



ANSWER BOOK

Plant responses: tropisms, auxins and the classic experiments

Hormonal communication, plant responses and homeostasis · Unit B15

AQA 3.6.1.1 · OCR A 5.1.5 · CAIE 15.3, 14.2

6 questions · 20 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** it is positive phototropism, because growth is towards the stimulus. **B1** the substance is auxin, in practice indole-3-acetic acid. [2]
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** the tip was cut off and replaced, with a thin block of gelatine inserted [4]
between the tip and the stump, and the coleoptile was then lit from one side. **B1**
bending towards the light still happened when gelatine was used. **B1** when the gelatine
was replaced by mica, which nothing can diffuse through, bending stopped. **A1** so
whatever passes from the tip to the growing region is a chemical that diffuses, rather
than an electrical signal or a mechanical pull; the experiment does not identify the
chemical.
- B2** **B1** auxin binds to receptors in the cell and stimulates the proton pumps in the [4]
cell surface membrane. **B1** the pumps actively transport hydrogen ions out into the cell
wall, so the pH of the wall falls to about 5. **B1** at that pH enzymes called expansins
become active and loosen the bonds between the cellulose microfibrils, so the wall
becomes more plastic. **A1** the turgor pressure already present can then stretch the
loosened wall, water enters by osmosis, and the cell lengthens along its axis.
- B3** **B1** gravity is detected by statoliths, dense starch-filled organelles that [4]
sediment to the lower side of particular cells, such as the columella cells of the root
cap. **B1** auxin is then redistributed to the lower side of both the shoot and the root. **B1** in
the shoot that concentration stimulates elongation, so the lower cells elongate more
than the upper ones and the shoot curves upwards, which is negative gravitropism. **A1**
root cells are inhibited at concentrations that stimulate a shoot, so the lower cells of the
root elongate less than the upper ones and the root curves downwards, which is
positive gravitropism.
- B4** **B1** broad-leaved weeds present a large surface area of leaf to the spray, so [3]
they absorb much more of the synthetic auxin than the narrow upright leaves of a
cereal do. **B1** the high concentration inside the weed causes rapid and uncontrolled
elongation and growth. **A1** the weed cannot supply the water and nutrients that growth
demands and it dies, while the cereal absorbs too little for the concentration in its
tissues to have that effect.
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B5 **B1** gibberellin diffuses to the aleurone layer surrounding the starchy endosperm and causes transcription of the gene for amylase. **B1** the amylase produced hydrolyses the stored starch to maltose, so sugars become available sooner than if the maltster waited for each embryo to secrete its own gibberellin. **A1** every grain receives gibberellin at the same time and in the same amount, so grains that would otherwise germinate at different rates produce amylase together and the batch is more uniform.
