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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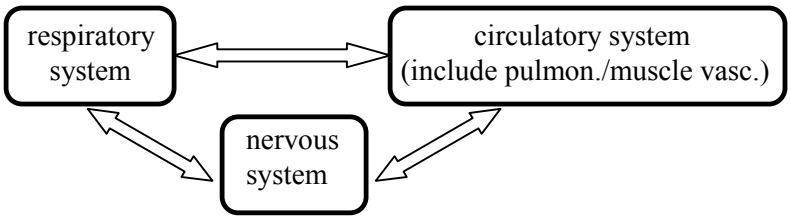
Question 2

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 medulla oblongata ANS/sympathetic, adrenalin chemosensory neurons (pH, O_2, CO_2, etc.)	← *interacting with* →	respiratory system diaphragm/ intercostals bronchodilation
respiratory system alveoli (small, thin air sacs)	← *interacting with* →	circulatory system capillaries, erythrocytes, hemoglobin
circulatory system blood containing O_2 /glucose	← *interacting with* →	exercising muscle produces ATP using O_2/glucose anaerobic – lactic acid
nervous system accelerator nerve ANS, sympathetic neurons chemosensory neurons (pH, O_2, CO_2, etc.)	← *interacting with* →	circulatory system SA/AV node (heart rate) vasodilation/vasoconstriction 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)

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.

Question 3 (cont'd.)

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

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, Molluska, 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