

Exemplar exam question – Chapter 9, *Plant science***Structured questions**

The question below is similar to those found on the essay section of Paper 2. Notice that not all sections of the question relate exclusively to one chapter. The first two parts are clearly relevant to Chapter 9, *Plant science*, but the third section requires knowledge from Chapter 7, *Nucleic acids and proteins*.

Exemplar question

- a Outline the factors that can lead to a high rate of transpiration. (6)
- b List **four** adaptations of xerophytic plants. (4)
- c Explain the role of temperature on enzyme activity. (8)

Student response

- a Transpiration is the uptake of water in the roots of a plant and the loss of water from the leaves. Water evaporates from the leaves and is pulled up from lower down the plant via the xylem. As water is sucked up, more water enters the roots via root hairs. Transpiration is affected by environmental conditions such as humidity, temperature and light. All these factors affect how quickly water can evaporate from leaves.
- b Xerophytes are plants that can survive in dry conditions such as deserts. They have ways to conserve water inside them. They have stomata in deep pits, their leaves may be hairy to trap water vapour. Cacti have deep roots so they can obtain water from deep underground. They also have waxy cuticles to stop water evaporating.
- c Enzymes have an optimum temperature at which they work best. At low temperatures they work slowly because there are few collisions between substrates and the active site. As the temperature increases molecules move faster and enzymes work faster. If the temperature is too high the enzyme will denature and not be able to work again.

Commentary

This is a type of question that appears on the HL paper so a reasonable level of detail and care in answers is required. This student has included the basics and provided a moderately good answer, but has not completed the response with accurate facts or explanation.

- a The student has spent several lines defining transpiration but not included enough detail on the factors that affect it, which the question has asked about.

More information is needed on each of the environmental factors that are mentioned. Which factors increase transpiration as they increase and which cause a decrease as they increase? Increasing humidity decreases transpiration because it prevents water vapour leaving the air spaces in the leaves, as the air is already saturated with water vapour. This has not been mentioned, nor has the effect of temperature or light on evaporation, stomatal opening and hence transpiration. Just 3 marks would be awarded, out of a possible 6.

- b** This part of the question only asks for a list of adaptations so the student has covered most of the answer. It would be better to explain that the hairy leaves of xerophytes prevent water vapour escaping rather than ‘trapping it’. The answer earns 3 marks out of 4.
- c** There are 8 marks allocated to this part of the question so it is clear that detail is required. The student has not included a graph or a diagram of the active site, which would help the explanation. It would also be sensible to mention what range of temperatures enzymes work at. The optimum temperature for human enzymes is 37 °C and they begin to denature at temperatures above 40 °C. These facts and others like them would gain marks. The student has mentioned collision theory but not explained what temperature does to the shape of the active site. Just 4 marks would be awarded.

Total marks awarded: 10 out of 18, + 1 additional mark = 11