

## Biology 1 practice test for website

### Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. Biology is the study of

a.	minerals.	c.	the weather.
b.	life.	d.	energy.

2. Ecology

a.	refers to change in species over time.
b.	refers to a delicate internal balance within organisms.
c.	is inconsistent with evolution.
d.	is the study of communities or organisms in relation to their environment.

3. Which example of scientific methodology is *incorrect*?

a.	observation—a number of people in a certain place dying of a disease outbreak
b.	measurement—a record of the number of people with symptoms of a disease and the number of people who had died from the disease
c.	analysis of data—comparison of the effects of mixing monkey cells with virus-containing blood in test tubes and the effects of mixing liquid from these test tubes with fresh monkey cells
d.	inference making—identification of the Ebola virus as the cause of a disease by taking electron micrographs of substances found in the blood of persons affected with the disease

4. The English physician Ronald Ross wanted to try to find the cause of malaria. Based on his observations, Dr. Ross suggested that the *Anopheles* mosquito might spread malaria from person to person. This suggestion was a

a.	prediction.	c.	theory.
b.	hypothesis.	d.	scientific “truth.”

5. Scientific hypotheses are most often tested by the process of

a.	communicating.	c.	experimenting.
b.	inferring.	d.	analyzing data.

6. A hypothesis is

a.	a definite answer to a given problem.
b.	a testable possible explanation of an observation.
c.	a proven statement.
d.	a concluding statement.

7. A hypothesis that does not explain an observation

a.	is known as an inaccurate forecast.
b.	often predicts a different observation.
c.	is rejected.
d.	None of the above

8. Which of the following components of a scientific investigation would benefit from communication between scientists?

a.	observing	c.	analyzing data
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b.	measuring	d.	All of the above
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9. A light microscope that has an objective lens of 10 and an ocular lens of 20 has a magnification of

a.	30.	c.	300.
b.	200.	d.	2000.

10. The smallest particle of carbon that can retain the chemical properties of carbon is

a.	a carbon molecule.
b.	a carbon macromolecule.
c.	a carbon atom.
d.	the nucleus of a carbon atom.

11. A substance that is composed of only one type of atom is called a(n)

a.	nucleus.	c.	element.
b.	cell.	d.	molecule.

12. All matter in the universe is composed of

a.	cells.	c.	atoms.
b.	molecules.	d.	carbon.

13. The electrons of an atom

a.	are found in the nucleus along with the protons.
b.	orbit the nucleus in various energy levels.
c.	have a positive charge.
d.	are attracted to the positive charge of neutrons.

14. Which of the following states of matter contain(s) particles that are tightly linked together in a definite shape?

a.	solid	c.	gas
b.	liquid	d.	solid and liquid

15. Refer to the graph above. Reaction 3 in the graph

a.	probably occurred in the presence of a catalyst.
b.	requires a greater activation energy than reaction 2.
c.	is the same as reaction 1, but faster.
d.	takes longer than reaction 2.

16. A single organism may contain

a.	thousands of different enzymes, each one specific to a different chemical reaction.
b.	one enzyme that plays a role in thousands of different chemical reactions.
c.	approximately 100 kinds of enzymes, each one specific to a different chemical reaction.
d.	one enzyme that is specific to photosynthesis and one enzyme that is specific to cellular respiration.

17. Oxidation-reduction reactions are important in organisms because they

a.	allow the passage of energy from molecule to molecule.
b.	prevent nuclear reactions from occurring.
c.	allow the creation and destruction of energy.
d.	None of the above; oxidation-reduction reactions do not occur in living organisms.

18. A solution with a pH of 11 is

a.	acidic.	c.	neutral.
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b.	alkaline.	d.	a buffer.
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19. A molecule that has a partial positive charge on one side and a partial negative charge on the other side is called a

a.	nonpolar molecule.	c.	charged molecule.
b.	polar molecule.	d.	bipolar molecule.

20. The size to which a cell can grow is limited by its			
a.	location.	c.	function.
b.	structure.	d.	surface area.

21. Which of the following is an example of a prokaryotic cell?			
a.	an amoeba	c.	a bacterium
b.	a virus	d.	a liver cell

22. Studying a picture of a cell taken with an electron microscope, you find that the cell has no nucleus and no mitochondria, but it does have a plasma membrane and a cell wall. You conclude that the cell is probably from a(n)

a.	animal.	c.	prokaryote.
b.	plant.	d.	extinct organism.

23. The Golgi apparatus is an organelle that	
a.	receives proteins and lipids from the endoplasmic reticulum.
b.	labels the molecules made in the endoplasmic reticulum with tags that specify their destination.
c.	releases molecules in vesicles.
d.	All of the above

24. One important organelle that helps maintain homeostasis by moving supplies from one part of the cell to the other is the

a.	endoplasmic reticulum.	c.	nucleus.
b.	mitochondrion.	d.	cytoplasm.

25. In which of the following organelles is a cell's ATP produced?			
a.	mitochondrion	c.	Golgi apparatus
b.	endoplasmic reticulum	d.	lysosome

26. Proteins are made on the			
a.	mitochondria.	c.	nucleus.
b.	ribosomes.	d.	plasma membrane.

27. All cells have	
a.	a covering called a plasma membrane that surrounds the cell and controls what information and materials enter and leave it.
b.	an internal fluid that gives shape to the cell and supports the other things within it.
c.	either a central zone or a nucleus that contains the cell's genes.
d.	All of the above

28. Refer to the illustration above. Which structure immediately identifies this cell as a eukaryote?

a.	structure 1	c.	structure 3
b.	structure 2	d.	structure 4

29. All of the following are found in both plant and animal cells, <i>except</i>			
a.	a cell wall.	c.	mitochondria.

b.	a plasma membrane.	d.	the endoplasmic reticulum.
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30. How are chloroplasts like mitochondria?

a.	They can both use energy from sunlight.
b.	They look alike.
c.	They both contain DNA.
d.	They are both found in animal cells.

31. The organelles associated with photosynthesis are the

a.	mitochondria.	c.	Golgi apparatus.
b.	chloroplasts.	d.	vacuoles.

32. Plant cells have a large membrane-bound space in which water, waste products, and nutrients are stored. This place is known as a

a.	mitochondrion.	c.	Golgi apparatus.
b.	chloroplast.	d.	central vacuole.

33. light reactions : thylakoids ::

a.	grana : thylakoids
b.	grana : ATP
c.	Calvin cycle : stroma
d.	stroma : grana of chloroplast

34. The energy from the sun is converted into chemical energy in the form of organic compounds in a series of linked chemical reactions called a

a.	photosynthetic reactant.
b.	ATP generator.
c.	chemical equation.
d.	biochemical pathway.

35. Chlorophyll is green because

a.	it absorbs green wavelengths of light.
b.	it absorbs blue and yellow wavelengths, which make green.
c.	it reflects green wavelengths of light.
d.	it transmits light and causes an optical illusion.

36.  $\text{NADP}^+$  is important in photosynthesis because it

a.	becomes oxidized to form NADP.
b.	is needed to form chlorophyll.
c.	provides additional oxygen atoms.
d.	provides protons and electrons for some reactions.

37. The electrons of photosystem I

a.	are eventually replaced by electrons from photosystem II.
b.	attach to water molecules during the light reaction.
c.	are at the end of the electron transport chain.
d.	are absorbed by oxygen molecules to form water.

38. The major atmospheric byproduct of photosynthesis is

a.	nitrogen.	c.	water.
b.	carbon dioxide.	d.	oxygen.

39. The Calvin cycle of photosynthesis

a.	requires ATP and NADPH.
b.	can occur in both light and dark conditions.
c.	generates glucose.

d.	All of the above
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40. Refer to the illustration above. Taken together, these graphs demonstrate that

a.	photosynthesis is independent of environmental influences.
b.	increases in light intensity cause increases in temperature.
c.	as the rate of photosynthesis increases, the temperature of the plant eventually decreases.
d.	the rate of photosynthesis is affected by changes in the plant's environment.

41. When cells break down food molecules, energy

a.	is released all at once.
b.	is released entirely as body heat into the environment.
c.	is temporarily stored in ATP molecules.
d.	causes excitation of electrons in chlorophyll molecules.

42. ATP

a.	contains five phosphate groups.
b.	is essential for a cell to perform all the tasks necessary for life.
c.	is found only in bacteria.
d.	All of the above

43. When muscles are exercised extensively in the absence of sufficient oxygen,

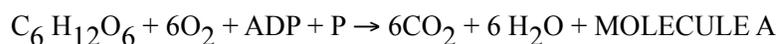
a.	a large amount of ATP is formed.
b.	NADH molecules split.
c.	lactic acid is produced.
d.	cellular respiration ceases.

44. With oxygen present, the Krebs cycle and the electron transport chain

a.	provide organisms an alternative to glycolysis.
b.	produce most of the ATP needed for life.
c.	break down glucose to produce carbon dioxide, water, and ATP.
d.	All of the above

45. At the end of the electron transport chain,

a.	the electrons combine with oxygen and protons to form water.
b.	the electrons are used in the formation of ethyl alcohol.
c.	the electrons build up inside the mitochondria and diffuse back to a thylakoid.
d.	None of the above



46. The equation above summarizes the process known as

a.	photosynthesis.	c.	cellular respiration.
b.	fermentation.	d.	protein breakdown.

47. Which of the following is the best explanation for the presence of both chloroplasts and mitochondria in plant cells?

a.	In the light, plants are photosynthetic autotrophs. In the dark, they are heterotrophs.
b.	If plants cannot produce enough ATP in the process of photosynthesis to meet their energy needs, they can produce it in aerobic respiration.
c.	Sugars are produced in chloroplasts. These sugars can be stored in the plant for later use, converted to other chemicals, or broken down in aerobic respiration to yield ATP for the plant to use to meet its energy needs.
d.	The leaves and sometimes the stems of plants contain chloroplasts, which produce ATP to meet the energy needs of these plant parts. The roots of plants contain mitochondria, which produce ATP to meet the energy needs of these plant parts.

48. In cellular respiration, the most energy is transferred during

a.	glycolysis.
b.	lactic acid fermentation.
c.	the Krebs cycle.
d.	the electron transport chain

49. In order to fit within a cell, DNA becomes more compact by

a.	breaking apart into separate genes.
b.	extending to form very long, thin molecules.
c.	wrapping tightly around associated proteins.
d.	being enzymatically changed into a protein.

50. In a bacterium, cell division takes place when

a.	its nucleus divides.
b.	the cell splits into two cells, one of which receives all of the DNA.
c.	the DNA is copied, a new cell membrane forms between the DNA copies, and the cell splits into two cells.
d.	None of the above

51. Which of the following shows the correct sequence of the cell cycle?

a.	$C \rightarrow M \rightarrow G_1 \rightarrow S \rightarrow G_2$	c.	$G_1 \rightarrow S \rightarrow G_2 \rightarrow M \rightarrow C$
b.	$S \rightarrow G_1 \rightarrow G_2 \rightarrow M \rightarrow C$	d.	None of the above

52. growth :  $G_1$  ::

a.	mitosis : meiosis	c.	cytokinesis : M
b.	mitochondria replication : S	d.	DNA copying : S

53. Refer to the illustration above. Mitosis begins with the stage shown in diagram

a.	1.	c.	3.
b.	2.	d.	4.

54. Refer to the illustration above. Which of the following correctly indicates the order in which these events occur?

a.	1, 2, 3, 4	c.	2, 1, 3, 4
b.	3, 2, 1, 4	d.	1, 3, 2, 4

55. In plant cells, cytokinesis occurs when

a.	the chromosomes make exact copies of themselves.
b.	spindle fibers are formed.
c.	a new cell wall forms.
d.	osmotic pressure is too low.

56. The difference between anaphase of mitosis and anaphase I of meiosis is that

a.	the chromosomes line up at the equator in anaphase I.
b.	centromeres do not exist in anaphase I.
c.	chromatids do not separate at the centromere in anaphase I.
d.	crossing-over occurs only in anaphase of mitosis.

57. What is the probability that the offspring of a homozygous dominant individual and a homozygous recessive individual will exhibit the dominant phenotype?

a.	0.25	c.	0.66
b.	0.5	d.	1.0

58. The passing of traits from parents to offspring is called

a.	genetics.	c.	development.
b.	heredity.	d.	maturation.

59. An individual heterozygous for a trait and an individual homozygous recessive for the trait are crossed and produce many offspring. These offspring are likely to be

a.	all the same genotype.
b.	of two different phenotypes.
c.	of three different phenotypes.
d.	all the same phenotype.

In humans, having freckles (F) is dominant over not having freckles (f). The inheritance of these traits can be studied using a Punnett square similar to the one shown below.

60. Refer to the illustration above. The genotype represented in box 1 in the Punnett square would

a.	be homozygous for freckles.
b.	have an extra freckles chromosome.
c.	be heterozygous for freckles.
d.	have freckles chromosomes.

61. A trait that occurs in 450 individuals out of a total of 1,800 individuals occurs with a probability of

a.	0.04.	c.	0.50.
b.	0.25.	d.	0.75.

62. Refer to the illustration above. The phenotype represented by box 1 is

a.	green, inflated.	c.	yellow, inflated.
b.	green, constricted.	d.	yellow, constricted.

63. Refer to the illustration above. The genotype represented by box 2 is

a.	Ggli.	c.	GI.
b.	GGIi.	d.	Gi.

64. 2,000 yellow seeds : 8,000 total seeds ::

a.	1 : 6	c.	1 : 3
b.	1 : 8	d.	1 : 4

In rabbits, black fur (B) is dominant over brown fur (b). Consider the following cross between two rabbits.

65. Refer to the illustration above. Both of the parents in the cross are

a.	black.
b.	brown.
c.	homozygous dominant.
d.	homozygous recessive.

66. What is the expected genotypic ratio resulting from a homozygous dominant × heterozygous monohybrid cross?

a.	1:0	c.	1:2:1
b.	1:1	d.	1:3:1

67. What is the expected genotypic ratio resulting from a heterozygous × heterozygous monohybrid cross?

a.	1:2:1	c.	1:2
b.	1:3:1	d.	1:0

68. Refer to the illustration above. Which of the following boxes represents the same phenotype as box 7?

a.	3	c.	5
b.	4	d.	6

69. The difference between a monohybrid cross and a dihybrid cross is that

a.	monohybrid crosses involve traits for which only one allele exists, while dihybrid traits involve two alleles.
b.	monohybrid crosses involve self-pollination, while dihybrid crosses involve cross-pollination.
c.	monohybrid crosses involve one trait; dihybrid crosses involve two traits.
d.	dihybrid crosses require two Punnett squares; monohybrid crosses need only one.

70. Restriction enzymes are specific in their identification of

a.	base sequences.	c.	proteins.
b.	amino acids.	d.	chromosomes.

71. Enzymes that cut DNA molecules at specific places

a.	have sticky ends.
b.	are restriction enzymes.
c.	work only on bacterial DNA.
d.	always break the DNA between guanine and adenine.

72. Cloning is a process by which

a.	undesirable genes may be eliminated.
b.	many identical DNA fragments are produced.

c.	a virus and a bacterium may be fused into one.
d.	many identical cells may be produced.

73. Which of the following procedures is *not* a usual step in a recombinant DNA experiment?

a.	inducing a mutation in a source chromosome
b.	cutting DNA with a restriction enzyme
c.	recombining pieces of DNA from different organisms
d.	cloning and screening bacterial cells

74. The use of genetic engineering to transfer human genes into bacteria

a.	is impossible with current technology.
b.	causes the human genes to manufacture bacterial proteins.
c.	results in the formation of a new species of organism.
d.	allows the bacteria to produce human proteins.

75. A strand of DNA formed by the splicing of DNA from two different species is called

a.	determinant RNA.	c.	plasmid DNA.
b.	recombinant DNA.	d.	restriction RNA.

76. DNA fingerprinting has been used in criminal investigations because

a.	criminals leave DNA samples behind them when they touch objects at a crime scene.
b.	DNA analysis is believed to allow investigators to distinguish body cells of different individuals, who are unlikely to have the same DNA.
c.	bacterial DNA on the hands of criminals may provide a clue as to where that person was when the crime was committed.
d.	DNA found on murder weapons is easy to identify.

77. If the half-life of a radioactive isotope is 5,000 years, how much of the radioactive isotope in a specimen will be left after 10,000 years?

a.	all of it
b.	one-half of the original amount
c.	one-quarter of the original amount
d.	none of it

78. The half-life of a radioactive isotope

a.	does not change.
b.	varies with the seasons.
c.	increases as the radioactive isotope ages.
d.	fluctuates.

79. The half-life of carbon-14 is 5,730 years. How much of an initial amount of this substance would remain after 17,190 years, which is three times its half-life?

a.	none	c.	one-fourth
b.	one-half	d.	one-eighth

80. The species of finches that Darwin observed differed in the shape of their beaks. According to Darwin, all of these species probably

a.	had a common ancestor.
b.	had migrated from Africa.
c.	had descended from similar birds in Africa.
d.	ate the same diet.

81. The process by which a population becomes better suited to its environment is known as

a.	accommodation.	c.	adaptation.
b.	variation.	d.	acclimation.

82. According to Darwin, evolution occurs

a.	only through artificial selection.
b.	during half-life periods of 5,715 years.
c.	because of natural selection.
d.	so rapidly that it can be observed easily.

83. Since natural resources are limited, all organisms

a.	must migrate to new habitats.
b.	must compete for resources.
c.	display vestigial structures.
d.	have inherited characteristics.

84. Refer to the illustration above. An analysis of DNA from these organisms would indicate that

a.	they have identical DNA.
b.	they all have the same number of bones.
c.	their nucleotide sequences show many similarities.
d.	they all have the same number of chromosomes.

85. The beak of a bird and the beak of a giant squid evolved independently and serve the same function. The beaks are

a.	divergent structures.	c.	analogous structures.
b.	homologous structures.	d.	hybrid structures.

86. The process in which two or more species become more adapted over time to each other's presence is called

a.	divergence.	c.	coevolution.
b.	radiation.	d.	competition.

87. Over millions of years, plants and their pollinators have

a.	coevolved.	c.	become parasites.
b.	crossbred.	d.	become competitive.

88. Which of the following describes a population?

a.	dogs and cats living in Austin, Texas
b.	four species of fish living in a pond
c.	dogwood trees in Middletown, Connecticut
d.	roses and tulips in a garden

89. The number of individuals with a particular phenotype divided by the total number of individuals in the population is the

a.	genotype frequency.
b.	phenotype frequency.
c.	Hardy-Weinberg equilibrium.
d.	allele frequency.

90. recessive allele frequency : dominant allele frequency :: 0.02 :

a.	0.01	c.	0.98
b.	0.04	d.	1.0

91. The movement of alleles into or out of a population due to migration is called

a.	mutation.	c.	nonrandom mating.
b.	gene flow.	d.	natural selection.

92. The large, brightly colored tail feathers of the male peacock are valuable to him because

a.	they attract potential predators.
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b.	they warn off potential competitors for mates.
c.	they attract potential mates.
d.	they attract people who provide them with food.

93. Speciation can occur as a result of geographic isolation because

a.	members of a species can no longer find mates.
b.	populations that live in different environments may be exposed to different selection pressures.
c.	the biological concept of species defines individuals that do not interbreed as members of different species.
d.	All of the above

94. The hypothesis that evolution occurs at a slow, constant rate is known as

a.	gradualism.	c.	natural selection.
b.	slow motion.	d.	adaptation.

95. Which of the following traits would *not* be useful to the study of the genetic variation in a population of fish?

a.	the length of the fish
b.	the color of the fish
c.	the fin size of the fish
d.	the diet of the fish

96. Reproductive isolation differs from geographic isolation in that

a.	reproductive isolation only occurs after fertilization, whereas geographic isolation occurs before fertilization.
b.	members of the same species are not physically separated in reproductive isolation, whereas they are separated in geographic isolation.
c.	geographic isolation never leads to speciation, whereas reproductive isolation sometimes does.
d.	members of two species in which reproductive isolation occurs never try to interbreed, whereas geographically isolated ones do.

97. The science of classifying living things is called

a.	identification.	c.	taxonomy.
b.	classification.	d.	speciation.

98. As we move through the biological hierarchy from the kingdom to species level, organisms

a.	vary more and more.
b.	are less and less related to each other.
c.	become more similar in appearance.
d.	always are members of the same order.

99.

Refer to the illustration above. A shark's skeleton is made of cartilage while a dolphin's skeleton is made of bone. This is one reason the two organisms are placed in different

a.	kingdoms.	c.	subspecies.
b.	domains.	d.	classes.

100. An organism can have

a.	one genus name and one species identifier.
b.	one genus name and two species identifiers.
c.	two scientific names if it is found on different continents.

d.	two genus names but only one species identifier.		
101. Which of the following is the <i>least</i> inclusive classification group?			
a.	class	c.	phylum
b.	genus	d.	species
102. Which of the following is (are) used in systematic taxonomy to classify organisms?			
a.	patterns of embryological development		
b.	homologous features		
c.	amino acid sequences of proteins		
d.	All of the above		
103. Refer to the illustration above. A branching diagram like the one shown is called a			
a.	phenetic tree.	c.	family tree.
b.	cladogram.	d.	homology.
104. An organism's niche includes			
a.	what it eats.	c.	when it eats.
b.	where it eats.	d.	All of the above
105. Refer to the illustration above. The diagram, which shows how energy moves through an ecosystem, is called a			
a.	habitat net.	c.	trophic level.
b.	food chain.	d.	food web.
106. In a food web, which type of organism receives energy from every other type?			
a.	producer	c.	decomposer
b.	carnivore	d.	All of the above
107. Humans affect the carbon cycle by			
a.	burning fossil fuels.		
b.	destroying vegetation that absorbs carbon dioxide.		
c.	clearing forests.		
d.	All of the above		
108. Demographic studies of populations must take into consideration			
a.	population size.		
b.	population density.		
c.	population dispersion.		
d.	All of the above		
109. Regarding population dispersion patterns, which of the following is an <i>improper</i> pairing?			
a.	random—not evenly spaced		
b.	uniform—evenly spaced		
c.	clumped—clustered in space		
d.	random—clustered in space		
110. Trees growing along the banks of a river but not growing in the surrounding area would best be described as a _____ dispersion of the trees.			
a.	clumped		
b.	uniform		
c.	random		
d.	mixture of clumped, uniform, and random		
111. A population of organisms grows			
a.	with no natural restrictions except the availability of food.		

b.	when the birth rate exceeds the death rate.
c.	only in the absence of predators or natural diseases.
d.	All of the above

112. Refer to the illustration above. Which point on the graph indicates the approximate world population in the year 1950?

a.	W	c.	Y
b.	X	d.	Z

113. Refer to the illustration above. The time period during which  $r$  would have a negative value is

a.	period 1	c.	period 3
b.	period 2	d.	period 4

114. Parasites

a.	coevolve with their hosts.
b.	are usually smaller than their hosts.
c.	rarely kill their hosts.
d.	All of the above

115. A tick feeding on a human is an example of

a.	parasitism.	c.	competition.
b.	mutualism.	d.	commensalism.

116. In his experiments with two species of paramecia, George F. Gause proved that two competitors cannot coexist on the same limited resources. This outcome demonstrated the principle of

a.	competitive exclusion.
b.	secondary succession.
c.	intraspecific competition.
d.	symbiosis.

117. Cattle egrets are birds that mostly feed on insects that have been disturbed by grazing cattle. The cattle are neither helped nor harmed by the presence of the egrets. This relationship is an example of

a.	commensalism.	c.	mutualism.
b.	competition.	d.	parasitism.

The diagrams below show different kinds of interactions between species.

118. Refer to the illustration above. The relationship shown in diagram 4 is

a.	commensalism.	c.	mutualism.
b.	competition.	d.	parasitism.

<b>1</b>	<b>Both organisms benefit from the activity of each other.</b>
<b>2</b>	<b>One organism benefits, and the other organism neither benefits nor suffers harm.</b>
<b>3</b>	<b>One organism obtains its nutrients from another, and the other organism may weaken due to deprivation.</b>

119. Refer to the chart above. The table represents three types of

a.	competition.	c.	symbiosis.
b.	rhythmic patterns.	d.	secondary succession.

120. Refer to the chart above. The relationship described in line 2 in the table is called

a.	parasitism.	c.	mutualism.
b.	commensalism.	d.	predation.

121. Species evenness is a measure of

a.	the number of different species in a community.
b.	the total number of individuals in a community.
c.	the number of plant species relative to the number of animal species in a community.
d.	the relative abundance of different species in a community.

122. Succession is

a.	an organism's ability to survive in its environment.
b.	the number of species living in an ecosystem.
c.	the regular progression of species replacement in an environment.
d.	the transfer of energy through a food chain.

123. primary succession : areas of no previous plant growth ::

a.	secondary succession : abandoned farm fields
b.	rain forest : a desert
c.	farm field : a desert
d.	secondary succession : bare rock

124. Which of the following is *not* a characteristic of pioneer species?

a.	They are small.
b.	They grow quickly.
c.	They reproduce slowly.
d.	They disperse many seeds.

125. An area that is in the early stages of secondary succession will typically contain

a.	perennial shrubs.	c.	annual grasses.
b.	rock lichens.	d.	evergreen trees.

Biome	Average Yearly Temperature Range	Vegetation
1	-10°C–14°C	Needle-leaved evergreen trees
2	0°C–25°C	Tall grasses in moist areas, short grasses in drier areas
3	24°C–34°C	Succulent plants, scattered grasses
4	25°C–27°C	Broad-leaved evergreen trees and shrubs
5	10°C–20°C	Giant needle-leaved evergreen trees

126. Refer to the table above. Which biome probably has the lowest average yearly precipitation?

a.	Biome 2	c.	Biome 4
b.	Biome 3	d.	Biome 5

127. Refer to the table above. Biome 1 is best described as

a.	temperate deciduous forest.
b.	tropical rain forest.
c.	taiga.

d.	tundra.		
128. Organisms with light-producing body parts would most likely be found in			
a.	estuaries.		
b.	shallow ocean waters.		
c.	the intertidal zone.		
d.	the aphotic zone.		
129. The greatest diversity and abundance of life in the ocean is found in			
a.	the neritic zone.		
b.	the pelagic zone.		
c.	the oceanic zone.		
d.	the intertidal zone.		
130. estuaries : young fish ::			
a.	oceanic zone : sea stars		
b.	intertidal zone : large fish		
c.	neritic zone : coral reefs		
d.	benthic zone : plankton		
131. Which of the following processes harnesses energy for organisms living near deep-sea vents?			
a.	photosynthesis	c.	chemosynthesis
b.	heterotrophy	d.	respiration
132. A wide, slow-moving stream with a muddy bottom would most likely have			
a.	a steep gradient.		
b.	fewer nutrients than a mountain stream.		
c.	a low gradient.		
d.	fewer nutrients than an oligotrophic lake.		
133. Which of the following is a benefit of biodiversity to humans?			
a.	food	c.	medicines
b.	timber	d.	All of the above
134. The destruction of the ozone layer could cause an increase in			
a.	global warming.	c.	biological magnification.
b.	acid precipitation.	d.	skin cancer.
135. Scientists strongly suspect that temperatures are increasing on Earth because			
a.	decomposers essential to recycling matter are being destroyed.		
b.	too much oxygen is being given off by plants.		
c.	increasing carbon dioxide in the atmosphere is trapping more heat.		
d.	Earth is tilting further toward the sun in the summer.		
136. Rising coastal sea levels are expected to result from			
a.	increased volcanic activity on the ocean floor.		
b.	global warming.		
c.	ozone layer depletion.		
d.	acid precipitation.		
137. burning of fossil fuels : atmospheric carbon dioxide ::			
a.	greenhouse effect : CFCs		
b.	atmospheric carbon dioxide : global warming		
c.	ground level ozone : carbon dioxide		
d.	ozone : global warming		
138. The periosteum is a section of the bone that contains			

a.	blood vessels.	c.	spongy bone.
b.	osteocytes.	d.	red bone marrow.

139. In a fetus, most bones are originally made of

a.	red and yellow marrow.	c.	cartilage.
b.	calcium phosphate.	d.	osteopores.

140. What is the difference between cartilage and bone?

a.	Cartilage contains cells that can continue to divide and grow, while bone does not.
b.	Cartilage is found only in the fetus, and bone is found only in children and adults.
c.	Bone contains significant mineral deposits between its cells, while cartilage does not.
d.	Bone contains dead cells, while cartilage contains living cells.

141. A muscle can

a.	push a bone.
b.	pull a bone.
c.	both push and pull a bone simultaneously.
d.	sometimes push and sometimes pull a bone.

142. The skin performs all of the following *except*

a.	protection.
b.	elimination of waste products.
c.	control of body temperature.
d.	production of chemical messengers.

143. Keratin

a.	is a protein.	c.	is a skin pigment.
b.	fills dead cells in the dermis.	d.	All of the above

144. The thin outer layer of the skin is

a.	the dermis.	c.	the fatty layer.
b.	the epidermis.	d.	connective skin.

145. nail root : nails ::

a.	lunula : hair	c.	melanin : hair
b.	keratin : melanocytes	d.	hair follicle : hair

146. The ventricles are

a.	the upper chambers of the heart.
b.	the chambers of the heart that pump blood to the lungs and the rest of the body.
c.	the chambers of the heart that receive blood from the lungs and the rest of the body.
d.	lower chambers of the heart that contract separately.

147. Refer to the illustration above. Structure 4 is

a.	the right atrium.	c.	the right ventricle.
b.	the left atrium.	d.	the left ventricle.

148. Vessels that carry blood away from the heart are called

a.	veins.	c.	arteries.
b.	capillaries.	d.	venules.

149. Blood entering the right atrium

a.	is full of oxygen.	c.	is deoxygenated.
b.	is returning from the lungs.	d.	is low in plasma and platelets.

150. The smallest and most numerous blood vessels in the body are the

a.	venules.	c.	arteries.
b.	veins.	d.	capillaries.

151. Atherosclerosis is characterized by

a.	increased circulation to the heart.
b.	larger muscles.
c.	a narrowing of the inner walls of coronary arteries due to buildup of fatty materials.
d.	a widening of inner walls of blood vessels as a result of a heart attack.

152. Mature red blood cells

a.	can live for about a year.	c.	promote clotting.
b.	are the largest cells in the blood.	d.	do not have a nucleus.

153. Red blood cells

a.	transport respiratory gases.	c.	destroy viruses.
b.	combat bacterial infection.	d.	transport cholesterol.

154. Refer to the illustration above. These cells

a.	can live for at least a year.
b.	are the largest cells in the circulatory system.
c.	promote clotting.
d.	contain hemoglobin.

155. Which of the following is *not* involved in the formation of blood clots?

a.	platelet congregation at the site of rupture of a blood vessel
b.	release of clotting factors from platelets
c.	production of fibrin, a protein
d.	formation of fibrin-red blood cell complexes that circulate in the blood and are too large to move through ruptured blood-vessel walls

156. Alveoli in the lungs are connected to the bronchi by a network of tiny tubes called

a.	arterioles.	c.	capillaries.
b.	venules.	d.	bronchioles.

157. The stomach is involved in defense against infection by

a.	regurgitating any pathogen that might be swallowed.
b.	secreting mucus that is carried away by cilia.
c.	containing acids that destroy potential pathogens that are swallowed.
d.	sending potential pathogens to the liver for destruction.

158. Which of the following is (are) a nonspecific defense against pathogens?

a.	B cells
b.	antibodies

c.	helper T cells
d.	the inflammatory response

159. The redness and swelling associated with an inflammatory response is caused by

a.	secretion of antibodies.
b.	expansion of local blood vessels.
c.	complement activity.
d.	natural killer cells destroying bacteria.

160. Phagocytes, such as macrophages,

a.	produce strong antibiotics.
b.	secrete interferon.
c.	shut down immune responses.
d.	ingest and destroy pathogens.

161. Which of the following engulfs foreign cells?

a.	a helper T cell	c.	a macrophage
b.	a B cell	d.	an antibody

162. Refer to the illustration above. During which time period are the first antibodies to the pathogen produced?

a.	A	c.	C
b.	B	d.	None of the above

163. Which of the following pairs is *incorrectly* associated?

a.	cytotoxic T cells—attack and kill infected cells
b.	helper T cells—activate killer T cells and B cells
c.	B cells—engulf cells that are infected with microbes
d.	macrophages—consume pathogens and infected cells

164. When B cells encounter a pathogen, they

a.	secrete interleukin-2, which stimulates cytotoxic T cells.
b.	divide and produce large amounts of antibody.
c.	initiate an inflammatory response.
d.	attack the cell by making a hole in its membrane.

165. A few B cells that have encountered a pathogen

a.	become killer T cells.
b.	are ingested by macrophages.
c.	have viral protein on their cell membrane surface.
d.	become memory cells.

166. pathogenic bacteria and viruses : enemies of humans ::

a.	B cells and T cells : mucous membrane cells
b.	helper T cells and cytotoxic T cells : skin cells
c.	cytotoxic T cells and macrophages : pathogens
d.	cytotoxic T cells and B cells : white blood cells

167. macrophages : helper T cells ::

a.	cytotoxic T cells : macrophages
b.	helper T cells : cytotoxic T cells and B cells
c.	B cells : cytotoxic T cells and macrophages
d.	mucous membrane cells : helper T cells and B cells

168. All vaccines are produced from killed or weakened

a.	phagocytes.	c.	antigens.
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b.	pathogens.	d.	allergens.
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169. John and James are identical twins. During the summer following their fifteenth birthday, they went on a vacation and stayed in a cabin with two of their cousins. One of the cousins came down with chicken pox during the vacation. Chicken pox is caused by a virus. Two weeks later, John came down with chicken pox. James, however, never developed any symptoms of the disease. Which of the following is the best explanation for the different responses John and James had to exposure to the same disease?

a.	John and James are not really identical twins. James inherited an immunity to chicken pox but John did not.
b.	Even though John and James are identical twins, they produce different kinds of immune system cells. James had cytotoxic T cells that could recognize and destroy the chicken pox viruses, while John did not.
c.	James had been exposed to chicken pox at an earlier age and developed the disease. His body produced memory cells that protected him from further infections of the disease. John did not get exposed to chicken pox at an earlier age.
d.	James had a cold at the time he was exposed to the chicken pox virus. The cold virus had stimulated his body to produce lots of B cells, which were then also able to recognize and bind to the chicken pox viruses. John did not have a cold at the time he was exposed to the chicken pox.

170. An autoimmune disease in which the immune system attacks myelinated nerves is

a.	multiple sclerosis.	c.	Crohn's disease.
b.	rheumatoid arthritis.	d.	lupus erythematosus.

171. Which of the following describes the actions of HIV?

a.	HIV attacks and cripples the immune system.
b.	HIV invades macrophages and helper T cells.
c.	HIV kills large numbers of helper T cells.
d.	All of the above

172. Pepsin and hydrochloric acid in the stomach begin the digestion of

a.	protein.	c.	fats.
b.	starch.	d.	carbohydrates.

173. The basic functional unit of the kidney is the

a.	villus.	c.	ureter.
b.	nephron.	d.	urethra.

174. Refer to the illustration above. At the location labeled "X,"

a.	filtration is taking place.
b.	water and solutes are moving back into the blood.
c.	red blood cells are moving out of the blood.
d.	red blood cells are forced back into the blood.

175. Urine, when compared with the initial filtrate, contains

a.	more glucose.
b.	less water, fewer minerals, and more urea.
c.	decomposed red blood cells.
d.	concentrated amino acids.

176. Ammonia is converted to urea because

a.	urea is less toxic to the body.
b.	urea can be converted to a nutrient.
c.	the nitrogenous wastes in urea can be recycled and do not need to be excreted.
d.	All of the above

177. Gray matter includes

a.	cell bodies of neurons.	c.	myelin.
b.	synapses.	d.	nodes.

178. Sensory neurons transmit messages

a.	from the central nervous system to a muscle or gland.
b.	from the brain to the spinal cord.
c.	from the environment to the spinal cord or brain.
d.	within the brain.

179. Motor neurons transmit messages

a.	from the environment to the brain.
b.	from the environment to the spinal cord.
c.	from the spinal cord to the brain.
d.	from the central nervous system to a muscle or gland.

180. The peripheral nervous system

a.	is not linked to the central nervous system.
b.	provides pathways to and from the central nervous system.
c.	consists of the cerebellum and spinal cord.
d.	is composed only of motor neurons.

181. The autonomic nervous system controls

a.	reflexes.
b.	voluntary movement.
c.	involuntary functions of the internal organs.
d.	locomotion.

182. Extensions at one end of a neuron's body that receive input are called

a.	axons.	c.	synapses.
b.	cell bodies.	d.	dendrites.

183. Nodes of Ranvier

a.	strengthen axons.	c.	occur in dendrites.
b.	slow the nerve impulse.	d.	are gaps in the myelin sheath.

184. Refer to the illustration above. The diagrams show a nerve impulse

a.	moving from the inside to the outside of an axon.
b.	moving from the outside to the inside of an axon.
c.	moving an action potential along a neuron.
d.	moving slowly.

185. Refer to the illustration above. When an impulse moves down the axon,

a.	sodium ions first rush out of the cell.
b.	a small part of the axon momentarily reverses its polarity.

c.	the resting potential of the cell does not change.
d.	potassium ions are pumped into the axon.

186. Refer to the illustration above. An action potential may be best described as

a.	an electrical impulse.
b.	an electromagnetic message.
c.	a chemical message.
d.	a chemical change occurring in the brain.

187. Electrical changes in a neuron create

a.	a stimulus.	c.	an action potential.
b.	an electrical shock.	d.	light and sound.

188. Refer to the illustration above. In the diagram, the structure labeled “X” is a

a.	neurotransmitter molecule.
b.	neuromodulator molecule.
c.	receptor protein molecule.
d.	psychoactive drug molecule.

189. Some neurotransmitters cross a synaptic cleft and open sodium channels in the membrane of the postsynaptic neuron, causing

a.	inhibition of impulses in the neuron.
b.	the death of the neuron.
c.	initiation of an impulse in the neuron.
d.	the formation of protein receptors in the neuron.

190. When a nerve impulse reaches a synapse, neurotransmitters

a.	become enzymes in the space between the neurons.
b.	are released into the synaptic cleft.
c.	cover the membrane of the axon.
d.	cause the cell body of the next neuron to enlarge.

191. Cocaine

a.	mimics neurotransmitters.
b.	inhibits the reuptake of neurotransmitters.
c.	degrades neurotransmitters.
d.	All of the above

192. All of the following are nonendocrine chemical signal molecules *except*

a.	steroids.	c.	neurotransmitters.
b.	neuropeptides.	d.	prostaglandins.

193. Refer to the illustration above. If a hormone attached to the receptor protein shown in the diagram, the receptor protein would

a.	detach and move into the cytoplasm.
b.	trigger events within the cell.
c.	change the shape of the hormone.
d.	become a phospholipid molecule.

194. Refer to the illustration above. If one of the steroid hormones were able to activate a cell containing the receptor protein,

a.	the hormone would first have to be chemically converted into a different shape.
b.	a receptor molecule for the steroid would have to be somewhere on the cell membrane.

c.	a receptor molecule for the steroid would have to be found in the cell's cytoplasm.		
d.	None of the above		
195. Modified lipids that tend to accumulate in areas of tissue disturbance or injury are			
a.	endorphins.	c.	neuromodulators.
b.	enkephalins.	d.	prostaglandins.
196. epinephrine : reaction to stress or danger ::			
a.	changes in blood pressure : norepinephrine		
b.	aldosterone : readiness to "fight"		
c.	aldosterone : readiness for "flight"		
d.	calcitonin : blood calcium level		
197. In a person with diabetes mellitus, even though blood glucose levels may be high,			
a.	glycogen is stored in large quantities.		
b.	insulin levels still increase.		
c.	cells do not receive glucose.		
d.	None of the above		
198. Hypothyroidism can cause			
a.	nervousness.	c.	increased blood sugar.
b.	weight loss.	d.	lack of energy.
199. Parathyroid hormone is important for survival because it			
a.	stimulates the body's metabolic rate.		
b.	regulates the amount of calcium in the blood.		
c.	causes the heart to contract and pump blood.		
d.	increases the excretion of calcium by the kidneys.		
200. parathyroid gland : parathyroid hormone ::			
a.	thyroid gland : thyroxine	c.	pituitary gland : insulin
b.	pancreas : estrogen	d.	adrenal gland : FSH

**Problem(s) Answer one problem of your choice. Do not write on the test answer all problems on a separate sheet of paper. 10 points**

201. Some scientists conducted an experiment in which they evaluated various measurements of human health in people who drank at least one cup of coffee a day. They found no significant differences in these health indicators between the subjects who drank only one cup of coffee a day and those who drank as many as 20 cups a day. They concluded that coffee has no adverse effects on human health. Write your answers to the following in the spaces below.

- What were the independent and dependent variables in this experiment?
- Was this a controlled experiment? If so, what were the control and experimental groups?
- Do you agree with the conclusion the scientists drew from their results? Why or why not?

202.

Refer to the illustration above. The graph depicts the relative energy levels of the products and reactants for the following chemical reaction:  $A + B \rightarrow C + D$ . Write your answers to the following in the spaces below.

- Which substances, A, B, C, and/or D, are present at point 1 on the graph?
- Which substances, A, B, C, and/or D, are present at point 3 on the graph?
- Why is point 2 at a higher energy level than point 1?
- Why is point 3 at a lower energy level than point 1?
- Draw a dashed line on the graph indicating how the energy level of this reaction over time would be different if the enzyme that catalyzes the reaction were not present.

203. A living cell has certain characteristics in common with a working factory. In a factory,

products are assembled according to specified plans, energy is used in the assembly process, products are packaged and taken out of the factory, and a supervisor directs and oversees all of the activities occurring in the factory. Draw a model of a factory, labeling areas where the following important activities would occur: main office where supervisor keeps the plans and oversees activities, assembly line, electricity generator, packaging center, and factory doors. Next to each of your labels, write the name of the cellular organelle or structure that has a similar function. Choose the cellular organelles and structures from this list: nucleus, cytoplasm, cell membrane, mitochondrion, endoplasmic reticulum, Golgi apparatus, vacuole. Write your answer in the space below.

204. Scientists have been able to induce chloroplasts to produce ATP in the dark. First, they remove intact chloroplasts from plants. Next, they soak the chloroplasts in a solution with a low pH (about 4) and keep them in the dark. After a period of time, the chloroplasts are removed from the low pH solution and placed in a higher pH solution (about 8), again in the dark. ATP is soon found to be present in the higher pH solution. Write your answers to the following in the spaces below.

- a. Evaluate the results of this experiment. Include an explanation of what apparently happened to the chloroplasts while they were in the low pH solution and how this enabled them to produce ATP when they were placed in the higher pH solution.
- b. What was simulated in this experiment that normally occurs in chloroplasts exposed to light?

205. All of the major components of the light reactions, including the pigment molecules clustered in photosystems I and II, are located in the thylakoid membrane. What is the advantage of having these components confined to the same membrane rather than dissolved in the stroma or the cytosol?

206.

Refer to the illustration above. Amy wants to test the hypothesis that the rate of photosynthesis is directly related to the light level to which plants are exposed. She has chosen the aquatic plant *Elodea* as her study organism. In her experimental design, she has four different tanks in which she will place *Elodea* plants. Each *Elodea* plant will be placed inside an inverted test tube. She plans to estimate the relative rate of photosynthesis by measuring the amount of oxygen produced by plants placed under different light levels. She plans to compare the amount of oxygen gas that collects in the top of each of the test tubes.

Amy plans to place tank 3 next to a window in the classroom. She plans to place tank 2 ten feet away from the window. She plans to place tank 1 twenty feet away from the window. She plans to place tank 4 in the classroom's refrigerator, because it is the only place she can find that is dark. Write your answers to the following in the spaces below.

- a. What is wrong with the design of Amy's experiment?
- b. What could Amy change in her experimental design to make it a better experiment?

207. In tomato plants, tallness is dominant over dwarfness and hairy stems are dominant over hairless stems. True-breeding (homozygous) plants that are tall and have hairy stems are available. True-breeding (homozygous) plants that are dwarf and have hairless stems are also available. Design an experiment to determine whether the genes for height and hairiness of stem are on the same or different chromosomes. Explain how you will be able to determine from the results whether the genes are on the same chromosome or different chromosomes, and whether they are close to each other or far apart if they are on the same chromosome. Write your answer in the space below.

208. A scientist crossed true-breeding tall and hairy-stemmed tomato plants with true-breeding dwarf and hairless-stemmed tomato plants. He found that all of the  $F_1$  plants produced as a result of this cross were tall and hairy-stemmed. He then allowed the  $F_1$  plants to pollinate each other and obtained 1000  $F_2$  plants. Of these 1000  $F_2$  plants, he observed the following numbers of four different phenotypes:

557 tall and hairy-stemmed plants	192 dwarf and hairy-stemmed plants
180 tall and hairless-stemmed plants	71 dwarf and hairless-stemmed plants

Write your answers to the following in the space below or on a separate sheet of paper.

- Which height characteristic is dominant, tallness or dwarfness?
- Which stem characteristic is dominant, hairiness or hairlessness?
- What are the genotypes of the original, true-breeding parents? (Be sure to indicate what the symbols you use stand for.)
- What are the genotypes of the F<sub>1</sub> hybrid plants? (Be sure to indicate what the symbols you use stand for.)
- What are the genotypes of the four types of plants found in the F<sub>2</sub> generation? (Be sure to indicate what the symbols you use stand for.)
- What were the expected numbers of plants of each type in the F<sub>2</sub> generation? (Round off to the nearest whole numbers.)
- Why did the observed numbers of plants of each type in the F<sub>2</sub> generation differ from the expected?
- How could this experiment have been changed to obtain numbers of plants of each type in the F<sub>2</sub> generation that were closer to the expected numbers?

209. You are a biologist accompanying other scientists on an expedition in a region that has not been studied intensively. In your explorations, you come across a colony of small vertebrates that do not look familiar to you. After conducting electronic searches of worldwide databases, you arrive at the tentative conclusion that this organism has never been observed before. Now your job is to determine what kind of vertebrate it is by identifying its closest relatives. Identify three types of data that you would collect and describe how you would use the data to draw your conclusions. Write your answer in the space below.

210. For each of the characteristics named below, describe how the characteristic might provide a selective advantage for male members of the species who possess it. Write your answers in the space below.

- larger than average antlers on a deer
- a bowerbird's ability to build a nest more elaborate than the average nest
- the ability of an insect to remove another insect's sperm packet from a female insect's reproductive tract

211. The following table presents data on some characteristics found in vertebrates. A "+" indicates that an organism has a particular characteristic and a "-" indicates that an organism does not have a particular characteristic.

Organism	Characteristics				
	Jaws	Limbs	Hair	Lungs	Tail
Lamprey	-	-	-	-	+
Turtle	+	+	-	+	+
Cat	+	+	+	+	+
Gorilla	+	+	+	+	+
Lungfish	+	-	-	+	+
Trout	+	-	-	-	+
Human	+	+	+	+	-

Using these data, construct a cladogram illustrating the evolutionary relationships among these organisms. Each branch point should indicate a common ancestor. Write the name of the shared character that is common to all organisms above each branching point. A shared character can be the absence of a structure common to organisms below that point on the tree. Write your answer in the space below.

212.

Refer to the illustration above. The graph depicts the growth of a population of fruit flies in an enclosed area over time. Write your answers to the following in the spaces below.

- Why does the population stop increasing after it reaches the point on the curve labeled "3"?
- If a density-dependent limiting factor is present, does it have a greater impact on the population at point 1, point 2, or point 3 on the curve? Why?

- c. Name one density-independent limiting factor that could affect this population of fruit flies. Would you expect this limiting factor to have a greater impact on the population at any particular point on the curve, and if so, which one?

213. The data in the table below were gathered during a study of an abandoned agricultural field. Scientists counted the number of different kinds of herbs, shrubs, and trees present in the field 1, 25, and 40 years after it had been abandoned.

	Time after abandonment of agricultural field		
	1 year	25 years	40 years
Number of herb species	31	30	36
Number of shrub species	0	7	19
Number of tree species	0	14	22
Total number of species	31	51	77

- a. In the space below, write three conclusions that you can draw from these data.  
 b. Predict the relative numbers of herbs, shrubs, and trees and the total number of plant species that you would expect to see 100 years after abandonment of the field.

214. The diagram below shows the concentration of the pesticide DDT in water and in a number of organisms that make up a food chain.

Refer to the illustration above. Explain how DDT and other toxic substances can become concentrated in organisms and how the substance is transferred up through a food chain. Write your answer in the space below.

215. Nitrogen fertilizer is added to soil in virtually all agricultural areas of the world. The use of nitrogen fertilizer greatly increases the amount of food produced. However, nitrogen fertilizer can also affect the ecology of an area. The data presented in the table below were obtained in an experiment conducted to evaluate the effects of nitrogen fertilizer on grass species diversity. Nitrogen fertilizer was applied yearly to an experimental plot, beginning in 1856.

Year	1856	1872	1949
Total number of grass species	49	15	3
Number of species producing more than 10% of the total dry weight of all species combined	2	3	1
Number of species producing more than 50% of the total dry weight of all species combined	0	1	1
Number of species producing more than 99% of the total dry weight of all species combined	0	0	1

Write your answers to the following in the space below.

- a. Write three inferences you can make from the data.
- b. How could this experiment have been designed differently to make it a better test of the effects of nitrogen fertilizer on grass species diversity?

216. Connective tissue plays many different roles in the human body. It is crucial for providing structural support for the body. It provides protection for internal organs. It facilitates the movements of body parts. It functions in the transport of substances throughout the body. It serves a storage function for certain kinds of molecules. It also plays a vital role in enabling the body to defend itself against invading organisms or other foreign substances.

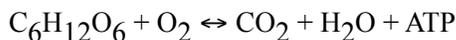
In the space below, write a short essay that first identifies the connective cell types discussed in your text. Next, distinguish these cell types from each other by their physical characteristics and by the type of matrix in which the cells are embedded. Finally, relate the physical characteristics and the type of intercellular matrix to the specific function(s) that each of these cell types performs.

217.

The diagram above shows two human blood vessels, 1 and 2, connected by a capillary bed, 3. Blood pressure is higher in vessel 2 than in vessel 1. The arrows indicate the direction of diffusion of O<sub>2</sub> and CO<sub>2</sub>. Write your answers to the following in the spaces below.

- a. What type of blood vessel is vessel 1?
- b. What type of blood vessel is vessel 2?
- c. Does this diagram show part of the systemic circuit or part of the pulmonary circuit of the human circulatory system?
- d. In which location, X or Y, will the concentration of O<sub>2</sub> in the blood be higher?
- e. Name one other substance typically found in blood that would move out of a capillary bed into body tissues along with the O<sub>2</sub> shown in the diagram.
- f. Name one other substance typically found in blood that would move into a capillary bed from body tissues along with the CO<sub>2</sub> shown in the diagram.

218. Every living cell in the human body must have an energy supply. Cells take up glucose or a related chemical and break it down inside the mitochondria to get ATP. ATP is the form of energy that cells use for their various activities. The breakdown of glucose occurs in the process of aerobic respiration. A summary of this process is shown in the following equation (note that this is not a balanced equation):



O<sub>2</sub>, which is a gas, is consumed in this process, and CO<sub>2</sub>, also a gas, is produced. Trace the pathway of a molecule of O<sub>2</sub> from the location where it enters the human body, across any cell membranes it must pass, until it reaches a muscle cell in the right leg. Then, trace the pathway of a molecule of CO<sub>2</sub> from inside that muscle cell, where it is produced in aerobic respiration, until it leaves the body. Write your answer in the space below or on a separate sheet of paper.

219.

The graph above shows the progress of digestion as carbohydrates, fats, and proteins pass through the human digestive tract. The horizontal axis indicates the relative distance along the digestive tract, from the mouth to the anus. The vertical axis indicates the percentage of undigested food remaining as the food moves through the digestive tract. The percentages of undigested carbohydrate, fat, and protein are shown separately, but they are identified only as 1, 2, and 3. Identify which of the graph lines shows carbohydrate digestion, which shows fat digestion, and which shows protein digestion. Write your answer in the space below.

220. The table below shows the composition of three different body fluids taken from a person. These fluids are identified as fluids A, B, and C. A number of substances are listed in the far left column of the table. The presence of one of these substances in a fluid is indicated by a “+” in the appropriate column. The absence of one of these substances from a fluid is indicated by a “-.”

<b>Substance</b>	<b>Fluid A</b>	<b>Fluid B</b>	<b>Fluid C</b>
Water	+	+	+
Blood cells	-	-	+
Proteins	-	-	+
Hormones	-	-	+
Amino acids	+	-	+
Urea	+	+	+
Glucose	+	-	+
Sodium	+	+	+
Other ions	+	+	+

Write your answers to the following in the spaces below.

- Which fluid, A, B, or C, is blood? Justify your choice.
- Which fluid, A, B, or C, is filtrate from nephrons of the kidney? Justify your choice.
- Which fluid, A, B, or C, is urine? Justify your choice.
- Which fluid, A, B, or C, would you expect to be the most concentrated (have the least amount of water in a given volume)?

**Essay(s) Answer one essay in 5 to 7 sentences. Do not write on the test answer on a separate sheet of paper. 10 points.**

221. Define *enzyme*, and describe how an enzyme can function in speeding up a chemical reaction within a cell. Write your answer in the space below.

222.

Refer to the illustration above. Identify the structure in the illustration and discuss its importance during eukaryotic cell division. Write your answer in the space below.

223. Briefly describe the five stages of the cell cycle. Write your answer in the space below.

224. Explain how offspring resulting from sexual reproduction differ from offspring resulting from asexual reproduction.

225. What conclusions did Gregor Mendel reach based on his observations of pea plants? Write your answer in the space below.

226. All of the offspring resulting from a cross between a red snapdragon and a white snapdragon are pink. What is a possible explanation for this? Write your answer in the space below.

227. List three practical uses of PCR. Write your answer in the space below.

228. Genetic engineering has made it possible for pharmaceutical companies to produce products such as insulin and human growth hormones by using DNA technology. Give at least two advantages of the use of DNA technology in medicine. Write your answer in the space below.

229. Why might it be more important to understand the human proteome than to understand the human genome? Write your answer in the space below.

230. Why is competition among individuals of the same species generally so intense? Write your answer in the space below.

231. Describe how you would determine the phenotype frequency of a certain phenotype in a population. Write your answer in the space below.

232. The red fox (*Vulpes vulpes*), the coyote (*Canis latrans*), and the dog (*Canis familiaris*) are all members of the family Canidae. The mountain lion (*Felis concolor*) is a member of the family Felidae.

Describe the relationships among these animals. Write your answer in the space below.

233. What are the main criteria currently used to classify organisms? Write your answer in the space below.
234. Describe how energy is transferred from one trophic level to another. Write your answer in the space below.
235. Give an example of an organism with a Type III survivorship curve, and explain the advantage a high reproductive rate might give an organism with this type of survivorship curve. Write your answer in the space below.
236. Some species of orchids grow high in the trees of tropical forests. The trees provide the orchids with the support to grow and allow them to capture more sunlight than they would on the forest floor. The orchids have little effect on the trees. What form of symbiosis is illustrated by this relationship? Explain your answer. Write your answer in the space below.
237. What is the difference between primary and secondary succession? Write your answer in the space below.
238. Explain and give an example of what is meant by the statement "Climate has an important influence on the type of ecosystem found in an area." Write your answer in the space below.
239. Using examples, describe the three basic types of joints and their primary functions. Write your answer in the space below.
240. What is a ligament? Write your answer in the space below.
241. Describe the function of sliding filaments in the contraction of muscles. Write your answer in the space below.
242. Do arteries carry oxygenated blood or deoxygenated blood? Explain. Write your answer in the space below.
243. Describe the antibody-antigen interactions that take place when an Rh<sup>-</sup> person who has blood type B receives blood from an Rh<sup>+</sup> person who has blood type AB. Write your answer in the space below.
244. Describe three components of the first line of defense that the body uses to prevent infections. Write your answer in the space below.
245. Briefly describe how a cell that has been infected by a virus can be recognized and destroyed. Write your answer in the space below.
246. Describe the chemical phase of digestion that occurs in the mouth. Write your answer in the space below.
247. Explain how the kidneys play a role in maintaining homeostasis in the body. Write your answer in the space below.
248. Briefly describe how sensory receptors help you maintain posture and keep your balance. Write your answer in the space below.
249. Explain why addiction to mood-altering drugs is said to have a physiological basis. Write your answer in the space below.
250. Describe the action of cocaine at the synapse and the effects of long-term cocaine use on receptors. Write your answer in the space below.

**Biology 1 practice test for website**  
**Answer Section**

## MULTIPLE CHOICE

1.	ANS: B	PTS: 1	DIF: 1	OBJ: 1-1.1
2.	ANS: D	PTS: 1	DIF: 1	OBJ: 1-2.3
3.	ANS: D	PTS: 1	DIF: 2	OBJ: 1-3.4
4.	ANS: B	PTS: 1	DIF: 1	OBJ: 1-3.2
5.	ANS: C	PTS: 1	DIF: 1	OBJ: 1-3.1
6.	ANS: B	PTS: 1	DIF: 1	OBJ: 1-3.1
7.	ANS: C	PTS: 1	DIF: 1	OBJ: 1-3.2
8.	ANS: D	PTS: 1	DIF: 2	OBJ: 1-3.6
9.	ANS: B	PTS: 1	DIF: 1	OBJ: 1-4.1
10.	ANS: C	PTS: 1	DIF: 1	OBJ: 2-1.2
11.	ANS: C	PTS: 1	DIF: 1	OBJ: 2-1.2
12.	ANS: C	PTS: 1	DIF: 1	OBJ: 2-1.1
13.	ANS: B	PTS: 1	DIF: 1	OBJ: 2-1.3
14.	ANS: A	PTS: 1	DIF: 2	OBJ: 2-2.1
15.	ANS: A	PTS: 1	DIF: 2	OBJ: 2-2.3
16.	ANS: A	PTS: 1	DIF: 1	OBJ: 2-2.3
17.	ANS: A	PTS: 1	DIF: 1	OBJ: 2-2.4
18.	ANS: B	PTS: 1	DIF: 1	OBJ: 2-3.5
19.	ANS: B	PTS: 1	DIF: 1	OBJ: 2-3.1
20.	ANS: D	PTS: 1	DIF: 1	OBJ: 4-2.2
21.	ANS: C	PTS: 1	DIF: 1	OBJ: 4-2.4
22.	ANS: C	PTS: 1	DIF: 1	OBJ: 4-2.4
23.	ANS: D	PTS: 1	DIF: 1	OBJ: 4-3.3
24.	ANS: A	PTS: 1	DIF: 1	OBJ: 4-3.3
25.	ANS: A	PTS: 1	DIF: 1	OBJ: 4-3.4
26.	ANS: B	PTS: 1	DIF: 1	OBJ: 4-3.3
27.	ANS: D	PTS: 1	DIF: 1	OBJ: 4-1.4
28.	ANS: B	PTS: 1	DIF: 2	OBJ: 4-2.4
29.	ANS: A	PTS: 1	DIF: 1	OBJ: 4-4.1
30.	ANS: C	PTS: 1	DIF: 1	OBJ: 4-4.4
31.	ANS: B	PTS: 1	DIF: 1	OBJ: 4-4.4
32.	ANS: D	PTS: 1	DIF: 1	OBJ: 4-4.3
33.	ANS: C	PTS: 1	DIF: 2	OBJ: 6-2.4
34.	ANS: D	PTS: 1	DIF: 1	OBJ: 6-2.4
35.	ANS: C	PTS: 1	DIF: 1	OBJ: 6-1.2
36.	ANS: D	PTS: 1	DIF: 2	OBJ: 6-1.3
37.	ANS: A	PTS: 1	DIF: 1	OBJ: 6-1.3
38.	ANS: D	PTS: 1	DIF: 1	OBJ: 6-1.3
39.	ANS: D	PTS: 1	DIF: 1	OBJ: 6-2.1
40.	ANS: D	PTS: 1	DIF: 1	OBJ: 6-2.5
41.	ANS: C	PTS: 1	DIF: 1	OBJ: 7-1.1
42.	ANS: B	PTS: 1	DIF: 1	OBJ: 7-1.1
43.	ANS: C	PTS: 1	DIF: 1	OBJ: 7-1.3
44.	ANS: D	PTS: 1	DIF: 1	OBJ: 7-1.1
45.	ANS: A	PTS: 1	DIF: 1	OBJ: 7-2.3
46.	ANS: C	PTS: 1	DIF: 2	OBJ: 7-1.1
47.	ANS: C	PTS: 1	DIF: 3	OBJ: 7-2.1
48.	ANS: D	PTS: 1	DIF: 2	OBJ: 7-2.5

49.	ANS: C	PTS: 1	DIF: 1	OBJ: 8-1.1
50.	ANS: C	PTS: 1	DIF: 1	OBJ: 8-2.1
51.	ANS: C	PTS: 1	DIF: 1	OBJ: 8-2.3
52.	ANS: D	PTS: 1	DIF: 2	OBJ: 8-2.3
53.	ANS: D	PTS: 1	DIF: 2	OBJ: 8-2.4
54.	ANS: B	PTS: 1	DIF: 2	OBJ: 8-2.4
55.	ANS: C	PTS: 1	DIF: 1	OBJ: 8-2.5
56.	ANS: C	PTS: 1	DIF: 1	OBJ: 8-3.1
57.	ANS: D	PTS: 1	DIF: 1	OBJ: 9-2.2
58.	ANS: B	PTS: 1	DIF: 1	OBJ: 9-1.4
59.	ANS: B	PTS: 1	DIF: 2	OBJ: 9-2.1
60.	ANS: A	PTS: 1	DIF: 2	OBJ: 9-2.3
61.	ANS: B	PTS: 1	DIF: 2	OBJ: 9-2.2
62.	ANS: A	PTS: 1	DIF: 2	OBJ: 9-2.3
63.	ANS: B	PTS: 1	DIF: 2	OBJ: 9-2.3
64.	ANS: D	PTS: 1	DIF: 2	OBJ: 9-2.2
65.	ANS: A	PTS: 1	DIF: 2	OBJ: 9-2.1
66.	ANS: B	PTS: 1	DIF: 2	OBJ: 9-2.1
67.	ANS: A	PTS: 1	DIF: 2	OBJ: 9-2.5
68.	ANS: D	PTS: 1	DIF: 2	OBJ: 9-2.3
69.	ANS: C	PTS: 1	DIF: 1	OBJ: 9-2.5
70.	ANS: A	PTS: 1	DIF: 1	OBJ: 13-1.2
71.	ANS: B	PTS: 1	DIF: 1	OBJ: 13-1.2
72.	ANS: D	PTS: 1	DIF: 1	OBJ: 13-1.3
73.	ANS: A	PTS: 1	DIF: 1	OBJ: 13-1.3
74.	ANS: D	PTS: 1	DIF: 1	OBJ: 13-1.3
75.	ANS: B	PTS: 1	DIF: 1	OBJ: 13-1.3
76.	ANS: B	PTS: 1	DIF: 1	OBJ: 13-1.4
77.	ANS: C	PTS: 1	DIF: 1	OBJ: 14-2.2
78.	ANS: A	PTS: 1	DIF: 1	OBJ: 14-2.2
79.	ANS: D	PTS: 1	DIF: 1	OBJ: 14-2.2
80.	ANS: A	PTS: 1	DIF: 1	OBJ: 15-1.4
81.	ANS: C	PTS: 1	DIF: 1	OBJ: 15-1.5
82.	ANS: C	PTS: 1	DIF: 1	OBJ: 15-1.5
83.	ANS: B	PTS: 1	DIF: 1	OBJ: 15-1.5
84.	ANS: C	PTS: 1	DIF: 2	OBJ: 15-2.4
85.	ANS: C	PTS: 1	DIF: 2	OBJ: 15-2.3
86.	ANS: C	PTS: 1	DIF: 1	OBJ: 15-3.4
87.	ANS: A	PTS: 1	DIF: 1	OBJ: 15-3.4
88.	ANS: C	PTS: 1	DIF: 1	OBJ: 16-1.2
89.	ANS: B	PTS: 1	DIF: 1	OBJ: 16-1.4
90.	ANS: C	PTS: 1	DIF: 2	OBJ: 16-1.4
91.	ANS: B	PTS: 1	DIF: 1	OBJ: 16-2.1
92.	ANS: C	PTS: 1	DIF: 1	OBJ: 16-2.5
93.	ANS: B	PTS: 1	DIF: 2	OBJ: 16-3.2
94.	ANS: A	PTS: 1	DIF: 1	OBJ: 16-3.4
95.	ANS: D	PTS: 1	DIF: 2	OBJ: 16-1.1
96.	ANS: B	PTS: 1	DIF: 1	OBJ: 16-3.3
97.	ANS: C	PTS: 1	DIF: 1	OBJ: 17-1.2
98.	ANS: C	PTS: 1	DIF: 1	OBJ: 17-1.3

99.	ANS: D	PTS: 1	DIF: 2	OBJ: 17-1.3
100.	ANS: A	PTS: 1	DIF: 1	OBJ: 17-1.4
101.	ANS: D	PTS: 1	DIF: 1	OBJ: 17-1.4
102.	ANS: D	PTS: 1	DIF: 1	OBJ: 17-2.1
103.	ANS: B	PTS: 1	DIF: 2	OBJ: 17-2.3
104.	ANS: D	PTS: 1	DIF: 1	OBJ: 18-2.3
105.	ANS: D	PTS: 1	DIF: 2	OBJ: 18-3.4
106.	ANS: C	PTS: 1	DIF: 1	OBJ: 18-3.4
107.	ANS: D	PTS: 1	DIF: 1	OBJ: 18-4.3
108.	ANS: D	PTS: 1	DIF: 1	OBJ: 19-1.1
109.	ANS: D	PTS: 1	DIF: 1	OBJ: 19-1.2
110.	ANS: A	PTS: 1	DIF: 2	OBJ: 19-1.2
111.	ANS: B	PTS: 1	DIF: 1	OBJ: 19-1.3
112.	ANS: C	PTS: 1	DIF: 2	OBJ: 19-3.2
113.	ANS: D	PTS: 1	DIF: 2	OBJ: 19-2.1
114.	ANS: D	PTS: 1	DIF: 1	OBJ: 20-1.3
115.	ANS: A	PTS: 1	DIF: 1	OBJ: 20-1.3
116.	ANS: A	PTS: 1	DIF: 1	OBJ: 20-1.2
117.	ANS: A	PTS: 1	DIF: 1	OBJ: 20-1.3
118.	ANS: D	PTS: 1	DIF: 2	OBJ: 20-1.3
119.	ANS: C	PTS: 1	DIF: 2	OBJ: 20-1.3
120.	ANS: B	PTS: 1	DIF: 2	OBJ: 20-1.3
121.	ANS: D	PTS: 1	DIF: 1	OBJ: 20-2.1
122.	ANS: C	PTS: 1	DIF: 1	OBJ: 20-2.3
123.	ANS: A	PTS: 1	DIF: 2	OBJ: 20-2.3
124.	ANS: C	PTS: 1	DIF: 1	OBJ: 20-2.3
125.	ANS: C	PTS: 1	DIF: 1	OBJ: 20-2.3
126.	ANS: B	PTS: 1	DIF: 2	OBJ: 21-1.1
127.	ANS: C	PTS: 1	DIF: 2	OBJ: 21-1.1
128.	ANS: D	PTS: 1	DIF: 2	OBJ: 21-2.3
129.	ANS: A	PTS: 1	DIF: 1	OBJ: 21-2.1
130.	ANS: C	PTS: 1	DIF: 2	OBJ: 21-2.4
131.	ANS: C	PTS: 1	DIF: 1	OBJ: 21-2.3
132.	ANS: C	PTS: 1	DIF: 2	OBJ: 21-2.6
133.	ANS: D	PTS: 1	DIF: 1	OBJ: 22-1.5
134.	ANS: D	PTS: 1	DIF: 1	OBJ: 22-1.3
135.	ANS: C	PTS: 1	DIF: 1	OBJ: 22-2.2
136.	ANS: B	PTS: 1	DIF: 2	OBJ: 22-2.2
137.	ANS: B	PTS: 1	DIF: 2	OBJ: 22-2.2
138.	ANS: A	PTS: 1	DIF: 1	OBJ: 45-2.2
139.	ANS: C	PTS: 1	DIF: 1	OBJ: 45-2.3
140.	ANS: C	PTS: 1	DIF: 1	OBJ: 45-2.3
141.	ANS: B	PTS: 1	DIF: 1	OBJ: 45-3.4
142.	ANS: D	PTS: 1	DIF: 1	OBJ: 45-4.1
143.	ANS: A	PTS: 1	DIF: 1	OBJ: 45-4.1
144.	ANS: B	PTS: 1	DIF: 1	OBJ: 45-4.2
145.	ANS: D	PTS: 1	DIF: 1	OBJ: 45-4.4
146.	ANS: B	PTS: 1	DIF: 1	OBJ: 46-1.1
147.	ANS: A	PTS: 1	DIF: 1	OBJ: 46-1.1
148.	ANS: C	PTS: 1	DIF: 1	OBJ: 46-1.3

149.	ANS: C	PTS: 1	DIF: 1	OBJ: 46-1.2
150.	ANS: D	PTS: 1	DIF: 1	OBJ: 46-1.3
151.	ANS: C	PTS: 1	DIF: 1	OBJ: 46-1.4
152.	ANS: D	PTS: 1	DIF: 1	OBJ: 46-2.2
153.	ANS: A	PTS: 1	DIF: 1	OBJ: 46-2.2
154.	ANS: D	PTS: 1	DIF: 1	OBJ: 46-2.2
155.	ANS: D	PTS: 1	DIF: 1	OBJ: 46-2.3
156.	ANS: D	PTS: 1	DIF: 1	OBJ: 46-3.2
157.	ANS: C	PTS: 1	DIF: 1	OBJ: 47-1.2
158.	ANS: D	PTS: 1	DIF: 1	OBJ: 47-1.3
159.	ANS: B	PTS: 1	DIF: 1	OBJ: 47-1.3
160.	ANS: D	PTS: 1	DIF: 1	OBJ: 47-1.4
161.	ANS: C	PTS: 1	DIF: 1	OBJ: 47-1.4
162.	ANS: B	PTS: 1	DIF: 1	OBJ: 47-2.3
163.	ANS: C	PTS: 1	DIF: 1	OBJ: 47-2.3
164.	ANS: B	PTS: 1	DIF: 1	OBJ: 47-2.3
165.	ANS: D	PTS: 1	DIF: 1	OBJ: 47-2.3
166.	ANS: D	PTS: 1	DIF: 2	OBJ: 47-2.3
167.	ANS: B	PTS: 1	DIF: 2	OBJ: 47-2.3
168.	ANS: B	PTS: 1	DIF: 1	OBJ: 47-2.4
169.	ANS: C	PTS: 1	DIF: 2	OBJ: 47-2.3
170.	ANS: A	PTS: 1	DIF: 1	OBJ: 47-2.5
171.	ANS: D	PTS: 1	DIF: 1	OBJ: 47-3.2
172.	ANS: A	PTS: 1	DIF: 1	OBJ: 48-2.4
173.	ANS: B	PTS: 1	DIF: 1	OBJ: 48-3.2
174.	ANS: A	PTS: 1	DIF: 1	OBJ: 48-3.3
175.	ANS: B	PTS: 1	DIF: 1	OBJ: 48-3.4
176.	ANS: A	PTS: 1	DIF: 1	OBJ: 48-3.1
177.	ANS: A	PTS: 1	DIF: 1	OBJ: 49-2.1
178.	ANS: C	PTS: 1	DIF: 1	OBJ: 49-2.3
179.	ANS: D	PTS: 1	DIF: 1	OBJ: 49-2.3
180.	ANS: B	PTS: 1	DIF: 1	OBJ: 49-2.3
181.	ANS: C	PTS: 1	DIF: 1	OBJ: 49-2.4
182.	ANS: D	PTS: 1	DIF: 1	OBJ: 49-1.1
183.	ANS: D	PTS: 1	DIF: 1	OBJ: 49-1.1
184.	ANS: C	PTS: 1	DIF: 1	OBJ: 49-1.3
185.	ANS: B	PTS: 1	DIF: 1	OBJ: 49-1.3
186.	ANS: A	PTS: 1	DIF: 1	OBJ: 49-1.3
187.	ANS: C	PTS: 1	DIF: 1	OBJ: 49-1.3
188.	ANS: A	PTS: 1	DIF: 1	OBJ: 49-1.4
189.	ANS: C	PTS: 1	DIF: 1	OBJ: 49-1.4
190.	ANS: B	PTS: 1	DIF: 1	OBJ: 49-1.4
191.	ANS: B	PTS: 1	DIF: 2	OBJ: 49-4.2
192.	ANS: A	PTS: 1	DIF: 1	OBJ: 50-1.3
193.	ANS: B	PTS: 1	DIF: 1	OBJ: 50-1.4
194.	ANS: C	PTS: 1	DIF: 1	OBJ: 50-1.4
195.	ANS: D	PTS: 1	DIF: 1	OBJ: 50-1.5
196.	ANS: D	PTS: 1	DIF: 2	OBJ: 50-2.2
197.	ANS: C	PTS: 1	DIF: 1	OBJ: 50-2.3
198.	ANS: D	PTS: 1	DIF: 1	OBJ: 50-2.2

199.           ANS: B           PTS: 1           DIF: 1           OBJ: 50-2.2  
200.           ANS: A           PTS: 1           DIF: 2           OBJ: 50-2.2

## PROBLEM

201.           ANS:

- a. The independent variable was the number of cups of coffee a subject drank each day; the dependent variables were the indicators of human health measured.
- b. This was not a controlled experiment because there was no group of subjects who drank zero cups of coffee a day.
- c. Students should disagree with the scientists' conclusion because this was not a controlled experiment (there could be something harmful in coffee that would be effective when only one cup of coffee was consumed each day).

PTS: 1           DIF: 3           OBJ: 1-3.4

202.           ANS:

- a. A and B
- b. C and D
- c. An input of energy, called the activation energy, is required in order to get the reaction going.
- d. The products contain less energy than the reactants and energy is given off in the reaction.
- e. The graph should be the same except that the energy level at point 2 should be higher.

PTS: 1           DIF: 3           OBJ: 2-2.2

203.           ANS:

The drawing should include the following pairs:

main office—nucleus  
assembly line—endoplasmic reticulum  
electricity generator—mitochondrion  
packaging center—Golgi apparatus  
factory doors—plasma membrane

PTS: 1           DIF: 3           OBJ: 4-3.3

204.           ANS:

- a. In the low pH solution, the chloroplasts apparently take up protons (hydrogen ions) from the solution. The protons move inside the thylakoid compartments of the chloroplasts and accumulate there. When the chloroplasts are placed in the higher pH solution, a pH gradient exists between the inside of the thylakoid compartments and the stroma of the chloroplasts. This drives the movement of protons from the thylakoid compartments to the stroma. As the protons move into the stroma they pass through the protein ATP synthetase. This enzyme is thereby induced to produce ATP from ADP.
- b. Chloroplasts exposed to light will have electrons passed along an electron transport chain. As they pass along this chain, they give off energy. Some of this energy is used to pump protons into the thylakoid compartments. The resulting pH gradient between the thylakoid compartments and the stroma drives the movement of protons from the thylakoid compartments to the stroma. As the protons move into the stroma they pass through the protein ATP synthetase. This enzyme is thereby induced to produce ATP from ADP.

PTS: 1           DIF: 3           OBJ: 6-1.4

205.           ANS:

This placement makes it easier for energy and electrons to pass from one component to the next.

PTS: 1           DIF: 2           OBJ: 6-1.3

206.           ANS:

- a. By placing tank 4 in the refrigerator, Amy would be introducing a second variable, temperature, into her experiment. A true controlled experiment tests only one variable.

b. Amy should find some location for tank 4 that is as close as possible to the same temperature as the locations where tanks 1, 2, and 3 are to be placed. It would be better to have tank 4 shielded from light and kept within the same room.

PTS: 1                      DIF: 2                      OBJ: 6-2.5  
207.                      ANS:

The experiment should be designed to produce  $F_1$  plants that are then allowed to pollinate the other plants' flowers and produce an  $F_2$  generation of plants. If the  $F_2$  generation has four different phenotypes present in approximate proportions of 9/16 tall and hairy, 3/16 tall and hairless, 3/16 dwarf and hairy, and 1/16 dwarf and hairless, then the student can conclude that the genes for height and hairiness are on different chromosomes. If the  $F_2$  generation has only two different phenotypes present in approximate proportions of 3/4 tall and hairy and 1/4 dwarf and hairless, then the student can conclude that the genes for height and hairiness are on the same chromosome. The student could also conclude that the genes are located very close to each other on the chromosome. If the  $F_2$  generation has four different phenotypes with the tall and hairless types composing less than 3/16 of the total number and the dwarf and hairy types composing less than 3/16 of the total number, then the student could conclude that the genes for height and hairiness are on the same chromosome but not located adjacent to each other.

PTS: 1                      DIF: 3                      OBJ: 9-1.5  
208.                      ANS:

- a. Tallness is dominant.
- b. Hairiness is dominant.
- c. Let T stand for tallness, t stand for dwarfness, H stand for hairiness, and h stand for hairlessness. The tall, hairy-stemmed true-breeding parent has the genotype TTHH. The dwarf, hairless-stemmed true-breeding parent has the genotype tthh.
- d. Use the same symbols as in answer c above. The  $F_1$  plants all have the same genotype, which is TtHh.
- e. Use the same symbols as in answer c above. The possible genotypes of the  $F_2$  plants are the following:
  - tall and hairy-stemmed plants: TTHH, TTHh, TtHH, TtHh
  - tall and hairless-stemmed plants: TThh, Tthh
  - dwarf and hairy-stemmed plants: tTHH, tTHh
  - dwarf and hairless-stemmed plants: ttHH, ttHh
- f. The expected numbers were as follows: 563 tall and hairy-stemmed plants, 188 tall and hairless-stemmed plants, 188 dwarf and hairy-stemmed plants, 63 dwarf and hairless-stemmed plants. (Notice that rounding causes the total to exceed 1000.)
- g. The expected numbers are based on probabilities. The actual numbers should be close to the expected, but would not likely be exactly the expected numbers.
- h. Increasing the sample size, say to 10,000 plants, would likely result in the observed numbers being closer to the expected numbers. Again, this is because of probabilities.

PTS: 1                      DIF: 3                      OBJ: 9-2.2  
209.                      ANS:

- 1) You could analyze anatomical structures of the organism and compare them to similar structures of other vertebrates. For example, the skeleton of your organism could be compared to the skeletons of other vertebrates. Those vertebrates having the greatest number of similar (homologous) anatomical structures to those of your organism could be inferred to be its closest living relatives.
- 2) You could analyze the DNA of this organism and/or a protein it produces and compare this material to that of other vertebrates. Those vertebrates sharing the most similarities in DNA and/or protein sequences with your organism could be inferred to be its closest living relatives.
- 3) You could analyze embryonic development and compare the patterns of development and structures present at different stages of development with the patterns and structures of other vertebrates. For example, a

comparison could be made between the persistence of a particular trait in embryos of this organism until late in embryonic development and the persistence of the same trait in the embryos of other vertebrates.

PTS: 1                    DIF: 3                    OBJ: 15-2.5  
210.                    ANS:

- a. A male deer with larger than average antlers might be more likely to win battles with other males, sending the other males away or killing them. Or, the deer may be more likely to attract mates. Thus, a deer with larger antlers would be more likely to mate with a female deer and produce offspring.
- b. A bowerbird that builds a more elaborate nest than other bowerbirds is more likely to attract the attention of a female. Thus, he is also more likely to mate with a female bowerbird and produce offspring.
- c. A male insect that could remove another male's sperm packet from a female's body could then mate with the female himself. Thus, this male insect would be more likely to produce offspring than males that don't have this ability.

PTS: 1                    DIF: 3                    OBJ: 16-2.5  
211.                    ANS:

Students' cladograms should look something like the one depicted below. (A student's cladogram should also be considered correct if the gorilla and the human are placed in opposite positions.)

PTS: 1                    DIF: 3                    OBJ: 17-2.4  
212.                    ANS:

- a. The population stops increasing because it has reached the carrying capacity of the ecosystem in which it lives. The ecosystem cannot support any more flies than this number.
- b. It has the greatest impact on the population at point 3. This is because population density is greatest at point 3. Density-dependent limiting factors impact populations more as populations increase in density.
- c. Suitable answers include a number of abiotic factors. The most obvious answer and the most commonly important abiotic factor is a temperature extreme (e.g., freezing). Other abiotic limiting factors include floods, hurricanes, fires, and volcanic eruptions. Such limiting factors would not be expected to have a greater impact on the population at any particular population size.

PTS: 1                    DIF: 3                    OBJ: 19-2.3  
213.                    ANS:

- a. The following are some valid conclusions: (1) The total number of plant species present in the field increased over the 40-year time period. (2) The plants that grew initially in the field were all herbs. (3) Over the 40-year time period, the relative proportions of herbs, shrubs, and trees changed. The relative number of herbs decreased while the relative number of shrubs and trees increased. (4) The total number of herbs present did not change significantly over the 40-year time period.
- b. It is possible that the total number of species present would be even greater 100 years after abandonment, although at some point the community would probably reach a stable stage. There would probably be relatively fewer herbs and relatively more trees.

PTS: 1                    DIF: 1                    OBJ: 20-2.1  
214.                    ANS:

If there is a toxic substance such as DDT in an organism's food, it will pass through the organism's body. These substances are often taken up and stored in body tissues. When another organism ingests the organism containing stored toxins, it can also take up and store the toxins. The toxic substances become increasingly concentrated as they move up through the food chain because each successive organism consumes several contaminated organisms. This increased concentration is called biological magnification.

PTS: 1                    DIF: 3                    OBJ: 22-2.3  
215.                    ANS:

- a. The following are some possible inferences:
  - (1) The total number of grass species decreased over time and with exposure to nitrogen fertilizer.

(2) At the beginning of the experiment, there was no one dominant species of grass. Over time and with exposure to nitrogen fertilizer, a few species became dominant.

(3) Prolonged use of nitrogen fertilizer encourages the growth of one or at least only a few dominant species.

- b. The experiment should have included a control plot that did not receive nitrogen fertilizer. With the experiment as presented, the effects of nitrogen fertilizer cannot be distinguished from the effects of time.

PTS: 1                    DIF: 3                    OBJ: 22-1.5  
216.                    ANS:

The students' essays should include the following information: Bone is a kind of connective tissue that contains cells embedded in a hard, crystalline matrix containing calcium. This type of matrix makes bone rigid and thus well suited for providing structural support and protection of internal organs. For example, the skull protects the brain, the rib cage protects the heart and lungs, and the pelvic and abdominal cavities protect organs of the reproductive, digestive, and excretory systems. Cartilage is a kind of connective tissue that contains cells embedded in a semisolid, fibrous matrix. This structure makes cartilage strong yet flexible. Cartilage provides some structural support, particularly in young humans and at stress points between adjacent bones. Ligaments and tendons are both tough, fibrous connective tissue, also with a semisolid, fibrous matrix. Ligaments connect bones to each other at joints and tendons attach muscles to bones. Both help the body make skeletal movements. Fat tissue, which also has a semisolid matrix, is a kind of connective tissue that contains cells that store fat as an energy reserve. Blood is a kind of connective tissue that contains cells embedded in a liquid matrix. Blood is the medium in which nutrients and wastes are transported to and from the cells of the body. Some of the blood cells function as part of the immune system to defend our bodies against invading organisms and foreign substances.

PTS: 1                    DIF: 3                    OBJ: 45-1.1  
217.                    ANS:

- a. vein  
b. artery  
c. systemic circuit  
d. Y  
e. possible answers: food molecule, water, vitamin, ion, hormone, or white blood cell  
f. possible answers: wastes or ammonia

PTS: 1                    DIF: 3                    OBJ: 46-1.3  
218.                    ANS:

The O<sub>2</sub> molecule would enter the body through one of the nostrils, pass through the pharynx, the trachea, and one of the two bronchi, and then enter a bronchiole in the lung. It would then move into an alveolus and then move across a cell membrane of the alveolus and enter the blood. Once in the blood, the O<sub>2</sub> would move across the cell membrane into a red blood cell. It would then be transported through the pulmonary vein, which takes blood from the lungs to the heart. The O<sub>2</sub> in the blood would enter the heart in the left atrium, move to the left ventricle, and then be forced out of the heart into the aorta. The O<sub>2</sub> in the blood would then be transported into smaller arteries, still smaller arterioles, and finally a capillary bed in the muscle in the right leg. The O<sub>2</sub> would then move out of the red blood cell across its cell membrane, and would enter a muscle cell across that cell's membrane. A CO<sub>2</sub> molecule produced by aerobic respiration in this muscle cell would leave the cell by moving across the cell membrane and would enter the blood. In the blood, it might move across the cell membrane of a red blood cell and remain in its cytoplasm. (Alternately, the CO<sub>2</sub> might dissolve in the plasma or combine with water to form bicarbonate ions.) The CO<sub>2</sub> in blood would then be transported into venules, and then into veins, until it returned to the vena cava. From the vena cava, it would reenter the heart. The CO<sub>2</sub> in blood would enter the right atrium of the heart, move to the right ventricle, and then be forced out of the heart into the pulmonary artery. From there, it would be transported to one of the lungs. In a lung, the CO<sub>2</sub> would move out of the red blood cell by moving across its cell membrane. It would

then move across a cell membrane of an alveolus. From the alveolus, the CO<sub>2</sub> would pass through a bronchiole, a bronchus, the trachea, and the pharynx, and would then leave the body through one of the nostrils.

PTS: 1                    DIF: 3                    OBJ: 46-3.3

219.                    ANS:

1 is fat, 2 is protein, and 3 is carbohydrate.

PTS: 1                    DIF: 3                    OBJ: 48-2.4

220.                    ANS:

- a. C must be blood because it is the only one of the fluids that has blood cells in it.
- b. A must be filtrate in the nephrons because it contains glucose and amino acids, which are reabsorbed from the filtrate before urine leaves the body. A could not be blood because it does not contain blood cells.
- c. B must be urine because it contains only water, urea, sodium, and other ions. Both blood and nephron filtrate would contain additional substances.
- d. B

PTS: 1                    DIF: 3                    OBJ: 48-3.4

## ESSAY

221.                    ANS:

Enzymes are biological catalysts. They are protein or RNA molecules that lower the activation energy that would otherwise be required for a reaction to occur.

PTS: 1                    DIF: 2                    OBJ: 2-2.3

222.                    ANS:

This is a chromosome, which is made of DNA. During mitosis, the nucleus of a cell divides into two nuclei, each containing a complete set of the cell's chromosomes. Thus, each new cell formed during cell division contains identical DNA.

PTS: 1                    DIF: 2                    OBJ: 8-2.2

223.                    ANS:

The G<sub>1</sub> stage of the cell cycle is the phase of cell growth. This is followed by the S stage, during which DNA is copied. G<sub>2</sub> involves the cell preparing for cell division. The M phase is when mitosis occurs. The cell cycle concludes with cytokinesis. The newly formed cells then enter into a new cell cycle, repeating these stages.

PTS: 1                    DIF: 2                    OBJ: 8-2.3

224.                    ANS:

Offspring from sexual reproduction have two parents. They were produced through meiosis and fertilization. They are genetically different from either parent but have similarities to both. Offspring from asexual reproduction arise through mitosis in one parent. They are identical genetically to that parent.

PTS: 1                    DIF: 2                    OBJ: 8-3.6

225.                    ANS:

Mendel studied the hereditary patterns of pea plants by observing the results of controlled crosses. After studying the results of these crosses, Mendel concluded that patterns of inheritance were governed by three principles: (1) the law of dominance and recessiveness, (2) the law of segregation, and (3) the law of independent assortment.

PTS: 1                    DIF: 1                    OBJ: 9-1.4

226. ANS:

Incomplete dominance is a heredity pattern that occurs when neither of two alleles of a gene is dominant. In other words, the heterozygous offspring in this cross display a trait that is intermediate to the traits exhibited by the two homozygous parents. In this case, the genotype RR produces red flowers, the genotype rr produces white flowers, and the genotype Rr produces pink flowers.

PTS: 1 DIF: 2 OBJ: 9-2.1

227. ANS:

Answers should include any application that makes use of PCR's ability to make thousands of copies of a tiny DNA sample. PCR can be used to make DNA fingerprints from tiny samples found at a crime scene, to diagnose genetic disorders from a few embryonic cells, and to trace human origins and migration from ancient fragments of DNA found in minute amounts.

PTS: 1 DIF: 1 OBJ: 13-1.4

228. ANS:

Advantages of DNA technology include the following: (1) large amounts of medical products such as human insulin can be produced, and (2) genetically engineered products are highly specific and have fewer side effects than conventional medicines.

PTS: 1 DIF: 1 OBJ: 13-3.1

229. ANS:

It is the proteins, not the genes themselves, that carry out the work of cells. Scientists must understand proteins and how they work if they are to understand a gene's function.

PTS: 1 DIF: 2 OBJ: 13-2.5

230. ANS:

Individuals of the same species require the same resources for survival. Because resources are generally limited, only those individuals able to secure sufficient amounts of those resources will survive.

PTS: 1 DIF: 2 OBJ: 15-1.5

231. ANS:

To determine the phenotype frequency, determine the number of individuals with the phenotype and divide that number by the total number of individuals in the population.

PTS: 1 DIF: 1 OBJ: 16-1.4

232. ANS:

Since the coyote and the dog are both members of the same genus, they are the most closely related. The red fox is more closely related to these two animals than to the mountain lion since the mountain lion is in a different family.

PTS: 1 DIF: 2 OBJ: 17-1.4

233. ANS:

Scientists use fossils, homologous features, patterns of embryonic development, chromosomes, and macromolecules such as DNA and RNA to classify organisms.

PTS: 1 DIF: 2 OBJ: 17-2.1

234. ANS:

A portion of the energy available to the organisms at each level of the food chain is stored in the chemical bonds of nutrients or tissues of an organism. When that organism is eaten by another, some of the stored chemical energy is transferred to the new organism and used to sustain its life.

PTS: 1 DIF: 2 OBJ: 18-3.5

235. ANS:

Organisms with a Type III survivorship curve, such as salmon, insects, or frogs, produce many young at once.

A large number of these individuals die while young. A high reproductive rate offsets this enormous early mortality.

PTS: 1                    DIF: 2                    OBJ: 19-1.4  
236.                    ANS:

Commensalism is the form of symbiosis illustrated here. In commensalism, one organism benefits and the other organism neither benefits nor suffers harm. In this example, the orchids benefit from the presence of the trees, but the orchids have little effect on the trees.

PTS: 1                    DIF: 2                    OBJ: 20-1.3  
237.                    ANS:

Primary succession is the replacement of species in an area that had not previously supported life, such as bare rock or sand dunes. Secondary succession is the replacement of species in a habitat that has been disrupted due to natural disaster or human activity but still possesses a small amount of soil and vegetation.

PTS: 1                    DIF: 2                    OBJ: 20-2.3  
238.                    ANS:

Answers will vary. Sample answer: The climate of an area refers to the daily atmospheric conditions—the temperature, amount of rainfall, and amount of sunlight in a given area. Ecosystems vary based on the types of living organisms—plants and animals—that can survive in an area. Areas receiving large amounts of sunlight and precipitation tend to be warm and moist and will support different types of organisms than colder, dry areas. Areas that are warm and dry, such as parts of southern Arizona, allow the growth of fewer plants than areas with heavy rainfall. The plants that do survive in warm, dry areas, such as cacti, have developed structures that promote water conservation. Areas with mild temperatures and heavier rainfall, such as Virginia and North Carolina, promote the growth of dense forests with tall trees that shed their leaves and consume large amounts of water on a daily basis. (Acceptable answers may include other examples that establish a link between the type of organisms that can survive and the area's climate.)

PTS: 1                    DIF: 2                    OBJ: 21-1.1  
239.                    ANS:

Fixed joints are very tight joints that hold adjacent bones together, permitting no movement. The cranial bones of the skull are held together by fixed joints. Limited mobility is permitted by semi-movable joints, the second basic type of joint. In these joints, a bridge of cartilage joins two bones together, as in the joints between the vertebrae of the spine. The third type of joint is the freely movable joint. These joints allow the greatest degree of movement; they are found between bones that are held together by ligaments.

PTS: 1                    DIF: 1                    OBJ: 45-2.4  
240.                    ANS:

A ligament is a tough connective tissue that joins one bone to another.

PTS: 1                    DIF: 1                    OBJ: 45-2.4  
241.                    ANS:

Myosin and actin filaments lie in parallel lines along the length of a myofibril in units called sarcomeres. The myosin heads touch the adjacent actin filaments. When a muscle contracts, the myosin heads attach to the actin filaments, and when the heads bend inward, they pull the actin filaments along with them toward each other. Muscle contraction requires energy supplied by ATP. As the actin filaments move toward each other along the myosin filament, they pull their Z lines with them, thus shortening the sarcomere. As sarcomeres are shortened along the entire muscle fiber, the muscle contracts.

PTS: 1                    DIF: 2                    OBJ: 45-3.3  
242.                    ANS:

An artery is a blood vessel that carries blood away from the heart. Most arteries carry oxygenated blood from the heart to the rest of the body, but some arteries—the pulmonary arteries, which carry blood from the heart to the lungs—carry deoxygenated blood that has been returned to the heart from the rest of the body.

PTS: 1                    DIF: 2                    OBJ: 46-1.2  
243.                    ANS:

An Rh<sup>-</sup> person who has blood type B has only blood antigen B. A person having this antigen would produce antibodies to antigens A and Rh. An Rh<sup>+</sup> person who has blood type AB has blood antigens Rh, A, and B. When these antigens enter the recipient's blood, antibodies to the A and Rh will produce agglutination. The B antigen of the donor's blood will not cause agglutination because the recipient does not produce antibodies to this antigen.

PTS: 1                    DIF: 2                    OBJ: 46-2.4  
244.                    ANS:

The skin prevents a pathogen from entering the body. In addition, oils and sweat produced by glands in the skin create an environment unfavorable to pathogens. Sweat also contains enzymes that destroy some bacteria. Mucous membranes line internal body surfaces that are exposed to the environment. They secrete mucus, which is a sticky substance for trapping pathogens. In the respiratory tract, cilia lining the respiratory tract sweep trapped pathogens up to the pharynx, where they are swallowed and travel to the stomach, where stomach acids destroy the pathogens.

PTS: 1                    DIF: 1                    OBJ: 47-1.2  
245.                    ANS:

Macrophages contact infected cells and release interleukin-1. This protein activates helper T cells that secrete another protein, interleukin-2. This substance, in turn, stimulates cytotoxic T cells, which bind to the infected cell using surface receptor molecules that recognize traces of viral protein on the surface of the infected cell. This interaction causes damage to the cell membrane of the infected cell, resulting in its destruction.

PTS: 1                    DIF: 1                    OBJ: 47-2.3  
246.                    ANS:

In the mouth, salivary glands release saliva, which is a mixture of water, mucus, and the enzyme salivary amylase. The salivary amylase begins the chemical digestion of carbohydrates by breaking down some starch into maltose.

PTS: 1                    DIF: 1                    OBJ: 48-2.4  
247.                    ANS:

The kidneys regulate the amounts of substances like salts, minerals, and other chemicals that are retained in the blood or excreted in the urine. In addition, the kidneys regulate the concentration of substances in the blood by adjusting the total amount of water in the body to keep the concentration nearly constant. Kidneys also remove urea and other waste products from the body.

PTS: 1                    DIF: 1                    OBJ: 48-3.4  
248.                    ANS:

Receptors in the inner ear signal the direction of gravity and the speed and direction of movements to the brain, enabling us to maintain a vertical posture. Pressure receptors in our joints, tendons, and muscles detect movement and degree of stretch. These receptors help control how we move and how we maintain our balance.

PTS: 1                    DIF: 1                    OBJ: 49-3.1  
249.                    ANS:

Some drugs cause excessive amounts of neurotransmitter to be present in synapses for long periods of time. This results in a decreased number of receptors on the postsynaptic membrane and a less sensitive nerve pathway. The only way a person who is addicted can maintain normal functioning of the nerve pathway is to continue taking the drug.

PTS: 1                    DIF: 2                    OBJ: 49-4.1

250.           ANS:

Cocaine prevents the reuptake of neurotransmitters from the synapse. The trapped neurotransmitters repeatedly stimulate neurons. Neurons adjust to the presence of cocaine by decreasing their number of neurotransmitter receptors. This causes neurons to become less and less sensitive, requiring more and more cocaine for stimulation.

PTS: 1

DIF: 1

OBJ: 49-4.2