

8.1 Adaptation: a function in an environment

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS adaptation • acclimatization

Objective

Adaptation: a function in an environment. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

■ What would explain this observation?

- Leaves in dry environments often have features that reduce water loss. The value of a feature depends on environmental conditions and trade-offs.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- An **adaptation** is a heritable feature associated with improved survival or reproduction in particular conditions. A thick cuticle can reduce evaporation; stomatal control affects gas exchange and water loss. **Acclimatization** is an individual response during life and is different from evolutionary adaptation.
- adaptation: A heritable feature benefiting survival or reproduction in a context; acclimatization: An individual adjustment to changed conditions during life.



■ Choose evidence that can test it

- Explain both a benefit and a cost. Reducing stomatal opening conserves water but can limit carbon dioxide entry. A feature cannot be judged as universally best without its ecological context.
- Compare replicated observations across a measured environmental gradient. Account for relatedness, leaf area and age. Use local permitted plant observations rather than removing protected species.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: water loss is 12 g from 0.20 square metres of leaf area over 2 h. Area-time-normalized rate = $12 / (0.20 \times 2) = 30 \text{ g}/(\text{m}^2 \text{ h})$. Comparisons require the same humidity and temperature.

Example:

Water loss is 8 g from 0.20 m² over 2 h. Calculate rate per area per hour. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- An individual organism does not evolve a new inherited trait because it needs it. A plausible story about function is a hypothesis requiring evidence.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Every useful individual response is evidence of a newly evolved inherited trait. This claim is false: An individual organism does not evolve a new inherited trait because it needs it. A plausible story about function is a hypothesis requiring evidence.

Key:

Adaptation: a function in an environment: Explain both a benefit and a cost. Reducing stomatal opening conserves water but can limit carbon dioxide entry. A feature cannot be judged as universally best without its ecological context.

2 Practice

2.1 Which statement distinguishes acclimatization? Choose one answer.

- **A** It is an individual adjustment during life
 - **B** It must change the allele frequency of a whole population
 - **C** It always produces a new species
- [1]

2.2 Water loss is 8 g from 0.20 m² over 2 h. Calculate rate per area per hour. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: Every useful individual response is evidence of a newly evolved inherited trait.

[2]

2.4 A heritable feature benefiting survival or reproduction in a context: write the technical term.

[1]

3 Exam-style questions

3.1 Fictional plants lose 12 g from 0.20 m² in 2 h and 9 g from 0.10 m² in 3 h. Compare normalized rates. Can this alone prove which is better adapted?

[4]

Solutions

2.1 A Explain both a benefit and a cost. Reducing stomatal opening conserves water but can limit carbon dioxide entry. A feature cannot be judged as universally best without its ecological context.

2.2 $\text{rate} = \text{mass} / (\text{area} \times \text{time}) = 8 / (0.20 \times 2) = 20 \text{ g}/(\text{m}^2 \text{ h})$.

2.3 False. An individual organism does not evolve a new inherited trait because it needs it. A plausible story about function is a hypothesis requiring evidence.

2.4 adaptation. adaptation means A heritable feature benefiting survival or reproduction in a context.

3.1 Both give $30 \text{ g}/(\text{m}^2 \text{ h})$. Match humidity, temperature and plant condition; equal recorded water loss is not proof of equal survival or adaptation. Repeat with representative samples.