

Evolution and speciation · supported focus

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

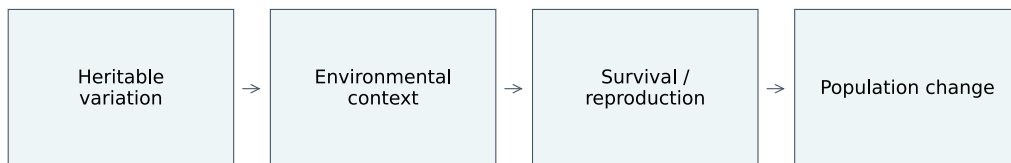
Adaptation : a function in an environment

■ 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.