Sunlight at the marsh

Suggested time for the entire exam: 35–50 min; adjust to local conditions.

Name _____ **Date** _____

In equal-volume transparent jars, teams placed the same mass of aquatic plants. At the start, dissolved oxygen was 6.0 mg/L in every jar. After four hours, oxygen was 8.4 in bright light, 6.8 in dim light and 5.2 in darkness. Water temperature stayed constant. These are simulated observations.

Condition	Start (mg/L)	After 4 h (mg/L)
Bright	6.0	8.4
Dim	6.0	6.8
Dark	6.0	5.2

1. Which comparison best isolates the influence of light among the tested conditions?

- ○ A The number of jars versus the starting concentration
- ○ B Bright-jar oxygen versus the plant’s mass
- ○ C Water temperature versus the mass of a dry jar
- ○ D Oxygen change in bright versus dim jars with equal plant mass

2. Which statement best explains the dark-jar pattern?

- ○ A Respiration requires bright light.
- ○ B Respiration can consume oxygen in darkness.
- ○ C All plant cells stopped chemical reactions.
- ○ D Water cannot hold oxygen in darkness.

3. A team claims that plants respire only in the dark. Evaluate what these oxygen data can establish. Use values and a process explanation.

Seeds after a dry season

Use the stimulus and your course knowledge.

Name _____ **Date** _____

A population has inherited variation in root depth. Before a drought, 30 of 100 plants sampled had deep roots. In the drought, deep-rooted plants averaged 8 surviving seeds per plant and shallow-rooted plants averaged 3. After several generations, 52 of 100 sampled plants had deep roots.

4. Which observation is directly relevant to differential reproductive success?

- ○ A Both samples had exactly 100 plants.
- ○ B Root depth can be measured in centimeters.
- ○ C The site was sampled more than once.
- ○ D The two root groups produced different numbers of surviving seeds.

5. Which additional observation would most weaken selection as the sole explanation for the frequency change?

- ○ A Observers used the same depth definition at both samplings.
- ○ B Some shallow-rooted plants produced seeds.
- ○ C Many deep-rooted seeds were carried into the population from another site.
- ○ D Both groups flowered during the same month.

6. Use the evidence to explain how deep roots could become more frequent. Distinguish a change in a population from a change in one individual.

An inherited seed pattern

Use the stimulus and your course knowledge.

Name _____ **Date** _____

In a simplified plant model, allele P gives purple seed coats and is completely dominant over p. Two purple heterozygous parents are crossed. Assume ordinary Mendelian segregation with no survival differences.

7. What fraction of offspring are expected to be purple heterozygotes?

- ○ A 1/2
- ○ B 1/4
- ○ C 3/4
- ○ D 1

8. A purple offspring is crossed with pp and produces at least one nonpurple offspring. What follows under the model?

- ○ A The purple parent contributed p and is Pp.
- ○ B Every future offspring will be nonpurple.
- ○ C The nonpurple offspring has genotype Pp.
- ○ D The purple parent must be PP.

9. A class observes six purple offspring and no nonpurple offspring from the original Pp × Pp cross. Is that observation impossible? Support your reasoning with the expected ratio or a probability.

Restoring a stream bank

Use the stimulus and your course knowledge.

Name _____ **Date** _____

Four matched stream sections received native plants and four were left unchanged. Both groups averaged 12 aquatic insect species before planting. One year later, planted sections averaged 18 species and comparison sections averaged 13. Planted sites also had cooler water. The team proposes that added shade caused the species increase.

10. Which result best summarizes the change relative to comparison sites?

- ○ A A thirteen-species decline at comparison sites
- ○ B A five-species larger average gain in planted sections
- ○ C An eighteen-species gain caused by shade
- ○ D A six-species gain in both groups

11. Which design best tests temperature as a mechanism?

- ○ A Remove all comparison measurements.
- ○ B Count species once only in the coolest planted section.
- ○ C Manipulate shading across similar sections and measure both temperature and species richness.
- ○ D Assume that any planted site has identical food availability.

12. Write a supported restoration claim and one reason the observations leave the mechanism uncertain.