



**AP[®] Biology
2007 Scoring Guidelines
Form B**

The College Board: Connecting Students to College Success

The College Board is a not-for-profit membership association whose mission is to connect students to college success and opportunity. Founded in 1900, the association is composed of more than 5,000 schools, colleges, universities, and other educational organizations. Each year, the College Board serves seven million students and their parents, 23,000 high schools, and 3,500 colleges through major programs and services in college admissions, guidance, assessment, financial aid, enrollment, and teaching and learning. Among its best-known programs are the SAT[®], the PSAT/NMSQT[®], and the Advanced Placement Program[®] (AP[®]). The College Board is committed to the principles of excellence and equity, and that commitment is embodied in all of its programs, services, activities, and concerns.

© 2007 The College Board. All rights reserved. College Board, Advanced Placement Program, AP, AP Central, SAT, and the acorn logo are registered trademarks of the College Board. PSAT/NMSQT is a registered trademark of the College Board and National Merit Scholarship Corporation.

Permission to use copyrighted College Board materials may be requested online at:
www.collegeboard.com/inquiry/cbpermit.html.

Visit the College Board on the Web: www.collegeboard.com.

AP Central is the official online home for the AP Program: apcentral.collegeboard.com.

**AP[®] BIOLOGY
2007 SCORING GUIDELINES (Form B)**

Question 1

Without adaptive behaviors, animals would not survive.

- (a) **Describe** what innate and learned behaviors are. **Explain** the adaptive value of each of these two categories of behavior to an individual animal.

One point for each of the following explanations/identifications (4 points maximum):

- Description or definition of innate behavior
- Description or definition of learned behavior (change with experience/trial and error)
- Explanation of how innate behavior is adaptive
- Explanation of how learned behavior is adaptive

- (b) During mating season, male snakes exhibit tracking behavior when they follow chemical pheromone trails deposited on the ground by females. **Design** a controlled experiment to determine whether a male garter snake will track only a female of his species or will also follow the female of a related species.

One point for each of the following explanations/identifications (7 points maximum):

- Hypothesis/prediction of results
- Description of the independent variable (female of same species and female of different species)
- Description of how to measure movement (e.g., sensors, observation)
- Description of how to measure male's choice (e.g., Y-maze, *in situ* observation)
- Verification of results (e.g., repetitions, number of snakes)
- Statistical analysis
- Control group (no female snakes)
- Control of at least one variable (e.g., sexually mature snakes, temperature, light, mating season)

AP[®] BIOLOGY
2007 SCORING GUIDELINES (Form B)

Question 2

The defenses of the human body to the entry and establishment of a pathogen (disease-causing organism) can be divided into nonspecific responses and specific responses.

- (a) **Explain** how THREE types of nonspecific defenses can prevent the entry and/or establishment of a pathogen in a person's body.

One point for each of the following explanations/identifications (3 points maximum):

- Barrier (skin)
- Traps (mucous membranes, cilia, hair, ear wax)
- Phagocytosis (white blood cells)
- Elimination (coughing, sneezing, urination)
- Unfavorable pH (stomach acid, sweat, saliva, urine)
- Unfavorable environment (normal flora, fatty acids, enzymes)
- Cell destruction (complement, natural killer cells)
- Interference with viral replication (interferon)
- Lysozyme action (tears, sweat)
- Inflammatory response (increase in body temperature, capillary permeability, attraction of macrophages, histamine release, vasodilation)

- (b) **Discuss** how the immune system responds to an initial pathogenic exposure, and how this initial exposure can lead to a quicker response following a second exposure to the same pathogen.

One point for each of the following explanations/identifications (6 points maximum):

- APCs (macrophages, dendritic cells, B cells) present antigen
- B cells/plasma cells produce/secrete antibodies
- Helper T cells activate B cells, cytotoxic T cells, and/or macrophages
- Cytotoxic T cells cause cell death (apoptosis)
- Ag presented on MHC
- Explanation of how antibodies destroy the pathogen
- Secretion of cytokines (or interleukins) to signal or activate
- Memory cells produced in primary response speed up secondary response

- (c) **Explain** the biological mechanisms that lead to the rejection of transplanted organs.

One point for each of the following explanations/identifications (3 points maximum):

- Cell-mediated response or explanation of cytotoxic T, CD8, killer T cells, or natural killer cells
- Concept of nonself (foreign) or MHC incompatibility
- Explanation of the role of cell death or apoptosis or cell lysis

Note: To obtain a score of 10, the student must earn the memory cell point in part (b).

AP[®] BIOLOGY
2007 SCORING GUIDELINES (Form B)

Question 3

A molecule of messenger RNA (mRNA) has just been synthesized in the nucleus of a human cell.

- (a) What type of modifications may occur to this RNA before it leaves the nucleus?

One point for each of the following explanations/identifications (3 points maximum):

- Difference between introns and exons
- Description of splicing
- 5' cap added or description of function
- 3' poly A tail added or description of function

- (b) Once in the cytoplasm, how is the mRNA translated to a protein?

One point for each of the following explanations/identifications (6 points maximum):

- Description of the role of tRNA in the transport of amino acids
- Description of the ribosome/rRNA
- Peptide bond formation (or the connecting of amino acids into a polypeptide chain)
- Concept of codon-anticodon binding
- Concept of the role of the genetic code (e.g., mRNA bases determine the sequence of amino acids)
- Description of stages (initiation, elongation, and termination)
- Elaboration point for a detailed explanation—examples of acceptable answers include, but are not limited to, the following:
 - Description of 40S and 60S ribosomal subunits
 - Role of aminoacyl-tRNA synthetase
 - Structure of tRNA
 - Use of GTP as energy source

- (c) If the cell is a secretory cell, how is the protein from part (b) eventually targeted, packaged, and secreted to the exterior of the cell?

One point for each of the following explanations/identifications (3 points maximum):

- Role of chaperones in folding a polypeptide into the protein
- Modification of the protein or addition of sugars and/or phosphate
- Concept of the endomembrane system (description of protein moving from ER to Golgi to vesicles)
- Exocytosis through the fusion of the vesicle with the cell membrane

AP[®] BIOLOGY
2007 SCORING GUIDELINES (Form B)

Question 4

The energy flow in ecosystems is based on the primary productivity of autotrophs.

(a) **Discuss** the energy flow through an ecosystem and the relative efficiency with which it occurs.

One point for each of the following explanations/identifications (6 points maximum):

- Conversion of light (or inorganic chemical) energy to cellular chemical energy
- Explanation that conversion is the result of photosynthesis or chemoautotrophy
- Concept that energy moves from one trophic level to another
- Understanding that there is a dramatic decrease in the amount of energy transferred from one trophic level to the next
- Energy loss is the result of metabolic activity/heat loss from one trophic level to the next
- Explanation of the concept of primary productivity

(b) **Discuss** the impact of the following on energy flow on a global scale.

- Deforestation
- Global climate change

One point for each of the following explanations/identifications (6 points maximum):

Deforestation (3 points)	Global climate change (3 points)
<u>Impact</u> • Loss of energy • Removal of primary producers • Destruction of habitat decreases food supply • Disruption of ecosystem • Natural succession—NO change in energy flow • Clear-cutting for agriculture increases primary productivity • Clear-cutting for development decreases primary productivity	<u>Definition</u> • Alternation of climate/global warming or cooling <u>Impact</u> • Increase or decrease in numbers of producers • Increase or decrease in energy • Increase or decrease in metabolism/energy • Changes in respiratory heat depending on the ecosystem • Replacement of productive ecosystems with less productive ones (desertification, tundrification)