



## **AP<sup>®</sup> Biology 2004 Free-Response Questions**

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# 2004 AP<sup>®</sup> 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. Meiosis reduces chromosome number and rearranges genetic information.
  - (a) **Explain** how the reduction and rearrangement are accomplished in meiosis.
  - (b) Several human disorders occur as a result of defects in the meiotic process. **Identify** ONE such chromosomal abnormality; what effects does it have on the phenotype of people with the disorder? **Describe** how this abnormality could result from a defect in meiosis.
  - (c) Production of offspring by parthenogenesis or cloning bypasses the typical meiotic process. **Describe** either parthenogenesis or cloning and **compare** the genomes of the offspring with those of the parents.
  
2. Darwin is considered the “father of evolutionary biology.” Four of his contributions to the field of evolutionary biology are listed below.
  - The nonconstancy of species
  - Branching evolution, which implies the common descent of all species
  - Occurrence of gradual changes in species
  - Natural selection as the mechanism for evolution
  - (a) For EACH of the four contributions listed above, **discuss** one example of supporting evidence.
  - (b) Darwin’s ideas have been enhanced and modified as new knowledge and technologies have become available. **Discuss** how TWO of the following have modified biologists’ interpretation of Darwin’s original contributions.
    - Hardy-Weinberg equilibrium
    - Punctuated equilibrium
    - Genetic engineering

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3. A controlled experiment was conducted to analyze the effects of darkness and boiling on the photosynthetic rate of incubated chloroplast suspensions. The dye reduction technique was used. Each chloroplast suspension was mixed with DPIP, an electron acceptor that changes from blue to clear when it is reduced. Each sample was placed individually in a spectrophotometer and the percent transmittance was recorded. The three samples used were prepared as follows.

- Sample 1 – chloroplast suspension + DPIP
- Sample 2 – chloroplast suspension surrounded by foil wrap to provide a dark environment + DPIP
- Sample 3 – chloroplast suspension that has been boiled + DPIP

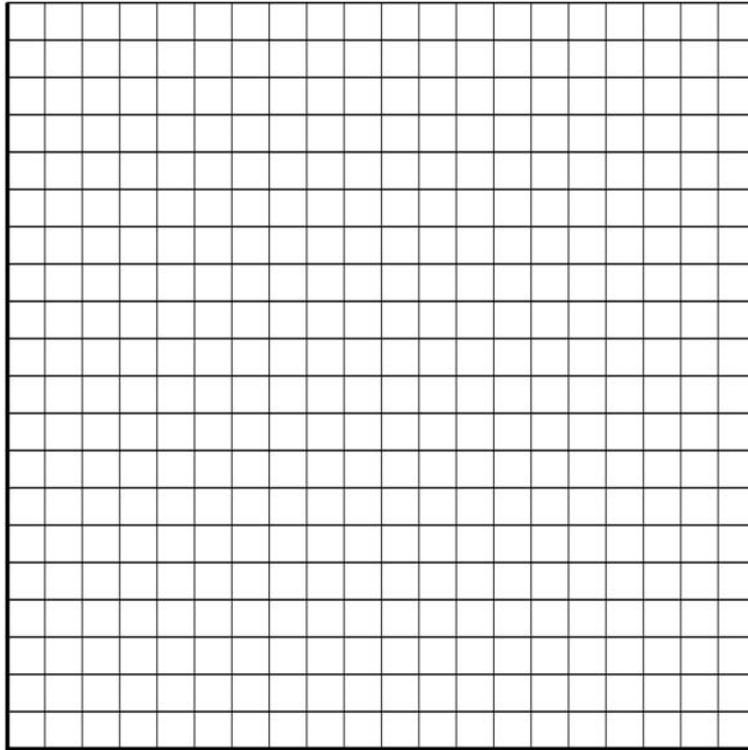
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Percent Transmittance in Three Samples

Time (min)	Light, Unboiled % Transmittance	Dark, Unboiled % Transmittance	Light, Boiled % Transmittance
	Sample 1	Sample 2	Sample 3
0	28.8	29.2	28.8
5	48.7	30.1	29.2
10	57.8	31.2	29.4
15	62.5	32.4	28.7
20	66.7	31.8	28.5

- (a) On the axes provided, **construct** and **label** a graph showing the results for the three samples.
- (b) **Identify** and **explain** the control or controls for this experiment.
- (c) The differences in the curves of the graphed data indicate that there were differences in the number of electrons produced in the three samples during the experiment. **Discuss** how electrons are generated in photosynthesis and why the three samples gave different transmittance results.

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4. Organisms rarely exist alone in the natural environment. The following are five examples of symbiotic relationships.

- Plant root nodules
- Digestion of cellulose
- Epiphytic plants
- AIDS (acquired immune deficiency syndrome)
- Anthrax

Choose FOUR of the above and for each example chosen,

- (a) **identify** the participants involved in the symbiosis and describe the symbiotic relationship, and
- (b) **discuss** the specific benefit or detriment, if any, that each participant receives from the relationship.

**END OF EXAMINATION**