Photosynthesis as an energy transfer process

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Photosynthesis
Sub Topic	Photosynthesis as an energy transfer process
Booklet	Theory
Paper Type	Question Paper 2

Time Allowed : **64 minutes**

Score : **/ 53**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** Explain how the physiology of the leaves of a C4 plant, such as maize, is adapted for efficient carbon fixation at high temperatures. [7]

(b) Describe how, in photosynthesis, light energy is converted into chemical energy, in the form of ATP. [8]

[Total: 15]

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2 **(a)** A student investigated the effects of temperature and light intensity on the rate of photosynthesis of an aquatic plant.

Fig. 1.1 shows the results of the investigation.

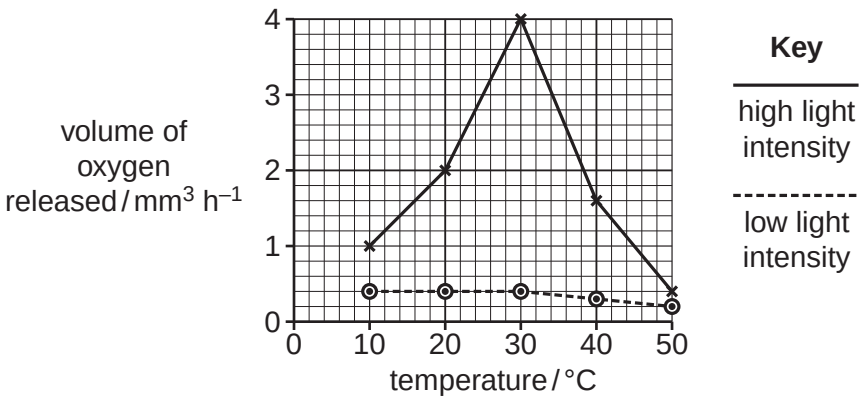

Fig. 1.1

With reference to Fig. 1.1:

(i) describe the results of the investigation

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(ii) suggest explanations for the results for high light intensity **above 30 °C**.

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(b) (i) Name the process in the light-dependent stage of photosynthesis that produces oxygen.

..... [1]

(ii) Name the photosystem involved in the production of oxygen in the light-dependent stage.

..... [1]

(iii) Explain why the volume of oxygen released from the plant does not give a true rate of photosynthesis.

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..... [1]

[Total: 8]

3 **(a)** Describe the structure of a chloroplast. [7]

(b) Explain how rice is adapted to growing in flooded fields. [8]

[Total:15]

4 **(a)** Fig. 8.1 shows the effect of temperature on the rate of photosynthesis of a plant at a constant light intensity and a carbon dioxide concentration of 0.03%.

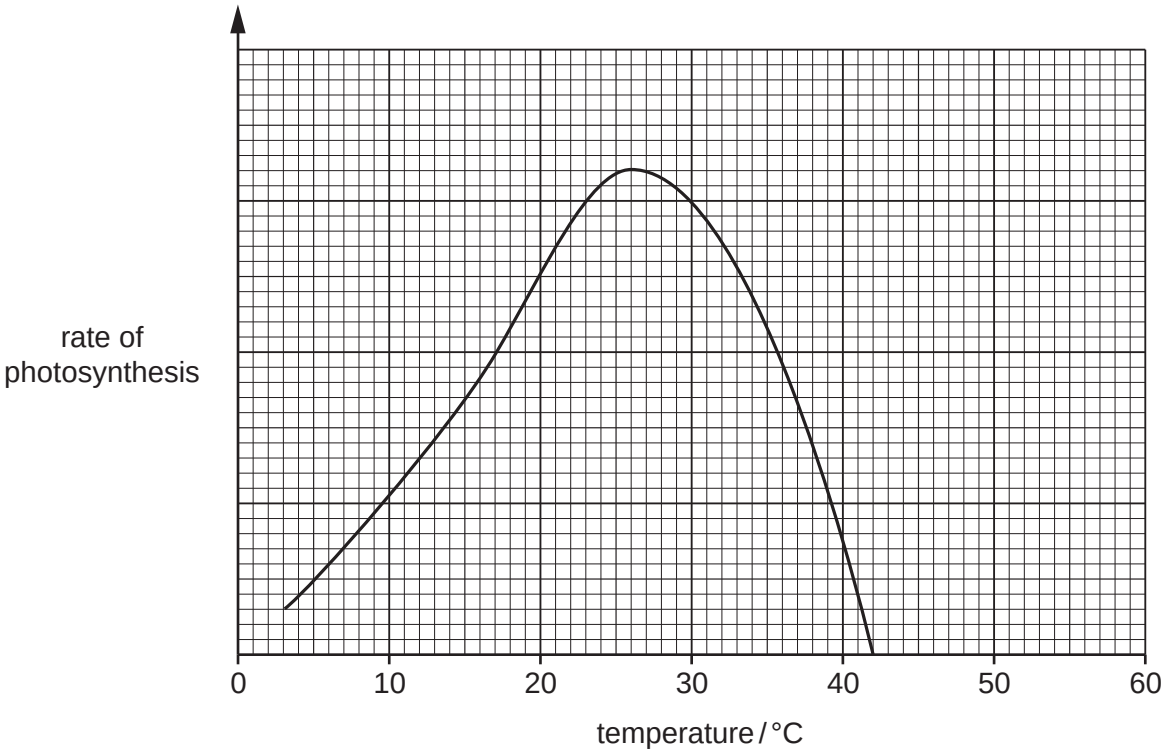

Fig. 8.1

(i) Suggest and explain why the rate of photosynthesis of the plant decreases to zero just above 40 °C.

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(ii) Draw, **on Fig. 8.1**, the likely curve if the same experiment were carried out on a C4 plant, such as sorghum.

Give reasons to explain your curve.

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(b) Experiments were carried out to determine the effect of light intensity on the rate of photosynthesis of a species of the unicellular protoctist, *Chlorella*. A cell suspension of *Chlorella* was used.

- The suspension of *Chlorella* was illuminated at a light intensity of 5 lux for 20 seconds.
- The carbon dioxide uptake by *Chlorella* was measured at the end of the 20 second period of illumination.
- The experiment was repeated at 10, 13 and 15 lux.
- The suspension was maintained at a temperature of 20 °C.

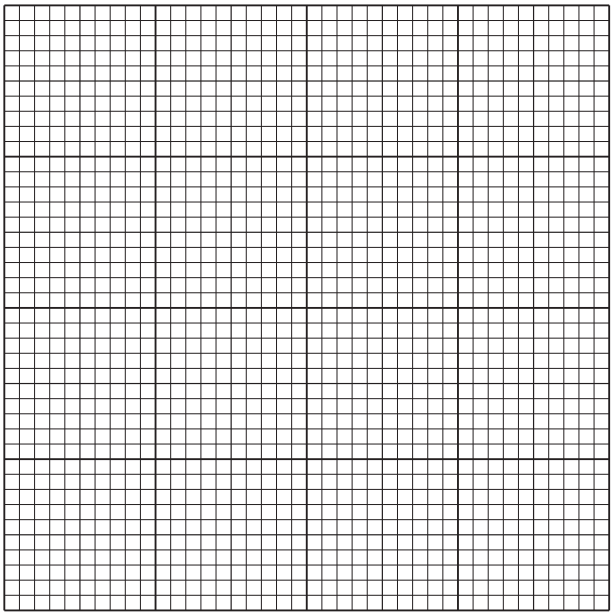
Table 8.1 shows the results of the experiments.

Table 8.1

light intensity / lux	total CO_2 uptake after 20 seconds / μmol	rate of photosynthesis / μmol s^{-1}
5	36	1.8
10	84	
13	104	
15	120	

(i) Complete Table 8.1. [1]

(ii) Use the data in the table to plot a graph on the grid below to show the effect of light intensity on the rate of photosynthesis.



[3]

(iii) With reference to photosynthesis, state what is meant by a limiting factor.

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(iv) State the limiting factor in these four experiments.

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[Total: 15]