Higher Tier — Separate Science

Full Higher Separate content. ★ = Higher Tier. ◆ = Separate Science only.

Q1. State the THREE main limiting factors of photosynthesis.

[1 mark]

Q2. A student measures O■ production from pondweed at different light intensities. At high light intensity, increasing the light further has no effect on the rate. Explain this and suggest TWO changes that could increase the rate.

[4 marks]

★ HIGHER TIER

Q3. ★ A lamp is moved from 10 cm to 20 cm from a pondweed. Explain the effect on photosynthesis rate and calculate the change in light intensity.

[3 marks]

Q4. Explain why greenhouse growers might use a paraffin heater inside the greenhouse. Refer to TWO effects of burning paraffin.

[3 marks]

Total: 11 marks

osynthesis — Limiting Factors

Q1 (1 mark)

State the THREE main limiting factors of photosynthesis.

• Light intensity, CO■ concentration, temperature [1] — all three required

Q2 (4 marks)

A student measures O■ production from pondweed at different light intensities. At high lig…

• Another factor has become limiting — even though light is not limiting, something else is [1]

• Possible limiting factors: CO■ concentration or temperature [1]

• Increase CO■ (e.g. add NaHCO■ to water) [1]

• Increase temperature (up to enzyme optimum, ~25°C) [1]

Q3 (3 marks) [★ HT]

★ A lamp is moved from 10 cm to 20 cm from a pondweed. Explain the effect on photosynthesi…

• Light intensity ∝ 1/distance² → at 20 cm, intensity = ¼ of intensity at 10 cm [1]

• Rate of photosynthesis decreases — less light energy available [1]

• Fewer photons absorbed by chlorophyll → reaction rates slower [1]

Q4 (3 marks)

Explain why greenhouse growers might use a paraffin heater inside the greenhouse. Refer to…

• Burning paraffin releases CO■ → increases CO■ concentration → faster rate of photosynthesis (if CO■ was limiting) [1]

• Burning paraffin generates heat → increases temperature → faster enzyme reactions → faster photosynthesis (if temperature was limiting) [1]

• Both effects can simultaneously remove two limiting factors → significant increase in crop yield [1]