A Level Biology A

H420/01 Biological Processes

Question Set 22

22 (a) Plants are capable of synthesising a variety of molecules from the products of the light-independentstage of photosynthesis.

Fig 22.1 summarises these processes.

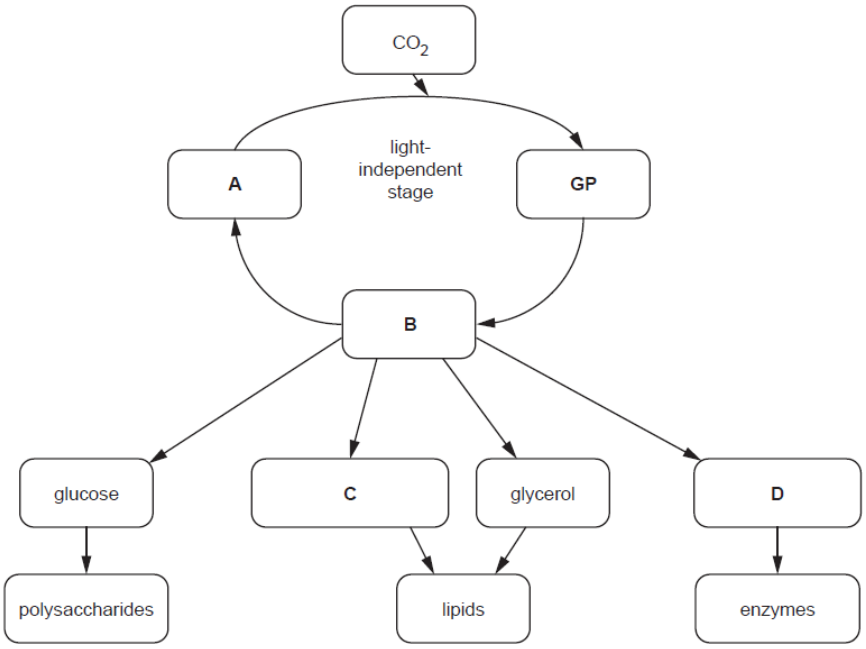

Fig. 22.1

Identify the molecules represented by the letters **A**, **B**, **C** and **D** in Fig. 22.1

A Ribulose bisphosphate (RuBP)

B Triose phosphate (TP)

C Fatty acids

D Amino acids

[4]

22 (b) (i) A scientist investigated the rate of photosynthesis in lesser pondweed, *Potamogeton pusillus*.

The method used is outlined below:

- Add 200 cm^3 of distilled water to a 300 cm^3 glass beaker.
- Dissolve 5 g of $NaHCO_3$ in the water to provide an excess of CO_2.
- Place the beaker in a water bath at 10 °C and leave for 10 min to equilibrate.
- Insert an oxygen sensor into the water in the beaker and measure the baseline O_2 concentration.
- Place 100 g of *P. pusillus* into the beaker.
- Remove all other light sources from the room and place an LED light source 20 cm abovethe top of the beaker.
- Use a light intensity meter to ensure the light intensity above the beaker is 5000 lux.
- Measure the concentration of oxygen dissolved in the water using a data logger every10 min for 200 min.
- Carry out four more repeats at 10 °C.
- Repeat all the above steps in water baths at 15 °C, 20 °C, 25 °C and 30 °C.

Identify the following variables from the scientist's method:independent variable

Temperature

dependent variable

Oxygen concentration in the water

one control variable

Light intensity

[3]

22 (b) (ii) Identify **one** variable that was **not** controlled in the scientist's method. **[2]**

pH of the solution

2 (c) A scientist investigated the rate of photosynthesis in lesser pondweed, *Potamogeton pusillus*.

Fig. 22.2 is a graph of the scientist's results.

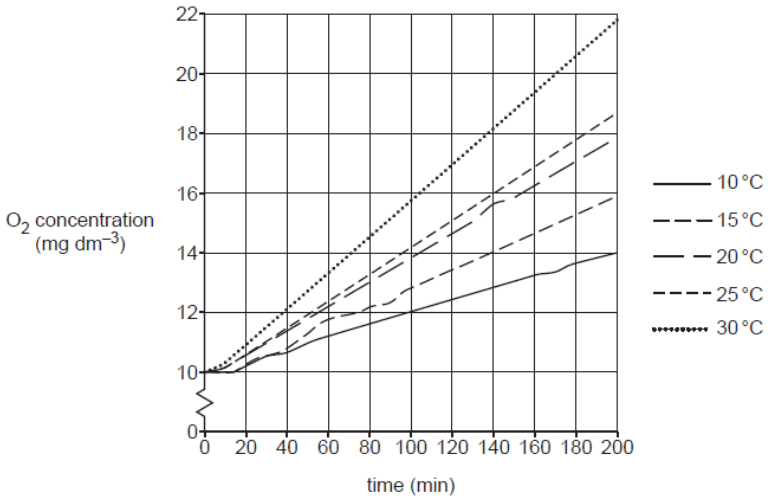

Fig. 22.2

Describe and explain what these results show about photosynthesis in *P. pusillus*. **[3]**

As temperature increases, the rate of O2 production, and thus the rate of photosynthesis in P.pusillus increases. At any given time, O2 concentration for P.pusillus at 30°C exceeds that of P.pusillus exposed to lower temperatures. This is because as temperature rises, the rate of enzyme activity increases. Enzymes such as RuBisCO possess more KE so the random movement of molecules increases and there is a greater chance of successful collisions. This increases the rate of photosynthetic enzyme-controlled reactions such as carbon fixation in the light-independent stage.

22 (d) (i) The light-independent stage of photosynthesis used to be referred to as the 'dark reaction'.

Explain why this is both an accurate **and** an inaccurate way to describe the light-independent stage.

The light-independent stage does not directly require light, so it may be accurate to describe it as the 'dark reaction'. However, 'dark reaction' implies that this stage is completely independent of light and occurs in the dark which is misleading. The light-independent stage does not take place in the dark because it is driven by ATP and NADPH produced in the light-dependent stage, which requires light. Thus, the phrase is innacurate. **[2]**

22 (d) (ii) Name the enzyme responsible for fixing CO_2 in the light-independent stage of photosynthesis. RuBisCO **[1]**

22 (e) (i) The scientist then investigated the effect of auxin on *P. pusillus* stems.

The growing tips of stems were removed and the stems were placed in solutions containingdifferent concentrations of auxin.

The scientist analysed the results and determined the following relationship:

The higher the concentration of auxin in the solution, the fewer side shoots grew on the *P. pusillus* stems.

Explain why this relationship occurs in *P. pusillus* stems. **[1]**

High auxin concentrations inhibit lateral shoot growth, apical dominance.

22 (e) (ii) Give **two** examples of the commercial uses of auxin.

Production of seedless fruit
Used in hormone rooting powders

[2]

Total Marks for Question Set 22: 17