) transcribe their RNA to DNA.
- 92. The correct answer is (D).** PTH controls calcium ions levels in the body by either having them conserved in the intestine or not passed in urine or by removing calcium from the bones.
- 93. The correct answer is (D).** Oxygen serves as the final electron and hydrogen acceptor to form water. The end goal of cellular respiration and oxidative phosphorylation is the production of ATP.
- 94. The correct answer is (C).** While both types have some peptidoglycan, the gram negative bacteria have less and are covered with a liposaccharide layer.
- 95. The correct answer is (D).** Every 4,000 years, the amount is reduced by half.
- 96. The correct answer is (E).** Cancer usually results from cells that handle signaling incorrectly. The analogy of overreactive cell division being like an accelerator in a car and improper control

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of cell division being poor brakes was put forth by Bishop and Varmus. Physiologically, the acceleration problems could be the overproduction of cell division signals or oversensitive receptors, perhaps locked in the on position.

97. The correct answer is (B). Sticky ends are the uneven ends of a strand that will base pair with sticky ends of another strand. For example,

GATTCNNNNNNN...

NNNNNNN...

would base pair with another strand

NNNNCTAAG

NNNN

- 98. The correct answer is (B).** Meselson-Stahl came later and proved the semiconservative nature of the replication of DNA.
- 99. The correct answer is (D).** Proteins that are produced in the ER are sent to the Golgi for modifications.
- 100. The correct answer is (C).** Oxygen is given off as water molecules are split.