Plant defence responses

4.3.3.2 · Infection and response · revision notes

The physical, chemical and mechanical ways in which plants defend themselves against pathogens and against animals that eat them. This subtopic is GCSE Biology only (not Combined Science). Questions ask you to name defences or to explain how an unfamiliar adaptation helps a plant survive.

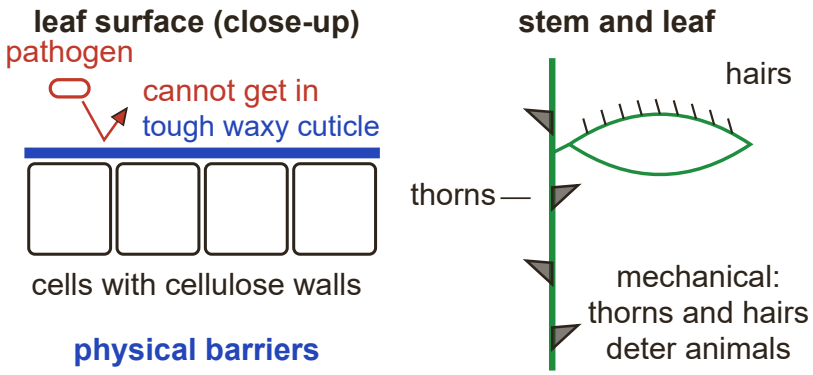
Key facts

- Physical: cellulose cell walls, tough waxy cuticle, layers of dead cells (e.g. bark) that fall off
- Mechanical: thorns and hairs, leaves that droop or curl when touched, mimicry
- Mimicry = looking like something else to trick animals
- Chemical: antibacterial chemicals, poisons to deter herbivores
- Herbivore = animal that eats plants

Notes

Physical defences against microorganisms

- **Cellulose cell walls**: a strong layer around each cell that pathogens find difficult to get through.
- A **tough waxy cuticle** on the leaves: a barrier over the leaf surface.
- **Layers of dead cells** on the surface of stems, e.g. **bark** on trees. They form a barrier, and they fall off, taking any pathogens on them with them.



Physical barriers keep microorganisms out; thorns and hairs deter animals.

Chemical defences

- **Antibacterial chemicals** kill bacteria. Some plants, such as mint, produce them.
- **Poisons** deter **herbivores** (animals that eat plants), e.g. foxgloves are poisonous.

Mechanical adaptations against animals

- **Thorns and hairs** deter animals from touching or eating the plant, e.g. the thorns on a rose stem.
- **Leaves that droop or curl when touched**, e.g. in the sensitive plant. This can knock insects off and makes the plant look less appealing to eat.
- **Mimicry** tricks animals. Some plants have spots that look like insect eggs, so the insects do not lay their eggs there. Some plants look like a stinging plant, so animals avoid them.

Why defences matter

- Fewer pathogens infect the plant and fewer animals eat it.
- So it keeps more leaves for photosynthesis and is more likely to survive and reproduce.

How to answer each type of question

Name and classify defences 1 to 3 marks **Grade 3**

1. Learn which defences are physical, chemical and mechanical.
2. Give one clear example for each type asked for.

Example. Give **one** physical defence, **one** chemical defence and **one** mechanical adaptation that plants use.

Model answer. Physical: any one from cellulose cell walls, a tough waxy cuticle, layers of dead cells or bark (1). Chemical: antibacterial chemicals or poisons (1). Mechanical: any one from thorns, hairs, leaves that droop or curl when touched, mimicry (1).

Explain how a physical defence protects a plant 2 marks **Grade 5**

1. Say that it forms a barrier to pathogens.
2. Add any extra feature, e.g. dead cells fall off, taking pathogens with them.

Example. Explain how bark helps to protect a tree from pathogens.

Model answer. The layers of dead cells form a barrier, so pathogens cannot reach the living cells (1). The dead cells fall off, taking pathogens on their surface with them (1).

Explain how a chemical defence helps a plant 2 marks **Grade 4**

1. Say what the chemical does: kills bacteria, or deters herbivores.
2. Link to the plant: fewer infections, or fewer leaves eaten, so it survives.

Example. The leaves of some plants contain poisons.
Explain how this helps the plants to survive.

Model answer. Herbivores are deterred from eating the leaves (1). So the plants keep their leaves for photosynthesis and are more likely to survive (1).

Suggest how an unfamiliar adaptation helps 2 marks **Grade 5**

1. Use the information given to work out what the adaptation does to animals or pathogens.
2. Link it to less damage to the plant.
3. Finish with survival, growth or reproduction.

Example. The leaves of one species of plant are covered in tiny hooked hairs. Caterpillars that crawl onto the leaves get caught on the hairs.
Suggest how this adaptation helps the plant to survive.

Model answer. The caterpillars get stuck and cannot move around, so they eat less of the leaves (1). So the plant keeps more leaf area for photosynthesis and is more likely to survive and reproduce (1).

Don’t lose marks

- Saying the cuticle or cell wall kills pathogens. Physical defences are barriers; antibacterial chemicals kill bacteria.
- Calling thorns a defence against microorganisms. Thorns are mechanical adaptations that deter animals.
- Stopping at 'animals don't eat it' in a 2-mark 'suggest' question, without linking it to the plant's survival.
- Saying plants make antibodies or have white blood cells. Plants defend themselves with barriers, chemicals and mechanical adaptations.
- Saying thorns deter 'predators'. Plants are eaten by herbivores, so say thorns deter herbivores or stop animals eating the plant.

More tips

Memory tricks

- Two targets: physical barriers and antibacterial chemicals stop microorganisms; poisons and mechanical adaptations stop animals.
- Physical = 'wall, wax, bark': cellulose cell walls, waxy cuticle, dead cells that fall off.
- Always end with the pay-off: fewer pathogens get in or fewer animals eat it → more photosynthesis → the plant survives.

Exam technique

- Decide the type of defence first (physical, chemical or mechanical), then say what it stops (pathogens or animals).
- Unfamiliar examples are common: use the information given and link it to survival.
- Use 'barrier' for defences against microorganisms and 'deter' for defences against animals.

What each grade needs

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

Grade 3

Name physical defences of plants

Cellulose cell walls, a tough waxy cuticle on leaves, and layers of dead cells on stems (e.g. bark) that fall off.

Grade 4

Name chemical defences of plants

Antibacterial chemicals, and poisons that deter herbivores.

Grade 4

Name mechanical adaptations of plants

Thorns and hairs, leaves that droop or curl when touched, and mimicry.

Grade 4

Explain how poisons and mechanical adaptations deter animals

They make the plant harmful, painful or unappealing to eat, so animals eat less of it.

Grade 5

Explain how physical barriers stop pathogens

They are barriers that pathogens cannot easily get through, and dead cells take pathogens with them when they fall off.

Grade 5

Explain an unfamiliar defence in context

Decide what type of defence it is, then link it to fewer pathogens getting in or fewer animals eating the plant.

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