5.4 Plant hormones

Name: _____ Class: _____ Date: _____ **Total: 16 marks**

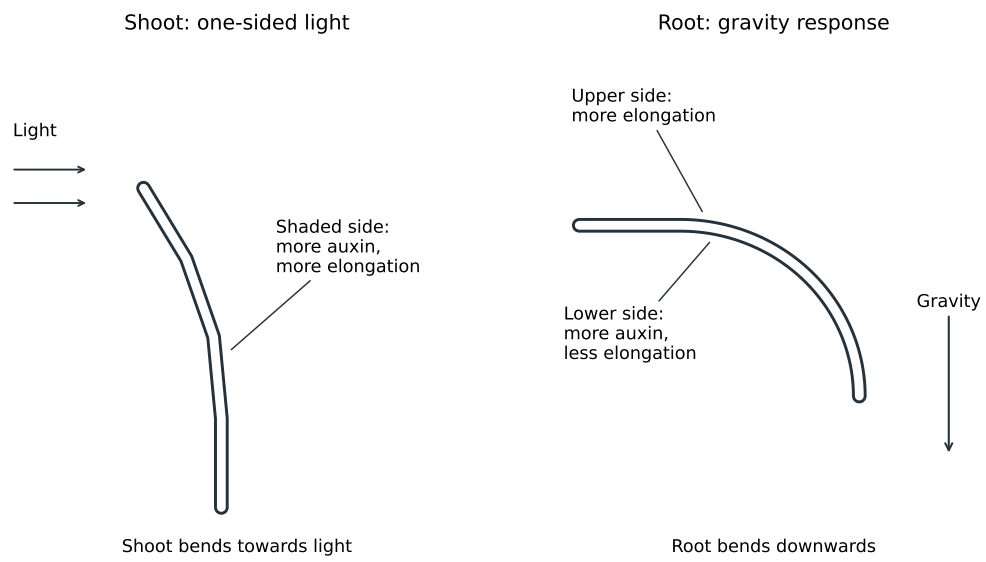
KEY WORDS phototropism • gravitropism • auxin

Objective

Explain phototropism and gravitropism by auxin distribution, describe RP8, and (HT) the uses of plant hormones. Biology only. Original questions for spec statement 4.5.4.

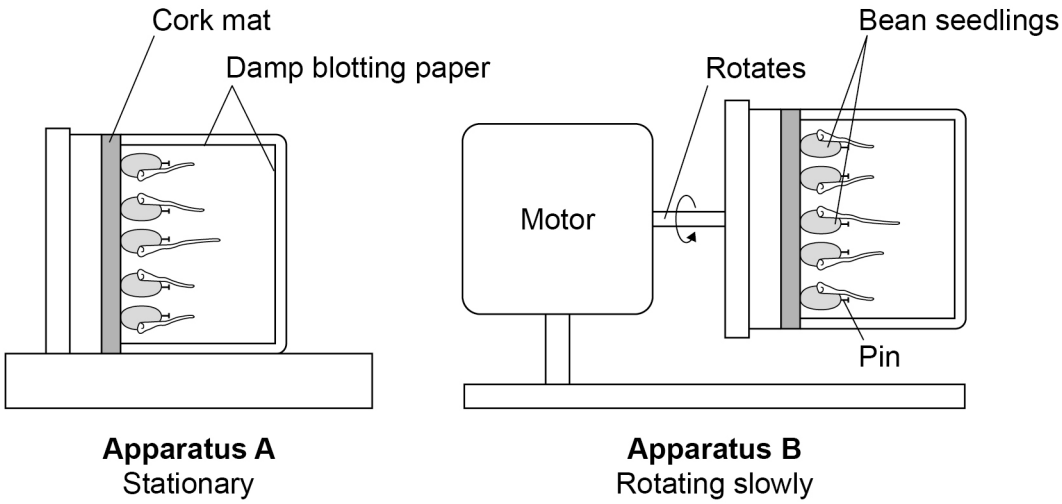
1 Key knowledge and worked examples

Phototropism is a growth response to the direction of light; **gravitropism/geotropism** responds to gravity. Positive means towards the stimulus, negative away. Shoots grow towards light; roots grow down with gravity.

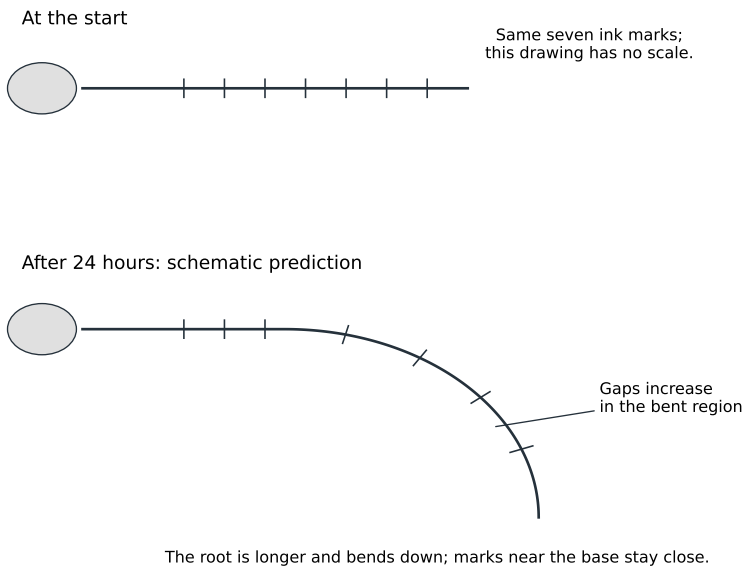


Worked Q3.1 [3]. More auxin accumulates on the shaded side of a shoot (1); cells there elongate more than on the lit side (1); the shoot bends towards light (1). Light does not simply destroy auxin. In a horizontal root, auxin on the lower side inhibits elongation; the upper side grows more, so the root bends down.

Figure 6



Worked controls, AQA 2024 Q04.1–.3. Darkness prevents directional light affecting growth. Damp paper provides water and avoids an uneven water supply affecting direction. Slow rotation changes which side faces gravity, giving a comparison; it does not remove gravity. The rotating root grows approximately straight, unlike the stationary root's bend.



Worked drawing, AQA 2024 Q04.4 [3]. Draw a root that is longer (1), bends down (1), and has wider ink-mark gaps in the bent region (1), not evenly along the base.

RP8 / worked Q3.2. Compare same-age/species seedlings in one-sided and all-round light. Keep water, temperature, medium and duration alike; measure initial/final lengths. Follow curved shoots with thread, then measure thread with a ruler. Repeat with several seedlings, calculate mean increases and compare. Record growth direction and careful labelled biological drawings. Darkness is an allowed ad-

ditional comparison but changes light availability too. The 2025 six-mark question requires a valid comparison and controls.

Teacher-written example. Start lengths 20 mm; final lengths 32, 34, 33 mm. Find individual increases, then mean:

$$\Delta L = L_{\text{final}} - L_{\text{initial}}$$

$$\Delta L_1 = 32 \text{ mm} - 20 \text{ mm} = 12 \text{ mm}$$

$$\Delta L_2 = 34 \text{ mm} - 20 \text{ mm} = 14 \text{ mm}$$

$$\Delta L_3 = 33 \text{ mm} - 20 \text{ mm} = 13 \text{ mm}$$

$$\overline{\Delta L} = \frac{\sum \Delta L}{n}$$

$$\overline{\Delta L} = \frac{12 + 14 + 13}{3} \text{ mm} = 13 \text{ mm}$$

(HT) Uses. Auxin: root formation in cuttings, growth in tissue culture, weed killing. Ethene: cell division/ripening; control fruit ripening in storage/transport. Gibberellins: germination, ending dormancy, flowering, larger fruit. AQA 2024 Q04.8 asks about an apple tree: flowering/larger fruit fit; seed dormancy does not. Evaluate weed killers' effects on non-target plants and biodiversity.

2 Practice

2.1 Define phototropism. [1]

2.2 In which direction do roots grow in response to gravity, and what is this response called? [2]

2.3 (HT) Name the plant hormone used to control fruit ripening in storage and transport. [1]

3 Exam-style questions

3.1 Explain how auxin causes a shoot to bend towards light shining from one side. [3]

3.2 A student germinates cress seedlings and places them in a box with a hole cut in one side. Describe how she should investigate the effect of light on growth, including how she records her results. [5]

3.3 *(HT)* A gardener takes cuttings and dips the cut ends in rooting powder before planting. Explain how rooting powder works, and give two other uses of plant hormones in agriculture or horticulture. [4]

Solutions

2.1 A growth response to the direction of light.

2.2 Downwards; gravitropism/geotropism.

2.3 Ethene.

3.1 Auxin moves/accumulates on the shaded side of the shoot; auxin stimulates cell elongation, so cells on the shaded side elongate more than on the lit side; the shoot bends towards the light source.

3.2 Put germinated seedlings of the same age/length in a box with a hole on one side, so light enters only from one direction; keep a control batch in uniform light/darkness and the same moisture/temperature; leave for a set time, e.g. 2–3 days; record growth direction; follow a curved shoot with thread and measure it against a ruler; make careful, labelled biological drawings of the seedlings showing the bend towards the light.

3.3 Rooting powder contains auxin, which stimulates root formation at the cut stem, so the cutting can establish and grow as a clone of the parent plant. Any two further uses, one mark each: auxin weed killers; auxin to promote growth in tissue culture; gibberellins to end seed dormancy, promote flowering or increase fruit size; ethene to control fruit ripening in storage/transport. Total 4 marks.