

Control and coordination

4.5.4.1 · Homeostasis and response · revision notes

How auxin makes shoots and roots grow towards or away from light and gravity, and the required practical on seedling growth. Expect 'explain why the shoot bends' questions, planning questions and results analysis. This subtopic is in GCSE Biology only.

Key facts

- Phototropism = growth response to light; gravitropism (geotropism) = growth response to gravity
- Shoots: towards light, against gravity. Roots: in the direction of gravity
- Unequal distribution of auxin → unequal growth → bending
- Shoots: auxin stimulates cell elongation
- Light from one side → auxin moves to the shaded side → shaded side grows faster → bends towards light

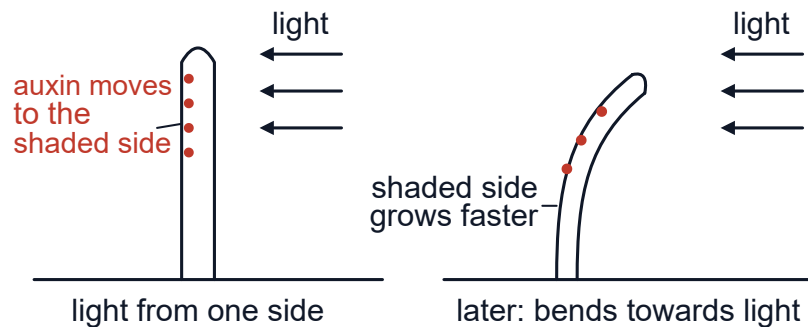
Notes

Plant hormones and tropisms

- Plants produce **hormones** to coordinate and control growth, and their responses to **light (phototropism)** and **gravity (gravitropism, also called geotropism)**.
- Shoots grow **towards light** and **against gravity**. Roots grow **in the direction of gravity** (downwards).
- This helps shoots get light for photosynthesis, and helps roots anchor the plant and reach water and mineral ions.
- **Unequal distributions of auxin** cause unequal growth rates in roots and shoots, so they bend.

How auxin works

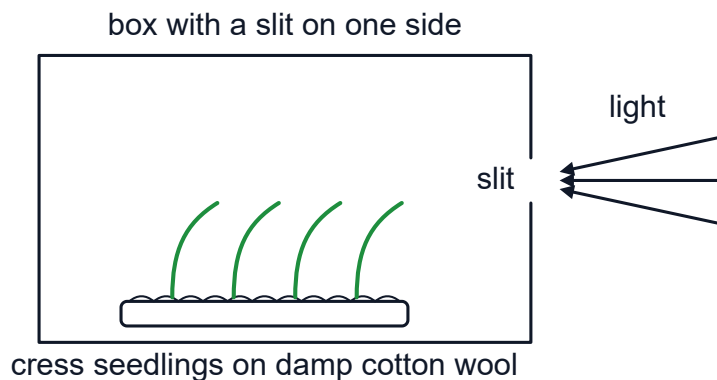
- Auxin is made in the tip of a shoot or root and moves into the region just behind the tip.
- In **shoots**, auxin **stimulates cell elongation**. In **roots**, a high concentration of auxin **inhibits** cell elongation.
- Light from one side**: auxin moves to the **shaded side** of the shoot. Cells there elongate faster, so the shoot bends **towards the light**.



Phototropism: auxin on the shaded side makes those cells elongate more.

Required practical: seedling growth

- Germinate seeds such as cress on damp cotton wool in Petri dishes.
- Light: put one dish in a box with a slit so light comes from one side, one in all-round light and one in the dark.



Light from one side: the seedlings grow towards the slit.

- Gravity: fix germinating seeds to damp cotton wool and turn the dish on its side, keeping it in the dark so light does not affect the result.
- Record **both** length measurements (with a ruler) and careful **observations** of the direction of growth. Control the type of seed, temperature and volume of water.

Don't lose marks

- ✗ Saying light kills the auxin or the cells on the lit side. Say auxin moves to (builds up on) the shaded side.
- ✗ Saying auxin makes shoot cells 'divide'. Say it makes cells elongate (grow longer).

- ✗ Forgetting that auxin has the opposite effect in roots.
- ✗ Explaining why bending is useful (to photosynthesise) when the question asks how it happens.
- ✗ In the practical, only measuring length. You must also record observations of the direction of growth.

More tips

Memory tricks

- Auxin in shoots: 'grow'. Auxin in roots: 'slow'.
- Auxin hides from light: it gathers on the dark side, which grows longer, so the shoot bends towards the light.
- Photo = light, gravi = gravity, tropism = a growth response.

Exam technique

- Use the three-step chain: where auxin goes → its effect on cell elongation → which side grows faster and which way it bends.
- Always say whether you mean a shoot or a root: auxin has opposite effects in each.
- In practical questions, name specific control variables (seed type, temperature, volume of water) and say exactly what you would measure.

What each grade needs

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

Grade 3

Define phototropism and gravitropism

Phototropism is a growth response to light; gravitropism (geotropism) is a growth response to gravity.

Grade 4

Describe how shoots and roots respond

Shoots grow towards light and against gravity; roots grow downwards, in the direction of gravity.

Grade 5

Describe the seedling growth practical

Grow seedlings with light from one side, or on their side, and record both lengths and direction of growth.

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