

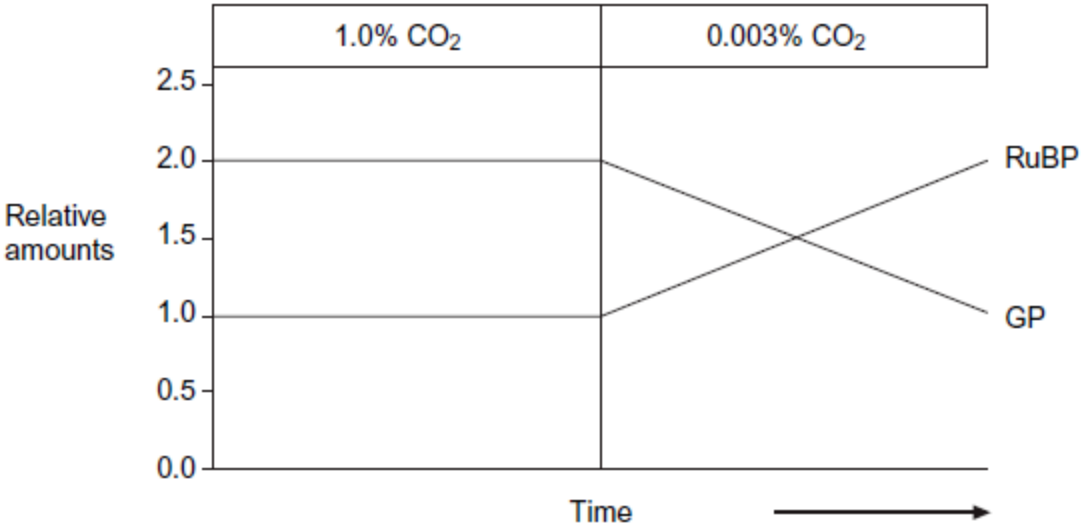
1

(a) Where precisely in a cell does the Calvin cycle take place?

(1)

(b) A scientist investigated the effect of changing the carbon dioxide concentration on the amounts of glycerate-3-phosphate (GP) and ribulose biphosphate (RuBP) in photosynthesising cells.

The graph shows the results obtained when the carbon dioxide concentration was reduced.



(i) Explain the decrease in the amount of GP after the carbon dioxide concentration was reduced.

(1)

(ii) The scientist carried out a similar experiment but increased the carbon dioxide concentration from 1% to 2%. The relative amounts of GP and RuBP remained the same.

Suggest **two** reasons why.

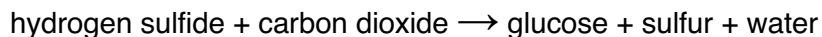
- 1. _____

- 2. _____

(2)

- (c) Some bacteria use hydrogen sulfide, H_2S , to produce organic compounds. The hydrogen sulfide has a similar role to that of water in photosynthesis.

A simple equation for this process in bacteria is shown below:



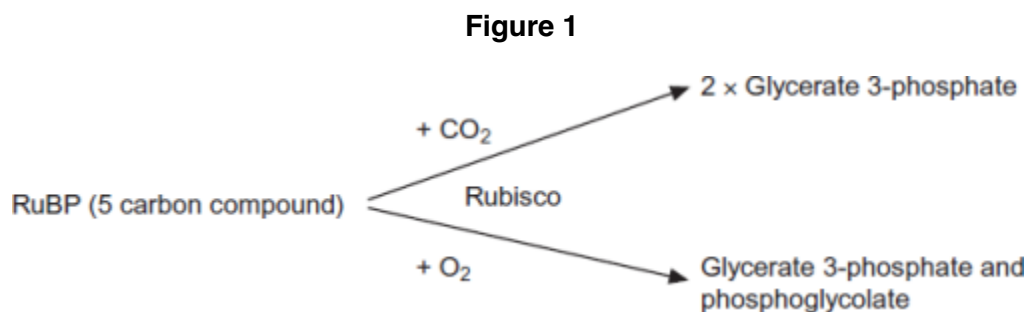
Suggest what the hydrogen sulfide is used for in these bacteria.

(2)

(Total 6 marks)

2

During photosynthesis, carbon dioxide reacts with ribulose biphosphate (RuBP) to form two molecules of glycerate 3-phosphate (GP). This reaction is catalysed by the enzyme Rubisco. Rubisco can also catalyse a reaction between RuBP and oxygen to form one molecule of GP and one molecule of phosphoglycolate. Both the reactions catalysed by Rubisco are shown in **Figure 1**.



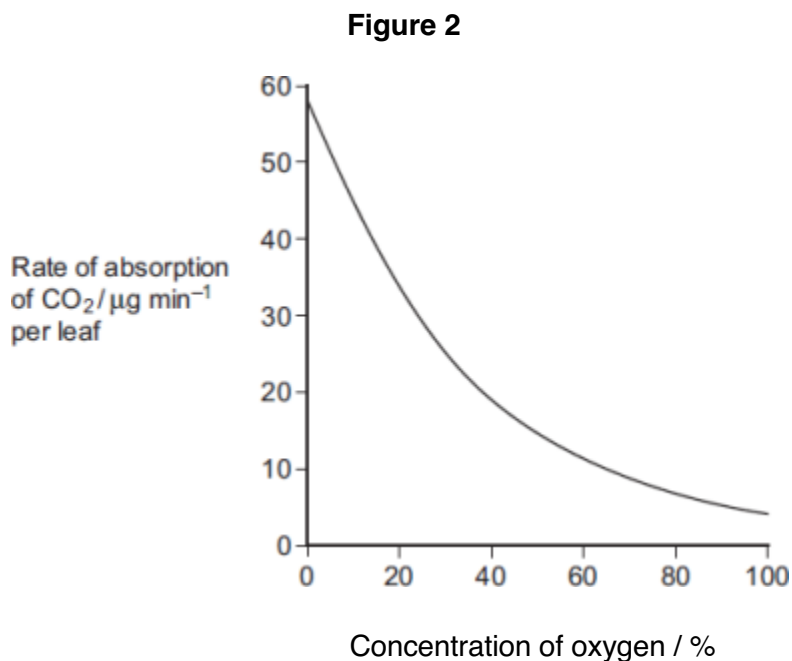
- (a) (i) Where exactly in a cell is the enzyme Rubisco found?

(1)

- (ii) Use the information provided to give the number of carbon atoms in **one** molecule of phosphoglycolate.

(1)

- (b) Scientists investigated the effect of different concentrations of oxygen on the rate of absorption of carbon dioxide by leaves of soya bean plants. Their results are shown in **Figure 2**.



Use **Figure 1** to explain the results obtained in **Figure 2**.

(2)

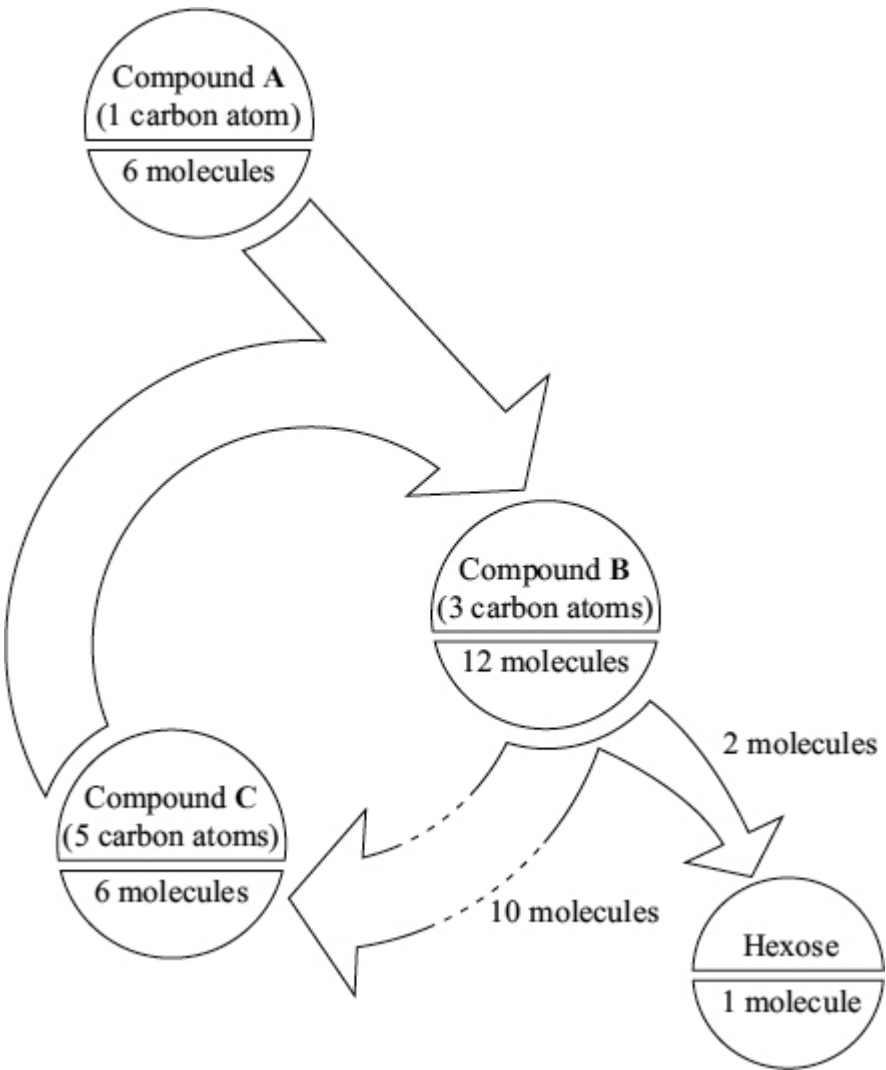
- (c) Use the information provided and your knowledge of the light-independent reaction to explain why the yield from soya bean plants is decreased at higher concentrations of oxygen. Phosphoglycolate is not used in the light-independent reaction.

(3)

(Total 7 marks)

3

The diagram represents some of the light-independent reactions of photosynthesis.



(a) Describe the light-independent reactions of photosynthesis and explain how they allow the continued synthesis of hexose sugars.

(6)

(b) Describe the role of electron transport chains in the light-dependent reactions of photosynthesis.

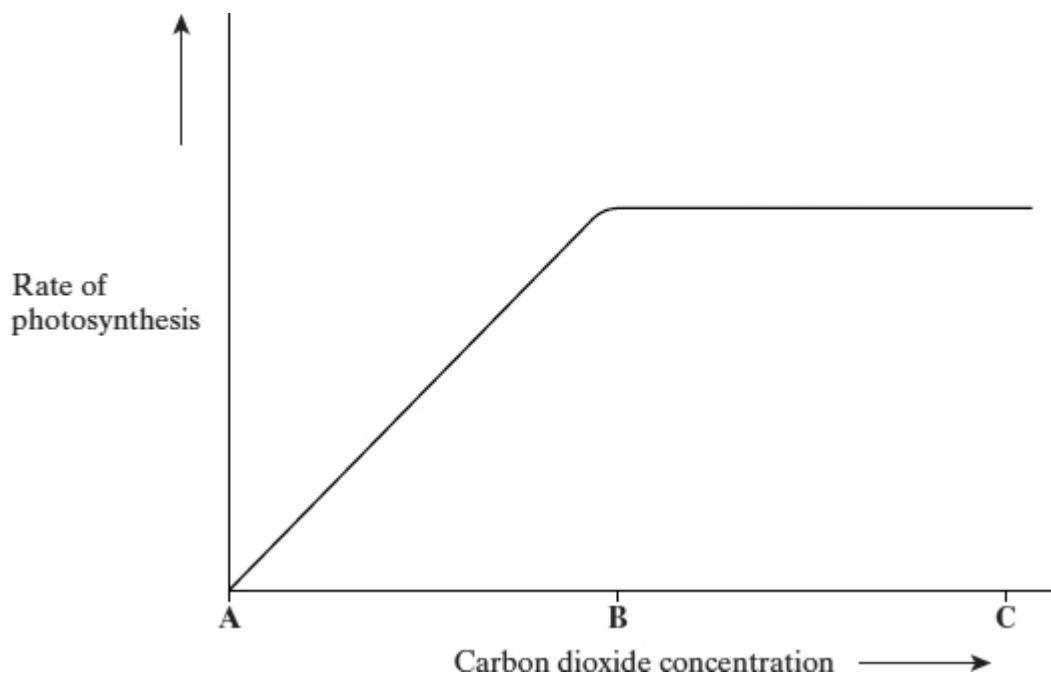
(6)

(c) Explain why the increase in the dry mass of a plant over twelve months is less than the mass of hexose produced over the same period.

(3)
(Total 15 marks)

4

An investigation was carried out to find the effect of increasing carbon dioxide concentration on the rate of photosynthesis in a particular type of plant. The graph shows the results.



(a) (i) In this investigation, temperature was kept constant. Explain why.

(1)

(ii) Suggest suitable units for measuring the rate of photosynthesis in this investigation.

(2)

- (b) (i) Give the evidence from the graph that carbon dioxide is limiting the rate of photosynthesis between **A** and **B**.

1

(1)

- (ii) Explain the shape of the curve between **B** and **C**.

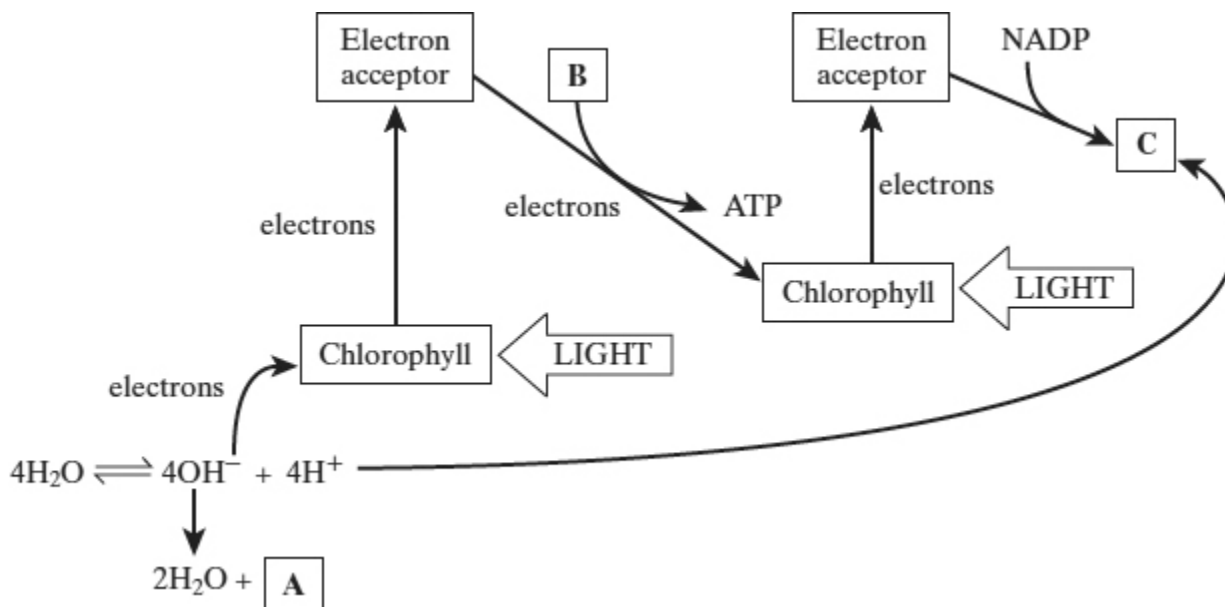
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(2)

(Total 6 marks)

5

The diagram shows the light-dependent reactions of photosynthesis.



- (a) In which part of a chloroplast do the light-dependent reactions occur?

(1)

(b) Name the substances in boxes **A**, **B** and **C**.

A _____

B _____ + _____

C _____

(3)

(c) Use information in the diagram to explain

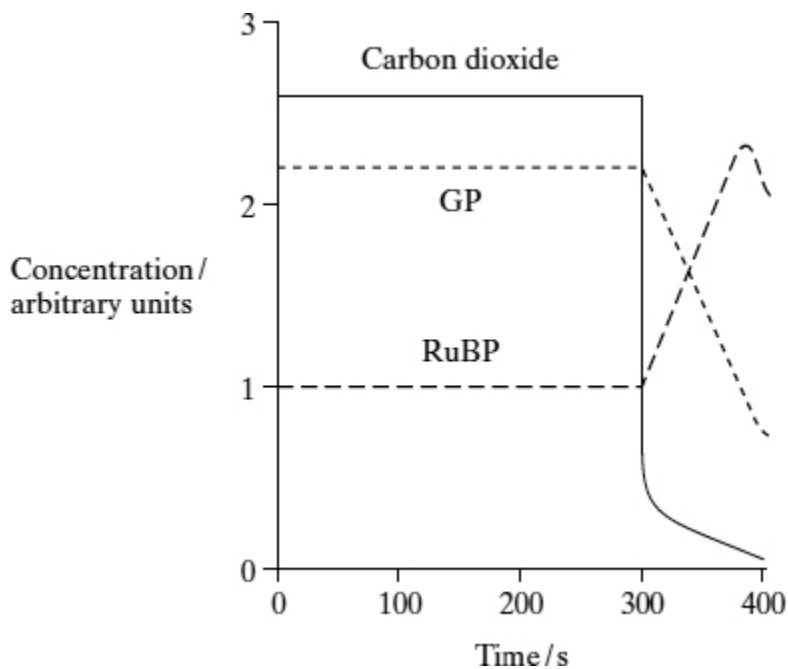
(i) the role of chlorophyll in photolysis;

(3)

(ii) how the energy of light is converted into chemical energy in the light-dependent reactions.

(3)

- (d) In an investigation, single-celled algae were kept in bright light and were supplied with carbon dioxide containing radioactive carbon atoms. After 300 seconds, the carbon dioxide supply was turned off. The graph shows how the concentrations of carbon dioxide, glycerate 3-phosphate (GP) and ribulose bisphosphate (RuBP) changed.



- (i) Explain why, between 0 seconds and 300 seconds, the concentration of radioactive GP remained constant.

(3)

- (ii) Explain why, between 300 seconds and 380 seconds, the concentration of radioactive RuBP increased.

(2)

(Total 15 marks)

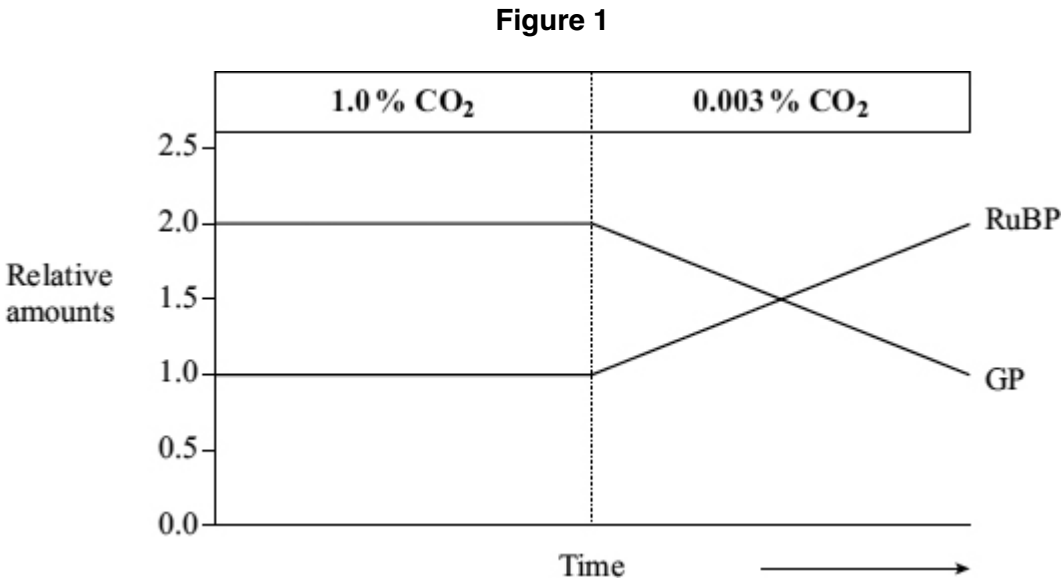
6

(a) Describe how NADP is reduced in the light-dependent reaction of photosynthesis.

(2)

(b) In an investigation of the light-independent reaction, the amounts of glycerate 3-phosphate (GP) and ribulose bisphosphate (RuBP) in photosynthesising cells were measured under different environmental conditions.

Figure 1 shows the effect of reducing the carbon dioxide concentration on the amounts of glycerate 3-phosphate and ribulose bisphosphate in photosynthesising cells.



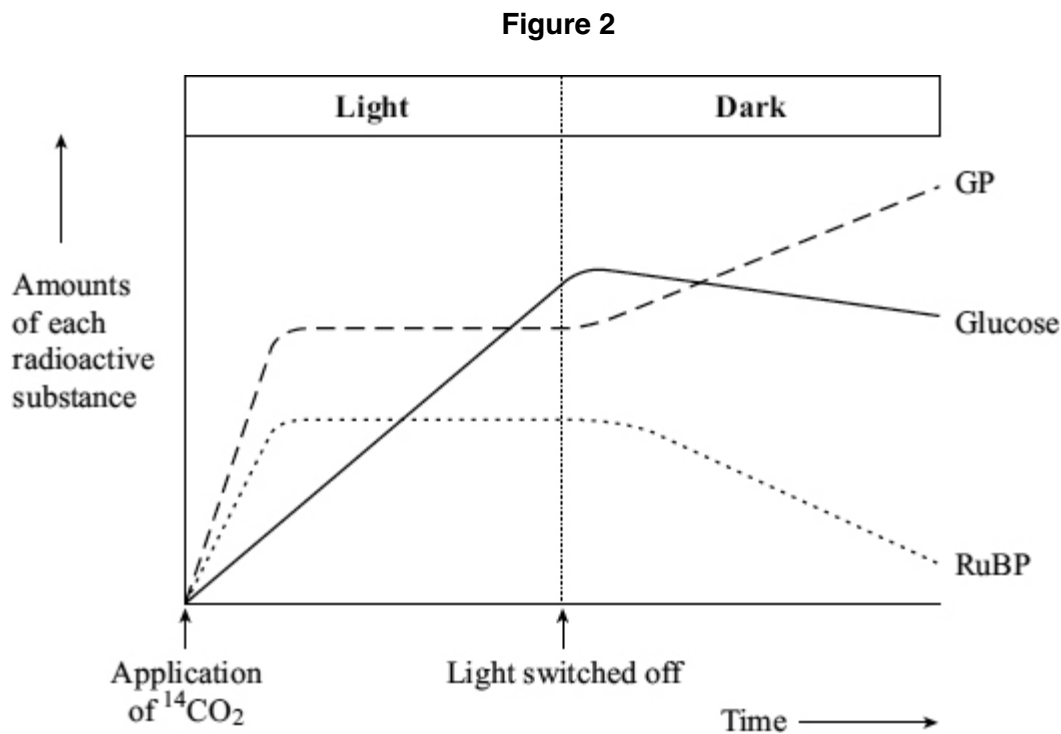
(i) Explain why there is twice the amount of glycerate 3-phosphate as ribulose bisphosphate when the carbon dioxide concentration is high.

(1)

(ii) Explain the rise in the amount of ribulose bisphosphate after the carbon dioxide concentration is reduced.

(1)

- (c) **Figure 2** shows the results of an experiment in which photosynthesising cells were kept in the light and then in darkness.



- (i) In the experiment the cells were supplied with radioactively labelled $^{14}\text{CO}_2$. Explain why the carbon dioxide used was radioactively labelled.

(1)

- (ii) Explain how lack of light caused the amount of radioactively labelled glycerate 3-phosphate to rise.

(2)

- (iii) Explain what caused the amount of radioactively labelled glucose to decrease after the light was switched off.

(1)

(Total 8 marks)