

Adaptations

4.7.1.4 · Biology · revision notes

Adaptations are features that help an organism survive in the conditions where it normally lives. Expect to classify adaptations as structural, behavioural or functional, and to explain the features of plants, animals and microorganisms (including extremophiles) from information you are given.

Key facts

- Adaptation = a feature that helps an organism survive in its normal conditions
- Behavioural = actions (e.g. migration, huddling)
- Small surface area to volume ratio → less heat lost (cold places)
- Extremophile = lives in extreme conditions of temperature, pressure or salt concentration
- Structural = body features (e.g. thick fur, spines)
- Functional = processes inside the body, such as metabolism and reproduction (e.g. concentrated urine)
- Large surface area to volume ratio → more heat lost (hot places)
- Example extremophile: bacteria in deep sea vents

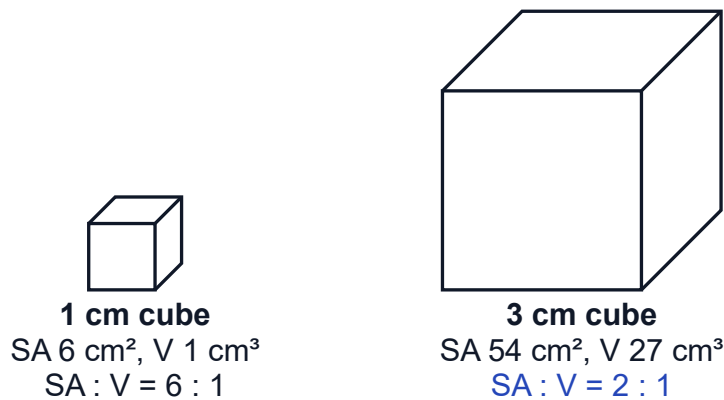
Notes

Three types of adaptation

- An **adaptation** is a feature that helps an organism survive in the conditions where it normally lives.
- Structural**: features of the body, e.g. thick fur, sharp claws, a thick waxy cuticle on leaves, camouflage colouring.
- Behavioural**: the way an organism acts, e.g. migrating to warmer places in winter, being active at night to avoid the daytime heat, huddling together to keep warm.
- Functional**: processes inside the body, such as metabolism and reproduction, e.g. a desert animal producing very little sweat and very concentrated urine to save water, or a mammal lowering its metabolic rate while it hibernates.

Hot, cold and dry places

- Cold: thick fur or a layer of fat insulates the body. A large body with small ears has a **small surface area to volume ratio**, so less heat is lost.
- Hot: large ears and thin fur increase heat loss. A **large surface area to volume ratio** helps an animal lose heat.



A bigger body has a smaller surface area to volume ratio, so it loses heat more slowly: useful in the cold.

- Dry (plants): spines instead of broad leaves and a thick waxy cuticle reduce water loss; long or widespread roots absorb as much water as possible; swollen stems store water.
- Camouflage, such as white fur in snow or sandy colours in a desert, helps animals hide from predators or approach prey unseen.

Extremophiles

- **Extremophiles** are organisms that can live where conditions are extreme: very hot, under very high pressure, or very salty (high salt concentration).
- Example: bacteria living around deep sea vents survive very high temperatures and pressures.
- Their enzymes and other proteins keep working in conditions that would denature the enzymes of most organisms.

Answering adaptation questions

- Name the feature, then say how it helps in that environment, e.g. 'thick fur traps air, which insulates the body, so less heat is lost'.

How to answer each type of question

Classify an adaptation

1 mark each

Grade 4

1. A body feature you could see or measure is structural.
2. Something the organism does is behavioural.
3. A process inside the body is functional.

Example. Classify each adaptation of a camel as structural, behavioural or functional.

- (a) Long eyelashes that keep sand out of its eyes.
- (b) Producing very concentrated urine.
- (c) Resting in the shade during the hottest part of the day.

Model answer. (a) Structural (1)

(b) Functional (1)

(c) Behavioural (1)

Don't lose marks

- ✗ Listing features without explaining how each one helps the organism survive.
- ✗ Saying the organism 'adapted itself' or 'chose' to change. Adaptations come about by natural selection over many generations.
- ✗ Mixing up surface area with surface area to volume ratio: in the cold, a small ratio reduces heat loss.
- ✗ Calling migration or huddling a structural adaptation. They are behavioural.
- ✗ Writing that extremophiles 'live in extreme places' without naming the condition (temperature, pressure or salt).

More tips

Memory tricks

- S-B-F: Structural = what it looks like, Behavioural = what it does, Functional = what goes on inside.
- Big and round keeps heat around: large, compact bodies have a small surface area to volume ratio.
- For every feature, ask 'so what?': feature → effect → how that helps survival.

Exam technique

- Explain questions usually give 1 mark for the feature and 1 mark for how it helps. Always pair them up.
- Unfamiliar organisms are common. The clues you need are usually in the question.
- Use scientific words: insulation, camouflage, surface area to volume ratio, water loss, denatured.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Define an adaptation

A feature that helps an organism survive in the conditions where it normally lives.

Grade 4

Classify adaptations as structural, behavioural or functional

Structural means body features, behavioural means what it does, and functional means processes inside the body.

Grade 5

Define an extremophile and give an example

An organism that lives in extreme conditions of temperature, pressure or salt concentration, e.g. bacteria in deep sea vents.

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