

A level Biology A
H420/03 Unified biology

Question Set 10

- 1 Temperature and light intensity are two factors that affect the rate of photosynthesis.

A student investigated how temperature and light intensity affected the rate of photosynthesis in the aquatic plant *Elodea canadensis*. The rate of photosynthesis was measured by counting the number of bubbles produced by the plant per minute.

The student's results are shown in Table 3

Light intensity	Temperature (°C)	Number of bubbles produced / minute
8	25.0	10
32	25.0	31
127	25.0	102
510	25.0	108
8	40.5	25
32	40.5	28
127	40.5	118
510	40.5	133
8	70.0	2
32	70.0	4
127	70.0	12
510	70.0	16

Table 3

- (a) (i) Identify the anomalous result in Table 3 and explain how this result could be confirmed as an anomaly. [2]

- 28 number of bubbles when light intensity of 32 & temperature of 40.5°C → repeat test

- (ii)* Describe how the student could improve their experimental method and the presentation of their data. [6]

PRESENTATION IMPROVEMENT

- units for light intensity should be shown (lux)
- table should be presented to make comparisons of light intensity easier (separate tables for temperature & light intensity)

- heading of column three could be improved (rate of photosynthesis - bubbles min^{-1})
- present data as a graph (light intensity or temperature vs number of bubbles)

METHOD IMPROVEMENT

- more precise method for measuring photosynthetic rate (calibrated oxygen sensor than counting bubbles, photosynthameter / gas syringe to measure gas volume)
- control other variables in experiment (same size / age / pH / wavelength of light, change water surrounding pondweed for each measurement)
- provide CO_2 source (in excess)
- smaller more consistent intervals between light & temperature values (intervals of 50 lux or 10°C)
- repeats should be used (to calculate mean & identify anomalies)

- (b) Photosynthesis occurs in two stages: the light-dependent stage and the light-independent stage. The light-independent stage is affected by temperature more than the light-dependent stage.

Explain why temperature has a greater effect on the rate of the light-independent stage. [2]

- light-independent stage controlled by enzymes
- higher temperature increases kinetic energy of enzyme molecules thus number of successful collisions per unit time
- enzymes may be denatured at high temperatures

- (c) Scientists are able to clone desirable plants that show a high rate of photosynthesis. The following passage describes how plants are cloned.

Complete the passage using the most appropriate words or phrases.

Cells are removed from the meristem tissue in axial buds or shoots tips. The tissue sample that is removed is called the explant Ethanol can be used to sterilise the plant tissue. Hormones are used to stimulate mitosis, which produces a mass of cells called a callus [4]



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