

LABORATORY 5—CELL RESPIRATION

FIRST THINGS

The student will measure oxygen consumption during respiration in germinating or nongerminating peas.

THE BASICS

In order to be successful on this lab, the student should understand (a) how a respirometer works and (b) the process of metabolism in a living organism. After performing this lab, the student should understand how to (a) test the effects of temperature on peas in a controlled experiment, (b) calculate the rate of respiration, and (c) relate gas consumption and production to the respiration rate.

LAST THINGS

The student should be familiar with the formula for cellular respiration and how a respirometer works.

LABORATORY 6—MOLECULAR BIOLOGY

FIRST THINGS

The student will investigate some basic principles of genetic engineering.

THE BASICS

In order to be successful on this lab, the student should understand (a) gel electrophoresis, (b) principles of bacterial transformation, (c) proper cell preparation, (d) the role of plasmids in genetic engineering, (e) how restriction enzymes function, and (f) transfer of antibiotic resistance. After performing this lab, the student should understand how to (a) use plasmids in genetic research, (b) use restriction enzymes, (c) calculate transformation efficiency, (d) use multiple experimental controls, and (e) use DNA fragments of known size to calculate the size of unknown fragments.

LAST THINGS

The student should be familiar with how bacteria incorporate foreign DNA, how restriction enzymes function and electrophoresis, and how bacteria are “transformed.”

LABORATORY 7—GENETICS OF DROSOPHILA

FIRST THINGS

The student will use fruit flies to investigate genetic crosses.

THE BASICS

In order to be successful on this lab, the student should understand (a) chi-square analysis and (b) the life cycle of diploid organisms. After performing this lab, the student should understand how to (a) investigate independent assortment of two genes, (b) use a multigenerational study to investigate the interactions between the two genes, and (c) analyze the data from chi-square analyses.

LAST THINGS

The student should be familiar with Punnett squares and multigenerational study techniques.

LABORATORY 8—POPULATION GENETICS AND EVOLUTION

FIRST THINGS

The student will learn the Hardy-Weinberg law and the relationship between evolution and gene frequency.

THE BASICS

In order to be successful on this lab, the student should understand (a) how natural selection alters gene frequency, (b) the Hardy-Weinberg equation, and (c) the effects of allele frequency on natural selection. After performing this lab, the student should understand how to (a) calculate the frequency of alleles in the gene pool, (b) use the Hardy-Weinberg law to do this, and (c) discuss deviations from Hardy-Weinberg.

LAST THINGS

The student should be familiar with the Hardy-Weinberg law and know how to calculate allele frequencies and evolution.

LABORATORY 9—TRANSPIRATION

FIRST THINGS

The student will measure transpiration under varying laboratory conditions and how the structures in the plant stem and leaf relate to this.

THE BASICS

In order to be successful on this lab, the student should understand (a) how water moves in plants, (b) the role of transpiration in moving water in a plant, and (c) plant physiology. After performing this lab, the student should understand how to (a) test the role that environmental variables play in the rate of transpiration, (b) make a thin section of tissue, and (c) identify the cells in plant vascular tissue.

LAST THINGS

The student should be familiar with transpiration, plant physiology, and how to make thin sections of tissues.

LABORATORY 10—PHYSIOLOGY AND THE CIRCULATORY SYSTEM

FIRST THINGS

The student will, under a variety of conditions, learn how to measure and analyze blood pressure, measure pulse rate, and determine the effect of temperature on the heart beat of a water flea.

THE BASICS

In order to be successful on this lab, the student should understand the relationship between temperature and the rates of physiological activities. After performing this lab, the student should understand how to (a) measure heart rate and blood pressure, (b) describe the effect of body position on heart rate and blood pressure, (c) analyze cardiovascular data, (d) explain how exercise changes heart rate, and (e) discuss the effect temperature has on heart rate.

LAST THINGS

The student should be familiar with how to measure pulse and blood pressure and should know that heat increases physiological activity.

LABORATORY 11—HABITAT SELECTION

FIRST THINGS

The student will observe the behavior of an insect and design an experiment to investigate its responses to changing environments. The student will also observe mating behavior.

THE BASICS

In order to be successful on this lab, the student should understand (a) organism distribution with respect to resources, (b) kinesis and taxis, (c) how environmental factors affect habitat selection among organisms, and (d) how to describe different mating behaviors. After performing this lab, the student should be able to (a) design an experiment to investigate an organism's responses to environmental variables, (b) measure the effects of various environmental variables on habitat selection in a controlled experiment, and (c) describe the different types of insect mating behavior.

LAST THINGS

The student should be familiar with the variables that affect an organism's habitat selection.

LABORATORY 12—DISSOLVED OXYGEN AND AQUATIC PRIMARY PRODUCTIVITY

FIRST THINGS

The student will analyze the dissolved oxygen content in water and the productivity of laboratory cultures relative to the intensity of light.

THE BASICS

In order to be successful on this lab, the student should understand (a) the carbon and oxygen cycles in nature, (b) primary productivity in an ecosystem, (c) solubility of gases in water, and (d) how photosynthesis, respiration, and dissolved oxygen affect primary productivity. After performing this lab, the student should understand (a) how to measure primary productivity and (b) the effect that light and inorganic nutrients have on primary productivity.

LAST THINGS

The student should be familiar with the carbon and oxygen cycle; the effect that temperature, salinity, and photorespiration have on the solubility of dissolved gases; primary production; and the difference between gross and net productivity.

FINAL TIPS

Here, finally, are a few things to be aware of. In this area, students will be tested either on experimental design or analysis. If you must construct a graph, don't forget labels—use the x-axis for independent variables and the y-axis for dependent ones. Where appropriate, connect the dots and provide values along the axes clearly and regularly. When you design an experiment, you want to distinguish between the dependent and the independent variables. Identify the experimental values and the control values, and remember that every experiment tests only one independent variable at a time. Organisms must be the result of a random sample. Describe the procedure, the expected results, and why you expected those results based on applicable biological principles.

PRACTICE TEST 1

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

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

1. Print *BIOLOGY-E* or *BIOLOGY-M* on the line to the right under the words *Subject Test* (*print*).
2. In the shaded box labeled *Test Code* fill in four ovals:

For BIOLOGY-E
—Fill in oval 1 in the row labeled V.
—Fill in oval 9 in the row labeled W.
—Fill in oval 4 in the row labeled X.

For BIOLOGY-M
—Fill in oval 1 in the row labeled V.
—Fill in oval 9 in the row labeled W.
—Fill in oval 4 in the row labeled X.

Test Code								
V	2	3	4	5	6	7	8	9
W	1	2	3	4	5	6	7	8
X	1	2	3	4	5	6	7	8
Q	1	2	3	4	5	6	7	8
Subject Test (print) BIOLOGY-E								

Test Code								
V	2	3	4	5	6	7	8	9
W	1	2	3	4	5	6	7	8
X	1	2	3	4	5	6	7	8
Q	1	2	3	4	5	6	7	8
Subject Test (print) BIOLOGY-M								

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

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

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

TEST 1—Continued

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

Questions 1–3 refer to the following cellular structures:

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

1. Structure found in plant cells but not animal cells.

2. Structure that functions as the site of protein synthesis in cells.

3. Structure that contains the codes for the specific proteins produced by a cell.

Questions 4–6 refer to the following processes:

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

4. The process by which both plants and animals obtain energy for cellular function.

5. The process that allows higher plants to be autotrophic (able to manufacture their own food).

6. The process that leads to the production of ethyl alcohol or lactic acid.

TEST 1—Continued

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

7. Which of the groups below represents the correct relationship in order from smallest (or simplest) to largest (or more complex)?

- (A) matter — element — compound — electron — atom
- (B) electron — element — atom — compound — matter
- (C) electron — atom — element — matter — compound
- (D) electron — atom — element — compound — matter
- (E) atom — electron — element — compound — matter

10. Which of the following descriptions of a DNA molecule is NOT correct?

- (A) Synthesis is semiconservative.
- (B) Opposite strands are antiparallel.
- (C) It contains the sugar deoxyribose.
- (D) The number of adenines present is roughly equal to the number of thymines.
- (E) The number of cytosines present is roughly equal to the number of uracils.

11. What defines the Sahara Desert as a desert?

- (A) It is characterized by very hot temperatures.
- (B) The growing season is very short.
- (C) Cacti make up the dominant form of vegetation.
- (D) It is very dry.
- (E) The average temperature fluctuates very little between winter and summer.

8. Which of the following pairs does NOT represent a correct relationship?

- (A) glucose; polysaccharide
- (B) starch; polysaccharide
- (C) starch; carbohydrate
- (D) glucose; carbohydrate
- (E) glucose; monosaccharide

9. Which of the following statements is correct?

- (A) The product of transcription is DNA.
- (B) The product of transcription is mRNA.
- (C) The product of transcription is a protein.
- (D) The product of translation is mRNA.
- (E) The product of translation is DNA.

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TEST 1—Continued

12. Which of the following represents the correct sequence, from simplest to most complex?
- (A) population — organism — community — ecosystem — biosphere
 (B) organism — population — community — ecosystem — biosphere
 (C) organism — population — community — biosphere — ecosystem
 (D) population — organism — community — biosphere — ecosystem
 (E) organism — community — population — ecosystem — biosphere
13. Lichens are composed of both fungal and algal (or cyanobacterial) components. The fungal component absorbs water and nutrients for both organisms, while the algal component manufactures food for both organisms through photosynthesis. This type of symbiotic relationship is referred to as
- (A) parasitism.
 (B) commensalism.
 (C) predation.
 (D) mutualism.
 (E) interspecific competition.
14. In the Eastern United States, many forested areas were cleared for agricultural purposes. If cultivation was abandoned in those areas, they would eventually return to forests. This is an example of
- (A) primary succession.
 (B) secondary succession.
 (C) decomposition.
 (D) interspecific competition.
 (E) eutrophication.
- Questions 15–17 refer to the food chain illustrated below:
- rose bush — grasshopper — mouse — snake — hawk — earthworm
15. What trophic level is represented by the snake?
- (A) producer
 (B) primary consumer
 (C) secondary consumer
 (D) tertiary consumer
 (E) detritivore
16. The hawk could eat either the snake or the mouse and, thus, could represent which two different levels of the food chain?
- (A) producer and primary consumer.
 (B) primary and secondary consumer.
 (C) secondary and tertiary consumer.
 (D) tertiary and quaternary consumer.
 (E) quaternary consumer and detritivore.
17. Which organism in the food chain represents a detritivore?
- (A) earthworm
 (B) hawk
 (C) snake
 (D) mouse
 (E) grasshopper

TEST 1—Continued

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


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TEST 1—Continued

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

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

P	plants with single ruffled flowers	x	plants with double plain flowers
F ₁	all offspring have single plain flowers		
	F ₂ 200 plants have single plain flowers		
	89 plants have single ruffled flowers		
	10 plants have double plain flowers		
	32 plants have double ruffled flowers		

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

TEST 1—Continued

25. The results suggest that the inheritance of flower form and flower shape are controlled by
- (A) different alleles of the same gene.
 (B) two different genes on the same chromosome.
 (C) four different genes on the same chromosome.
 (D) two different genes on different chromosomes.
 (E) four different genes on different chromosomes.
26. There are three alleles of the gene that controls the inheritance of the ABO blood groups; the A and B alleles are co-dominant, and O is recessive to both the A and B alleles. A man with type B blood and a woman with type A blood could have children showing which of the following phenotype(s)?
- (A) A only
 (B) B only
 (C) AB only
 (D) A, B, or AB
 (E) A, B, AB, or O
27. Most recessive sex-linked traits, such as colorblindness, show up more frequently in males than females because
- (A) males have no corresponding allele on their X chromosome to mask the allele carried on their Y chromosome.
 (B) males have no corresponding allele on their Y chromosome to mask the allele carried on their X chromosome.
 (C) males carry all sex-linked traits on their Y chromosome.
 (D) females always carry at least one dominant allele for sex-linked traits because they have two X chromosomes.
 (E) females compensate by "turning" off the recessive allele through dosage compensation.

Questions 28–32 relate to various tissue types found in the human body. For each question, choose the term that corresponds to the definition given and fill in the corresponding oval on your answer sheet.

28. A special form of loose connective tissue that pads and insulates the body and stores fuel reserves is known as
- (A) epithelial tissue.
 (B) adipose tissue.
 (C) fibrous connective tissue.
 (D) nervous tissue.
 (E) muscle tissue.

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TEST 1—Continued

- 29.** The tissue that consists of long contractile cells (fibers) that are packed with microfilaments of actin and myosin is known as
- (A) epithelial tissue.
 (B) adipose tissue.
 (C) fibrous connective tissue.
 (D) nervous tissue.
 (E) muscle tissue.
- 30.** Tissue that lines the outer and inner surfaces of the body in protective sheets of tightly packed cells is known as
- (A) epithelial tissue.
 (B) adipose tissue.
 (C) fibrous connective tissue.
 (D) nervous tissue.
 (E) muscle tissue.
- 31.** The tissue that senses stimuli and transmits electrical signals to the brain and other parts of the body is known as
- (A) epithelial tissue.
 (B) adipose tissue.
 (C) fibrous connective tissue.
 (D) nervous tissue.
 (E) muscle tissue.
- 32.** Tissue consisting of a dense arrangement of parallel collagenous fibers found in tendons and ligaments is known as
- (A) epithelial tissue.
 (B) adipose tissue.
 (C) fibrous connective tissue.
 (D) nervous tissue.
 (E) muscle tissue.
- 33.** Which of the following correctly describes the relationship, from simplest to most complex, among the terms listed?
- (A) cell — tissue — organ — organism
 (B) organism — organ — tissue — cell
 (C) cell — tissue — organism — organ
 (D) tissue — cell — organ — organism
 (E) tissue — organ — organism — cell
- Questions 34–38 relate to various organ systems found in animals. For each question, choose the term that corresponds to the definition given and fill in the corresponding oval on your answer sheet.**
- 34.** The organ system that transports materials, such as nutrients, oxygen, and hormones, to body cells and transports carbon dioxide and various waste products away from cells is known as the
- (A) digestive system.
 (B) respiratory system.
 (C) circulatory system.
 (D) endocrine system.
 (E) nervous system.
- 35.** The organ system that forms a communication and coordination network throughout all parts of an animal's body is known as the
- (A) digestive system.
 (B) respiratory system.
 (C) circulatory system.
 (D) skeletal system.
 (E) nervous system.