



AP[®] Biology
2002 Free-Response Questions

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2002 AP[®] BIOLOGY FREE-RESPONSE QUESTIONS

BIOLOGY
SECTION II

Time—1 hour and 30 minutes

Directions: Answer all questions.

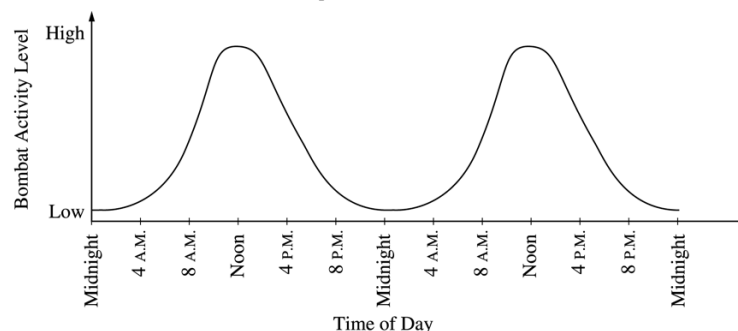
Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions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

1. The human genome illustrates both continuity and change.
 - (a) **Describe** the essential features of **two** of the procedures/techniques below. For **each** of the procedures/techniques you describe, **explain** how its application contributes to understanding genetics.
 - The use of a bacterial plasmid to clone and sequence a human gene
 - Polymerase chain reaction (PCR)
 - Restriction fragment length polymorphism (RFLP) analysis
 - (b) All humans are nearly identical genetically in coding sequences and have many proteins that are identical in structure and function. Nevertheless, each human has a unique DNA fingerprint. **Explain** this apparent contradiction.

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2. The activities of organisms change at regular time intervals. These changes are called biological rhythms. The graph depicts the activity cycle over a 48-hour period for a fictional group of mammals called pointy-eared bombats, found on an isolated island in the temperate zone.



- (a) **Describe** the cycle of activity for the bombats. **Discuss** how **three** of the following factors might affect the physiology and/or behavior of the bombats to result in this pattern of activity.
- temperature
 - food availability
 - presence of predators
 - social behavior
- (b) **Propose** a hypothesis regarding the effect of light on the cycle of activity in bombats. **Describe** a controlled experiment that could be performed to test this hypothesis, and the results you would expect.
3. The complexity of structure and function varies widely across the animal kingdom. Despite this variation, animals exhibit common processes. These include the following.
- transport of materials
 - response to stimuli
 - gas exchange
 - locomotion
- (a) Choose **two** of the processes above and for each, **describe** the relevant structures and how they function to accomplish the process in the following phyla.
- Cnidaria (e.g., hydra, jellyfish)
Annelida (e.g., earthworm)
Chordata (e.g., mouse)
- (b) **Explain** the adaptive (evolutionary) value(s) of the structural examples you described in part a.

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4. The following experiment was designed to test whether different concentration gradients affect the rate of diffusion. In this experiment, four solutions (0% NaCl, 1% NaCl, 5% NaCl, and 10% NaCl) were tested under identical conditions. Fifteen milliliters (mL) of 0% NaCl were put into a bag formed of dialysis tubing that is permeable to Na^+ , Cl^- , and water. The same was done for each NaCl solution. Each bag was submerged in a separate beaker containing 300 mL of distilled water. The concentration of NaCl in mg/L in the water outside each bag was measured at 40-second intervals. The results from the 5% bag are shown in the table below.

CONCENTRATION IN mg/L OF NaCl OUTSIDE THE 5% NaCl BAG

Time (seconds)	NaCl (mg/L)
0	0
40	130
80	220
120	320
160	400

- (a) On the axes provided, **graph** the data for the 5% NaCl solution.
- (b) Using the same set of axes, **draw** and **label** three additional lines representing the results that you would predict for the 0% NaCl, 1% NaCl, and 10% NaCl solutions. Explain your predictions.
- (c) Farmlands located near coastal regions are being threatened by encroaching seawater seeping into the soil. In terms of water movement into or out of plant cells, explain why seawater could decrease crop production. Include a discussion of water potential in your answer.

END OF EXAMINATION