

5.9 Plant responses and phytochrome

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS phytochrome • auxin • gibberellin • aleurone layer

Objective

Practise statements 8.11-8.12 with Core Practical 18: phytochrome and flowering, auxin in elongation, gibberellins in germination, and investigating plant responses.

1 Key knowledge and worked examples

■ Phytochrome - a light switch

Two interconvertible forms: **Pr** absorbs red light (660 nm) and becomes **Pfr**; **Pfr** absorbs far-red (730 nm) and becomes Pr. Sunlight contains more red than far-red, so in daylight Pfr accumulates - the active form that triggers flowering in long-day plants and germination in light-sensitive seeds. In darkness Pfr slowly reverts.

■ Auxin (IAA)

Produced at shoot tips; moves down by active transport; elongates cells by pumping H⁺ into the wall (acid growth) so the wall loosens. Unequal distribution bends shoots toward light.

■ Gibberellins

From the embryo of a germinating seed; induce amylase in the aleurone layer of the endosperm; the amylase digests starch to maltose feeding the embryo. That is why gibberellin treatment raises germination percentage and speed.

■ Worked example: designing the germination experiment

Fifty lettuce seeds each in light, darkness, red-light flash, red flash then far-red flash. Germination: high in light, low in dark, high after red, LOW after red-then-far-red (the last flash wins - Pr has returned). The reversal is the evidence that Pfr is the active form.

2 Practice

2.1 Name the form of phytochrome that absorbs red light and the form active in day-light. [2]

2.2 State the enzyme induced by gibberellin in germinating barley, and its substrate. [2]

2.3 Explain how auxin causes a shoot to bend toward light. [3]

3 Exam-style questions

3.1 Describe an experiment to show that gibberellin increases the rate of germination, including controls, the measurements taken and the expected results. [5]

3.2 A long-day plant flowers only when nights are shorter than a critical length. Explain how phytochrome controls this response, referring to the two forms and the effect of daylight. [5]

3.3 Coleus cuttings are treated with auxin on one side of an agar block. Predict the growth of roots and shoots on the treated and untreated sides, and explain the basis of the difference. [4]
