



AP Biology 2001 Scoring Guidelines

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Question 1

A maximum 4 points for each component.

Elaboration point: 1 point for either **structure** or **function** after the first 2 points have been earned

* = required element to receive elaboration point

1 point (a) Describe structure	1 point (a) Explain how structure is responsible for function (must be linked to structure described)	1 point (b) Explain how the structure contributes to the function of the <u>organ system</u> to which it belongs
Sarcomere * Thin-thick (i.e., actin-myosin or protein) filaments (i.e., myofilaments) • cross-bridges • troponin-tropomyosin complex/Ca^{++} binding • detailed description of sarcomere (e.g., A-band, Z-line, etc.)	* Shortening of sarcomere (unit) causes contraction • sliding of actin filaments during contraction • number of groups of sarcomeres regulate strength of muscle contraction	* Cause a muscle fiber (muscle) to contract (shorten) in the muscular system (muscle) OR movement in muscle
Neuron * Cell with dendrites and axon OR axon and dendrites and cell body OR nerve cell with cytoplasmic extensions • myelin sheath/Node of Ranvier • plasma membrane (neurilemma) • Na^+/K^+ pump-gated channels • synaptic knobs/dendrite membrane receptors • axon hillock (i.e., neck of cell body)	* Generate/conduct/transmit impulses (electrical/chemical signals or messages) • speed of impulse transmission • change in membrane polarity • change in membrane polarity • neurotransmitters • origin of depolarization	* Conduct impulses (electrical/chemical signals or messages) in the nervous system
Nephron * (Renal) tubules and capillaries (glomerulus) OR * Tubular excretory unit of the kidney • filtering unit • PCT, loop of Henle, DCT, collecting duct • epithelial cells • single layer of epithelial cells	* Filtration of materials from blood • (re)absorption of materials (e.g., HCO_3^-, NaCl, H_2O, glucose, amino acids, vitamins, K^+, urea) • tubular secretion of materials (H^+, NH_4^+, K^+, drugs, toxins) • counter-current multiplier	* Regulates osmolarity/ waste removal/ homeostasis in urinary (excretory) system

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Question 1 (cont.)

Villus * Finger-like (hair-like) projections in <u>small intestine</u> • microvilli (brush border) • capillary bed and lacteals • single-cell layer/simple columnar epithelial • tight junction • goblet cells * Also acceptable: Chorionic villus Finger-like projection in the placenta	* Absorption of digested material (nutrients) • increase surface area • secrete mucus Maternal-fetal exchange for nutrients, gases, etc.	* Increases amount of surface area for absorption of nutrients in digestive system Increases surface area for exchange in the reproductive system during fetal development
Capillary * Small(est) blood vessel (i.e., tiny tubes carrying blood) • one-cell layer • simple squamous epithelial (endothelium) • porous (fenestrated) • connects arterioles (arteries,metarterioles) to venules (veins)	* Movement of material (gases, nutrients, wastes, hormones, etc.) across capillary membrane • increases surface area • blood cells moving through one at a time • low pressure • slowest velocity of blood • allows passage (conduit) for white blood cells • heat dissipation	* Increases vessel contact with all body cells for the exchange of substances between body cells and blood in the circulatory system OR increases surface area in the circulatory system OR a description of a capillary network in the circulatory system
Alveolus * Air sac OR * Thin (single-celled) layer • simple, squamous, epithelial cells • moist permeable membrane • surfactant • thin basement membrane	* Allows gas diffusion (site to site) • surface area (High SA/V ratio) • close association with capillaries • reduces surface tension, prevents collapse of alveolus • enhance diffusion	* Increases amount of surface area which allows for the exchange of gases in respiratory system

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Question 2

2. (a) A maximum of 6 points may be given for part (a). A single point may be awarded for each concept that follows. Beware of anything that sounds like a Lamarckian statement.
- **Reproductive potential** — the ability to over produce
 - **Variability** — inheritable changes or mutations linked to variability
 - **Limited resources** — biotic or abiotic
 - **Competition** — intraspecific struggle for existence
 - **Differential Reproduction** — reproductive success of variants
 - **Generations** — time needed for evolution to occur
 - **Elaboration** — expansion of Darwin's ideas such as the effects of environmental change or artificial selection or good, linked example
2. (b) A maximum of 6 points can be scored in part (b).
A student may not receive a total score of ten without attempting to respond to three sections of part (b).
A single point may be awarded for each of the following:
- (i)
- 1 point Different species exhibit adaptations as a result of the same environment
1 point Correct descriptive example linked to biome and survival value or linked to natural selection
- (ii)
- 1 point An inherited characteristic enables the organism to resist the effect of the toxin
1 point Specific example, mechanisms of resistance, or extensive elaboration or link to natural selection
- (iii)
- 1 point A single population divides into two reproductively isolated populations or equivalent (use of gene pools)
1 point Role of barriers in speciation or discuss gene pool separation or link to natural selection
- (iv)
- 1 point Define or describe the behavior
1 point Give a clear example of how this behavior enhances survival or link to natural selection
- (v)
- 1 point Survival value of heterozygote over both homozygotes
1 point An example of how the heterozygous enhances the survival of the organism or link to natural selection

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Question 3

3. (a) 4 points possible

1 point for proper orientation of graph (independent variable on x-axis)

1 point for graph (all of the elements below must be present)

- Uniform spacing of units
- Correct labeling of axes
 - proper numbering (a minor error acceptable)
 - X-axis label: "Time"/ "Hour"/a.m., p.m. labels/a conversion to integers requires unit label as well
 - Y-axis: oxygen label **and** mg/L Unit

1 point for correct plot of data points

- No connecting line necessary
- No point if more than one data point is misplotted
- No point if there is a **solid** extrapolation line beyond the 6:00 a.m. data point to the origin **or** the 12 midnight data point

1 point for drawing the cloudy day prediction Line/Curve (all of the elements below must be present)

- Distinguish between the two curves with a legend or direct labeling of one curve
- Position completely under the bright-day curve (may touch toward the tails)
- There must be some curve to the line (no flat lines)

3. (b) 5 points possible

1 point Photosynthesis: production of O₂ correlated with light changes (i.e., explains changes in shape of bright-day curve). The student must link **photosynthesis to increase in light to increase in O₂** production. The student must use the term "photosynthesis" or an excellent replacement such as the chemical equation for the process.

1 point Respiration: consumption of O₂. Must link **respiration to decrease in O₂**. The student must use the term "respiration" or an excellent replacement such as the chemical equation for the process or the name of another appropriate process such as "decomposition."

1 point Description of the **interaction** of the above: photosynthetic rate changes while respiration rate remains relatively constant.

1 point Overcast prediction curve explanation

- Reduced light leads to decreased photosynthetic O₂ production, etc.
- No point given if there is no prediction line/curve on the graph.

1 **elaboration point (maximum)** for any one of the above. Examples of elaboration may include, but are not limited to:

- Water split/photolysis to produce O₂ in the light phase, etc.
- **Balanced** equation for photosynthesis or respiration (unless used as a substitute for the term above)
- Description of "light phase" processes (photosystem II, etc.)
- Gross vs. net productivity

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Question 3 (cont.)

3. (c) 3 points possible

1 point for describing (predicting) a change in lake conditions such as (must be related to the question)

- increased/decreased O₂
- increased/decreased biomass or numbers of organisms
- increased/decreased CO₂
- long-term or short-term changes
- no change

1 point for an explanation of the prediction above (may include toxic effects due to significant changes in pH, altered osmolarity, etc.)

1 **elaboration point** for the explanation of the prediction above **or** long term ecological consequences to lake.

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Question 4

4. (a) 4 points maximum

Chemical composition — **2 points maximum**

1 point amino acids are the basic building blocks of proteins

1 point amino acids contain amino, carboxyl and R groups

or

correct structural formula showing amino, carboxyl, and R group attached to central carbon

or

proteins are composed of carbon, hydrogen, oxygen and nitrogen

1 point R group determines the identity/properties of the amino acid

Elaboration

1 point for a description of addition of lipids, carbohydrates, and/or prosthetic group

Levels of structure — **3 points maximum** (Note: to obtain any points, response must name level or list in correct order.)

Primary structure — **1 point**

- sequence (chain, string) of amino acids or the number and order of amino acids
- amino acids linked by peptide bonds
- amino acids bonded through dehydration synthesis

Secondary structure — **1 point**

- helix and/or pleated sheet
- hydrogen bonds (between carboxyl and amino groups)

Tertiary structure — **1 point**

- single polypeptide chain forms globular shape
- hydrogen, ionic, disulfide, and van der Waals bonds, and/or hydrophobic interactions (if hydrogen must have more than one)
- interaction between R groups

Quaternary structure — **1 point**

- more than one polypeptide or subunit
- hydrogen, ionic, disulfide, and van der Waals bonds, and/or hydrophobic interactions (if hydrogen must have more than one)
- interaction between R groups

Elaboration — **1 point**

- explanation of domains
- explanation of chaperones

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Question 4 (cont.)

4. (b) 4 points maximum

Global understanding of information flow — **1 point**

- information in DNA is transcribed to mRNA which is translated into protein
- DNA contains the information that ultimately determines the sequence of amino acids in the protein

Roles

DNA — **1 point**

- codes for RNA, mRNA, tRNA, or rRNA

mRNA — **1 point**

- codes for amino acid sequence

tRNA — **1 point**

- brings the correct amino acid to the ribosome/mRNA
- contains anticodon complementary to codon

rRNA — **1 point**

- forms part of ribosome

Elaboration — **1 point**

- intron removal by RNA/snRNP/snRNA
- alternative splicing provides protein diversity
- acts as ribozyme/involved in formation of peptide bond
- rRNA finds and binds start AUG of mRNA (in prokaryotes)

4. (c) 4 points maximum

Role in membrane structure — **2 points maximum**

1 point — description of integral and/or peripheral proteins

1 point — membrane synthesis

1 point — defines membrane sidedness

Membrane function other than transport

1 point — receptors

1 point — enzymes

1 point — cell to cell communication

1 point — anchoring of cytoskeleton or extracellular matrix

1 point — spatial configuration of reaction pathways (e.g., electron transport system)

1 point — cell recognition

1 point — cell junctions

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Question 4 (cont.)

Role in transport — **3 points maximum**

- 1 point** — transport proteins may be specific
- 1 point** — process may require direct input of energy (e.g., use of ATP)
- 1 point** — description of transport mechanisms (bind molecule, conformational change, release molecule) **or** description of how proteins form channels and move molecules through them

Elaboration — **1 point**

- description of a specific transport system (e.g., ATP synthase, Na⁺/K⁺ pump, receptor mediated endocytosis)
- description of chemiosmosis
- more than one molecule transported (e.g., symport, antiport)
- may be regulated by electrical or chemical stimuli (gated channels)