



AP Biology 2001 Free-Response Questions

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2001 AP[®] BIOLOGY FREE-RESPONSE QUESTIONS

BIOLOGY

SECTION II

Time—1 hour and 30 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions in the pink booklet.

1. In biological systems, structure and function are related. Choose three of the following components of organ systems.

alveolus	villus
sarcomere	capillary
nephron	neuron

- (a) For each component, **describe** the structure of the component and **explain** how that structure is responsible for the function of that component.
- (b) For the three components that you chose in part a, **explain** how the structure of the component contributes to the functioning of the organ system to which it belongs.
2. Charles Darwin proposed that evolution by natural selection was the basis for the differences that he saw in similar organisms as he traveled and collected specimens in South America and on the Galapagos Islands.
- (a) **Explain** the theory of evolution by natural selection as presented by Darwin.
- (b) Each of the following relates to an aspect of evolution by natural selection. **Explain** three of the following.
- (i) Convergent evolution and the similarities among species (ecological equivalents) in a particular biome (e.g., tundra, taiga, etc.)
 - (ii) Natural selection and the formation of insecticide-resistant insects or antibiotic-resistant bacteria
 - (iii) Speciation and isolation
 - (iv) Natural selection and behavior such as kinesis, fixed-action-pattern, dominance hierarchy, etc.
 - (v) Natural selection and heterozygote advantage

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3. A biologist measured dissolved oxygen in the top 30 centimeters of a moderately eutrophic (mesotrophic) lake in the temperate zone. The day was bright and sunny, and the wind was calm. The results of the observations are presented below.

Hour	[O ₂]
6:00 A.M.	0.9 mg/L
8:00 A.M.	1.7 mg/L
10:00 A.M.	3.1 mg/L
12:00 noon	4.9 mg/L
2:00 P.M.	6.8 mg/L
4:00 P.M.	8.1 mg/L
6:00 P.M.	7.9 mg/L
8:00 P.M.	6.2 mg/L
10:00 P.M.	4.0 mg/L
12:00 midnight	2.4 mg/L

- (a) Using the graph paper provided, **plot** the results that were obtained. Then, using the same set of axes, draw and label an additional line/curve representing the results that you would predict had the day been heavily overcast.
- (b) **Explain** the biological processes that are operating in the lake to produce the observed data. **Explain** also how these processes would account for your prediction of results for a heavily overcast day.
- (c) **Describe** how the introduction of high levels of nutrients such as nitrates and phosphates into the lake would affect subsequent observations. **Explain** your prediction.
4. Proteins—large complex molecules—are major building blocks of all living organisms. Discuss the following in relation to proteins.
- (a) The chemical composition and levels of structure of proteins
- (b) The roles of DNA and RNA in protein synthesis
- (c) The roles of proteins in membrane structure and transport of molecules across the membrane

END OF EXAMINATION