18.1 Adaptation to environment

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS habitat • adaptation • abiotic factor • range of tolerance • transect • biome

Objective

Build the skills to answer exam questions on **adaptation to environment** : habitats, abiotic factors and ranges of tolerance, adaptations to extreme habitats, and biomes.

You must be able to:

- define habitat and adaptation, and explain how abiotic factors limit where species live
- use transects to test the link between an abiotic factor and the distribution of a species
- describe adaptations of organisms to sand dunes, mangrove swamps, hot deserts and tropical rainforests
- explain how temperature and rainfall decide biomes, using a climograph
- explain the conditions needed for coral reefs to form

1 Key knowledge and worked examples

Adaptation to environment

Habitat: the place where an organism or population lives. **Adaptation:** a feature that helps an organism survive and reproduce in its habitat.

Abiotic factors (non-living: temperature, water, light, soil pH, salinity) limit where a species can live. Each species has a **range of tolerance**: it does best at its **optimum** and cannot survive beyond its limits. Plants depend more on soil and water; animals on temperature and food.

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Testing a link: lay a **transect** across a gradient (e.g. from the sea up a beach), place a **quadrat** at regular intervals, record the species and measure the abiotic factor; repeat transects; use correlation.

habitat	adaptation	how it helps
sand dune (**marram grass**)	rolled leaves, sunken stomata, deep roots	less water loss; reaches deep water
mangrove swamp	salt glands, roots that stick up into the air	removes salt; gets oxygen from air
hot desert (**cactus**)	spines, thick waxy stem, CAM (stomata open at night)	less water loss
tropical rainforest	tall trees with **buttress roots**; drip-tip leaves	reach light; shed heavy rain

Biomes are groups of ecosystems with similar communities, decided mainly by **temperature** and **rainfall** (shown on a **climograph**): tropical rainforest (hot, wet), desert (dry), tundra (cold), temperate forest, grassland, taiga.

HL extension: coral reefs form only in clear, warm (23–29 °C), shallow, salty water with plenty of light, because the coral's algae (zooxanthellae) photosynthesize.

Worked example. At 6 quadrats along a transect, marram grass cover falls as distance from the sea rises: a **negative** correlation; it does not prove cause.

Answer shapes: adaptation → how it helps survival in **that** habitat.

2 Practice

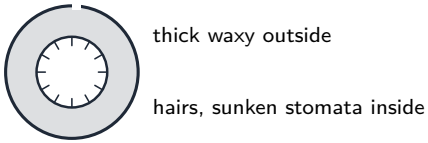
2.1 Define habitat and adaptation. [2]



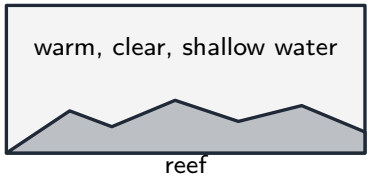
2.2 Describe how a student could investigate whether soil moisture affects the distribution of a plant across a field. [3]



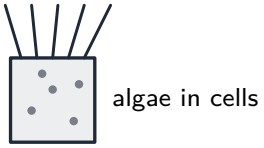
2.3 Explain two adaptations of marram grass to life on sand dunes. [3]



2.4 State two conditions needed for coral reefs to form. [2]

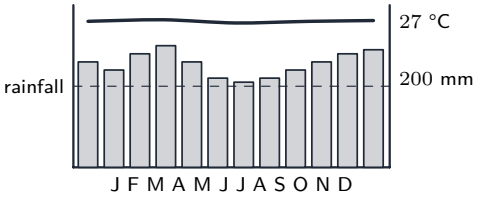


2.5 Explain why corals need light. [2]



3 Exam-style questions

3.1 The climograph shows mean monthly temperature and rainfall for a site.



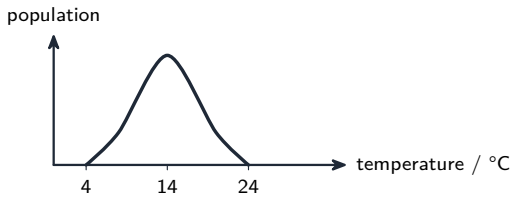
(a) Identify the biome. Give a reason. [2]

(b) Explain why trees in this biome have buttress roots and drip-tip leaves. [2]

(c) State the two abiotic factors that mainly decide which biome develops. [2]

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3.2 The graph shows the range of tolerance of a species of fish to water temperature.



(a) State the optimum temperature for this fish. [1]

(b) Describe what happens to the fish at 26 °C. [1]

(c) Suggest how climate change could affect the distribution of this fish. [2]

(d) Explain how a mangrove tree is adapted to salty, waterlogged soil. [2]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

habitat: the place where an organism lives; adaptation: a feature that increases its chance of survival and reproduction in that habitat

2.2

lay a transect line from wet to dry ground; place quadrats at regular intervals, recording plant percentage cover and soil moisture at each; repeat with more transects and look for a correlation

2.3

rolled leaves / hairs trap moist air, reducing water loss; sunken stomata reduce transpiration; deep roots reach water far below the surface

2.4

any two: warm water (23–29 °C); shallow / clear water with plenty of light; salt water / correct pH

2.5

the algae (zooxanthellae) inside coral cells photosynthesize; they supply the coral with sugars / food

3.1

(a) tropical rainforest; hot all year and high rainfall in every month

(b) buttress roots support tall trees in shallow soil; drip tips shed water quickly from leaves

(c) temperature; rainfall / precipitation

3.2

(a) 14 °C

(b) it is beyond the upper limit, so it cannot survive / is absent

(c) warmer water near the edges of its range goes past its upper limit; so the fish moves towards the poles / into deeper, cooler water, or dies out locally

(d) salt glands / ultrafiltration remove salt; roots that grow upwards into the air take in oxygen

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