



AP[®] Biology
2012 Free-Response Questions

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2012 AP[®] BIOLOGY FREE-RESPONSE QUESTIONS

BIOLOGY
SECTION II

Time—1 hour and 30 minutes

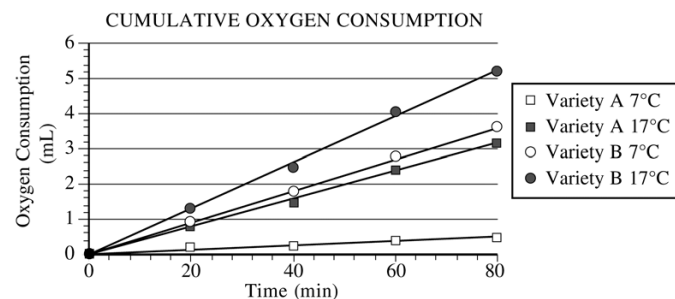
Directions: Answer all questions.

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 this booklet.

1. The ability to reproduce is a characteristic of life.
 - (a) **Describe** the process of embryological development in a typical vertebrate embryo, beginning with a fertilized egg and ending with the development of three tissue layers.
 - (b) **Identify** the developmental origin of TWO of the following tissues in vertebrates:
 - central nervous system
 - digestive system
 - muscle
 - (c) **Identify** and **explain** THREE differences between the embryological development of protostomes and the embryological development of deuterostomes.
 - (d) **Explain** TWO unique properties of human embryonic stem cells that distinguish them from other human cell types. **Describe** a current medical application of human stem cell research.

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2. An agricultural biologist was evaluating two newly developed varieties of wheat as potential crops. In an experiment, seedlings were germinated on moist paper towels at 20°C for 48 hours. Oxygen consumption of the two-day-old seedlings was measured at different temperatures. The data are shown in the graph below.



- (a) **Calculate** the rates of oxygen consumption in mL/min for each variety of wheat at 7°C and at 17°C. **Show** your work (including your setup and calculation).
- (b) **Explain** the relationship between metabolism and oxygen consumption. **Discuss** the effect of temperature on metabolism for each variety of seedlings.
- (c) In a second experiment, variety A seedlings at both temperatures were treated with a chemical that prevents NADH from being oxidized to NAD⁺. **Predict** the most likely effect of the chemical on metabolism and oxygen consumption of the treated seedlings. **Explain** your prediction.
3. Information flow in cells can be regulated by various mechanisms.
- (a) **Describe** the role of THREE of the following in the regulation of protein synthesis:
- RNA splicing
 - repressor proteins
 - methylation
 - siRNA
- (b) Information flow can be altered by mutation. **Describe** THREE different types of mutations and their effect on protein synthesis.
- (c) **Identify** TWO environmental factors that increase the mutation rate in an organism, and **discuss** their effect on the genome of the organism.
- (d) Epigenetics is the study of heritable changes in the phenotype caused by mechanisms other than changes in the DNA sequence. **Describe** ONE example of epigenetic inheritance.

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4. The element carbon is contained in all organic compounds.
- (a) **Discuss** the role of photosynthesis and cellular respiration in carbon cycling in the biosphere.
- (b) For THREE of the following, **predict** and **explain** the effect on the carbon cycle if:
- decomposers were absent
 - deforestation occurred
 - volcanic dust accumulated in the atmosphere
 - the average ocean temperature increased
- (c) **Explain** how increased CO₂ in the atmosphere results in greater acidification of oceans and **describe** the effect on marine organisms. **Include** in your discussion TWO examples of how human activity can increase atmospheric CO₂.

STOP

END OF EXAM