



**AP[®] Biology
2002 Scoring Guidelines
Form B**

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Question 1

1. (a) **Describe** and explain the observed results. (1 point for each bullet, 4 points maximum)
- description only of relative numbers of bacteria and viruses over time; must include initial bacterial growth phase
 - bacterial growth dynamics (exponential phase, carrying capacity)
 - infection phase (virus “attacks” bacteria, bacteria decline while virus multiplies)
 - recovery phase (resistant mutant/immune bacteria survive to reproduce, virus number drops)
 - co-existence phase (viruses multiply only in non-resistant/“sensitive” cells or lysogenic situation develops)
 - exceptional description of a particular phase
 - population reaches an equilibrium
1. (b) **Discuss** the infection cycle of a DNA virus from attachment to lysis (4 points maximum)
- attachment to host cell (cell wall, membrane, etc., attachment to something)
 - penetration/injection of DNA/nucleic acid
 - synthesis of viral components (nucleic acids and/or proteins)
 - assembly/packaging of viruses
 - lysis (release, budding); needs details beyond simply cells burst/lysed
1. (c) **Describe** how the genome of a retrovirus like HIV (Human Immunodeficiency Virus) becomes incorporated into the genome of the host cell. (4 points maximum)
- retrovirus = RNA virus
 - use of reverse transcriptase (enzyme) to create DNA “version”
 - single strand to double strand conversion
 - enzymatic incorporation into human genome, give at least one enzyme
 - exceptional description of mechanism

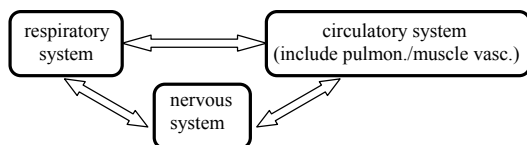
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Question 2

2. (a) **Discuss** the interactions of the respiratory, circulatory, and nervous systems during exercise. (4 points maximum)

*Note: Must have a “detail” on one side or the other of the interaction
non-inclusive list of possible examples . . .*



nervous system ← interacting with → respiratory system
 medulla oblongata diaphragm/ intercostals
 ANS/sympathetic, adrenalin bronchodilation
 chemosensory neurons (pH, O₂, CO₂, etc.)

respiratory system ← interacting with → circulatory system
 alveoli (small, thin air sacs) capillaries, erythrocytes, hemoglobin

circulatory system ← interacting with → exercising muscle
 blood containing O₂/glucose produces ATP using O₂/glucose
 anaerobic – lactic acid

nervous system ← interacting with → circulatory system
 accelerator nerve SA/AV node (heart rate)
 ANS, sympathetic neurons vasodilation/vasoconstriction
 chemosensory neurons (pH, O₂, CO₂, etc.) stroke volume

2. (b) **Design** a controlled experiment to determine the relationship between intensity of exercise and heart rate. (4 points maximum)

- hypothesis statement/prediction of results
- correctly describe the concept of a “control” group (baseline, resting)
- specify matched subjects (age, sex, fitness, twins, etc.)
- describe parameters of the exercise protocol
- describe how the heart rate will be measured (e.g., pulse, EKG, etc.)
- specify all other conditions stay the same (only one independent variable)
- statistical analysis
- large sample size/repetition (reliability)

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Question 2 (cont'd.)

2. (c) On the axes provided below, **indicate** results you expect for both the control and the experimental groups for the controlled experiment you described in part B. Remember to label the axes. (3 points maximum)

- axes labeled with continuous scalar values and correct unit
- independent variable on X axis, dependent (results) on Y axis
- plots indicate correct relationship between control and experimental group

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Question 3

6 points maximum for part (a) and part (b) below

For each of the three polymers chosen, **describe** its:

- (a) structure, and (**6 points maximum**)
- (b) role in a cell or organism (**6 points maximum**)

In the following tables, **structural characteristics** are listed first (**2 points maximum**) then a row of asterisks * * * * * and finally, **roles** (**2 points maximum**) are listed under the row of asterisks.

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Question 3 (cont'd.)

structure max. 2 points	Tubulin protein (amino acid) polymer α and β forms forms hollow tubes *****	Myosin protein (amino acid) polymer has actin-binding sites (crossbridges) has ATP-binding site (crossbridges) *****
	role max. 2 points component of microtubules maintain cell shape (cytoskeleton) compose cilia and flagella help in chromosome migration/organelle movement	hydrolysis of ATP “flexes” actin-bound myosin crossbridges cause “sliding filament motion”
structure max. 2 points	Cellulose carbohydrate/polysaccharide (glucose polymer) β -glucose form special β -glycosidic linkages straight, unbranched molecule (rigid) often bond in parallel bundles = microfibrils (fibers) water-insoluble *****	Chitin N-containing carbohydrate/polysaccharide (N-acetylglucosamine polymer) water-insoluble *****
	role max. 2 points plant cell wall component digestible for some microbes indigestible for others shape/firmness/stability	fungal cell wall component arthropod exoskeleton material
structure max. 2 points	Messenger RNA nucleic acid (nucleotide polymer) sugar/phosphate backbone with bases in center A, C, G, U nitrogen bases complement of DNA section 5' $\Rightarrow$ 3' orientation cap and/or polyA tail introns/exons (post-transcriptional modification) single-stranded *****	Transfer RNA nucleic acid (nucleotide polymer) sugar/phosphate backbone with bases in center A, C, G, U nitrogen bases amino acid binding site anticodon triplet 3' $\Rightarrow$ 5' orientation single-stranded except 4 base-paired regions (clover-leaf shape) *****
	role max. 2 points carries genetic message from DNA to ribosome/ exits nucleus template upon which protein is formed at ribosome gene regulation	transfers amino acids from cytoplasm to ribosome allows attachment of amino acids onto peptide chain

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Question 4

4. (a) **Identify** the three germ layers of a triploblastic embryo and **discuss** the fates of these germ layers in embryonic development. (4 points maximum)

- name the three layers: ectoderm, mesoderm, endoderm
- ectoderm derivatives:
 - epidermal structures including hair, nails (gives protection)
 - linings of anterior and posterior digestive tracts
 - nervous system and sense organs
- mesoderm derivatives:
 - connective tissues
 - circulatory system
 - muscles, bones
 - notochord
 - dermis of skin
 - gonads
 - kidneys
- endoderm derivatives:
 - digestive system lining
 - respiratory system lining (lungs and gills)
 - liver, pancreas, thyroid, parathyroid, thymus

4. (b) **Describe** acoelomate, pseudocoelomate, and coelomate body plans. **Identify** an animal that is representative of **each** of these types of body plans. (3 points maximum)

- acoelomate = no body cavity (solid body); Platyhelminthes
- pseudocoelomate = body cavity but NOT completely lined with mesoderm; Nematoda and Rotifera
- coelomate = body cavity completely lined with mesoderm; Annelida, Mollusca, Arthropoda, Echinodermata, or Chordata
- each of the three body plans has either a correct description or a correct example

4. (c) **Compare and contrast** the digestive systems of an acoelomate and a coelomate organism. (4 points maximum)

- gastrovascular cavity vs. complete digestive tract
- single opening (mouth-anus) vs. two openings
- no specialization of compartments in system vs. specialization along tract digestion usually extracellular in both