Plant Nutrition

Question Paper 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Plant Nutrition
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 2

Time Allowed: **69 minutes**

Score: **/57**

Percentage: **/100**

1 **(a)** Write a balanced chemical equation for photosynthesis.

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A student investigated the effect of light intensity on the rate of photosynthesis of algae.

Fig. 2.1 shows the apparatus set up for the investigation.

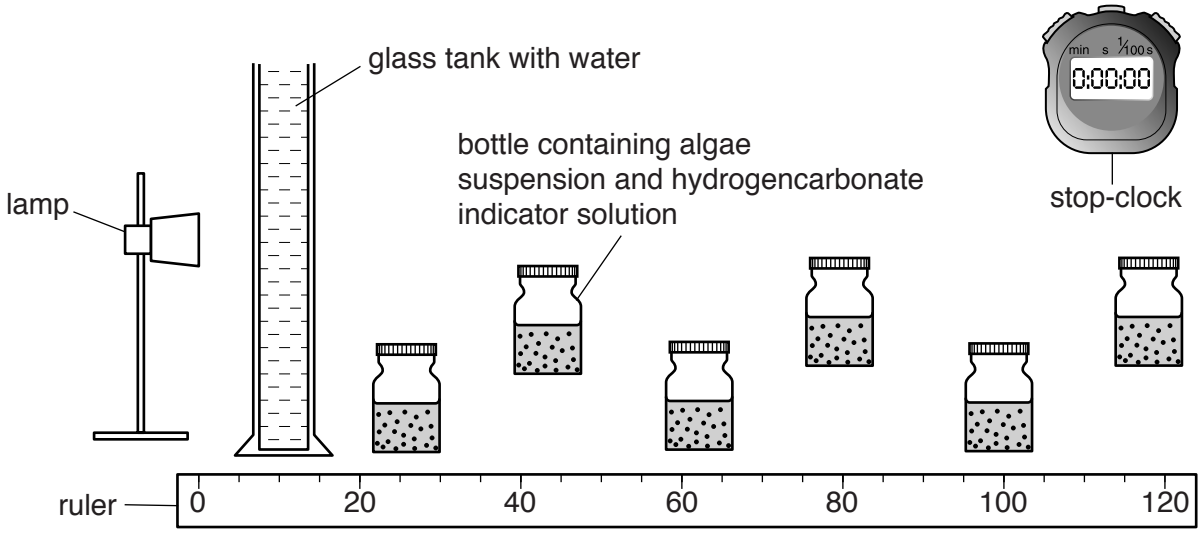

Fig. 2.1

(b) Suggest why a glass tank with water was placed between the lamp and the bottle in the investigation.

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..... [1]

(c) The hydrogencarbonate indicator solution changes colour when the pH changes. At pH 8.4 it is red, at pH 7.6 it is yellow and at pH 9 it is purple.

Predict the colour of the hydrogencarbonate indicator solution in the bottle nearest the lamp at the end of the investigation. Explain your answer.

colour prediction .....

explanation .....

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[3]

(d) The student's results are shown in Fig. 2.2.

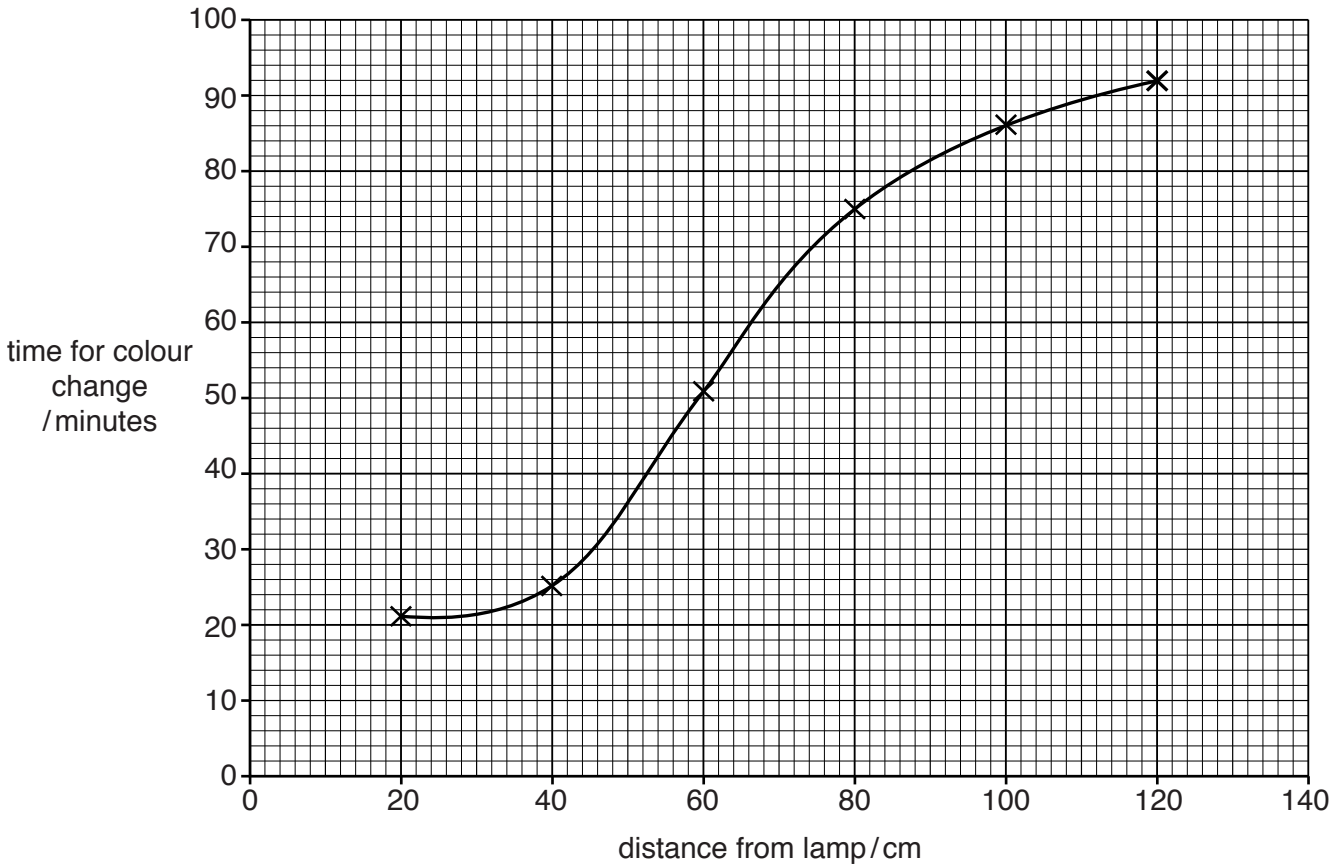

Fig. 2.2

Describe and explain how the rate of photosynthesis is affected by light intensity.

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[Total: 12]

2 Researchers in Michigan investigated the rate of photosynthesis in leaves of big-tooth aspen trees, *Populus grandidentata*, by placing some of the growing leaves inside transparent boxes.

The researchers measured the uptake of carbon dioxide by the leaves over a range of temperatures from 10–40 °C. They carried out their measurements at two different concentrations of carbon dioxide:

H – 325 ppm carbon dioxide which is close to the concentration in the atmosphere;

J – 1935 ppm carbon dioxide which is a very high concentration.

The results are shown in Fig. 3.1.

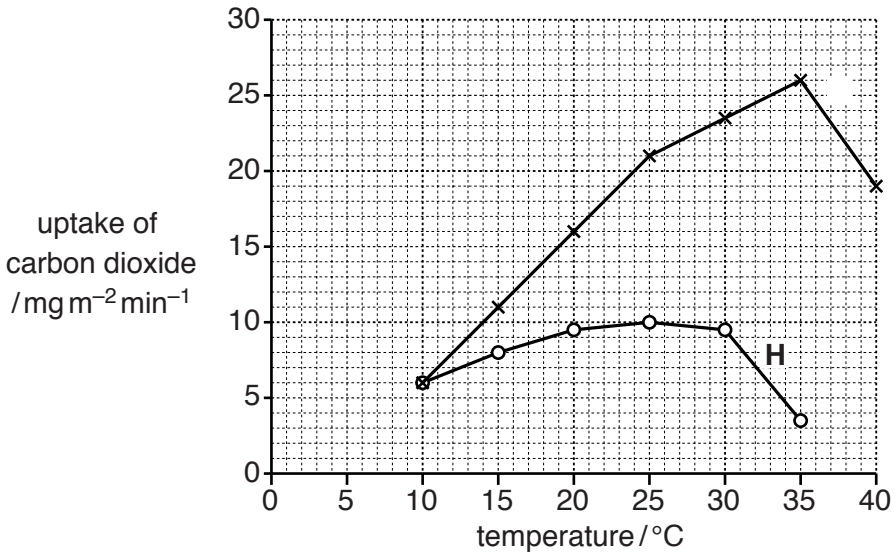

Fig. 3.1

(a) Describe how the results for the aspen leaves in batch **J** differ from the results for the aspen leaves in batch **H**. Use data from Fig. 3.1 in your answer.

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(b) Explain why the rate of photosynthesis in the leaves in batch **J**:

(i) increases with an increase in temperature from 15 °C to 35 °C

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(ii) decreases at temperatures above 35 °C.

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(c) Use the results in Fig. 3.1 to suggest **and** explain the likely effect on plant growth of an increase in carbon dioxide concentration in the atmosphere as a result of the combustion of fossil fuels.

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[Total: 12]

3 Fig. 6.1 shows the carbon cycle. **P**, **Q**, **R**, **S** and **T** each represent a part of the carbon cycle.

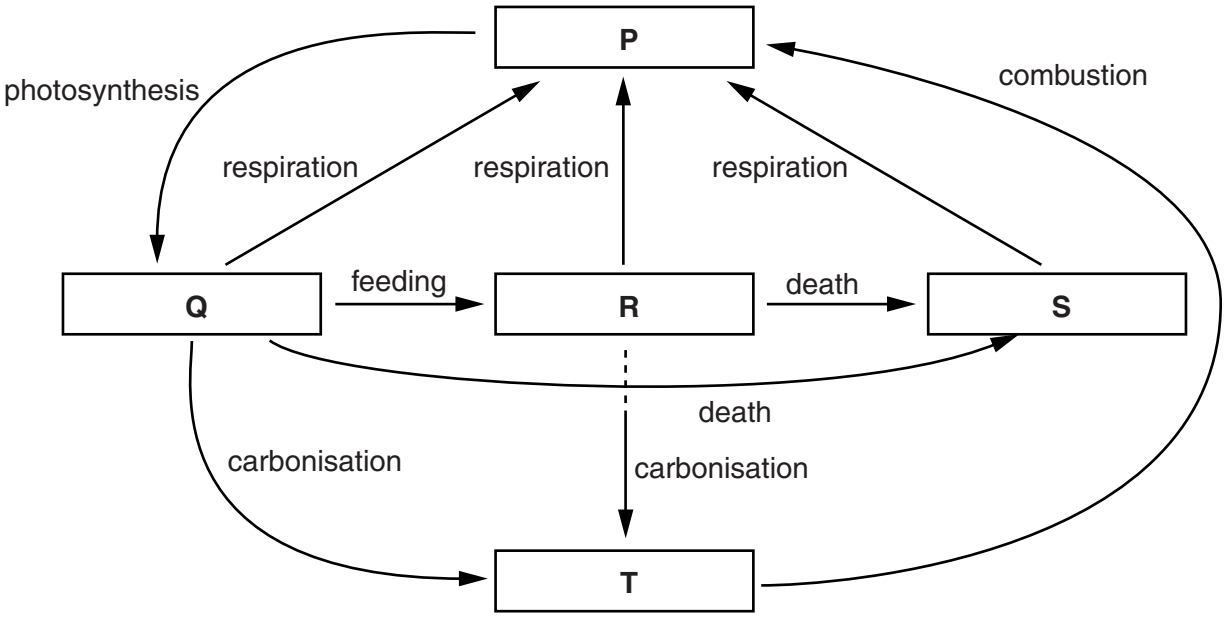

Fig. 6.1

(a) Complete Table 6.1 by identifying **P**, **Q**, **R** and **S** and the name of **one** example of a carbon compound found in each. **T** has been completed for you.

Table 6.1

letter	part of cycle	carbon compound found in each part
P		
Q		
R		
S		
T	fossil fuels, e.g. natural gas	methane

[4]

(b) Photosynthesis is a very important process in the carbon cycle.

Explain how the process of photosynthesis converts carbon compounds from **P** to carbon compounds in **Q**.

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(c) The rate of photosynthesis varies as a result of changes in environmental factors.

State **one** environmental factor and explain how it can affect the rate of photosynthesis.

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(d) Environmental factors can be controlled in glasshouses.

Describe how **three** environmental factors are controlled in a glasshouse to improve crop yield.

factor 1: .....

how is it controlled: .....

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factor 2: .....

how is it controlled: .....

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factor 3: .....

how is it controlled: .....

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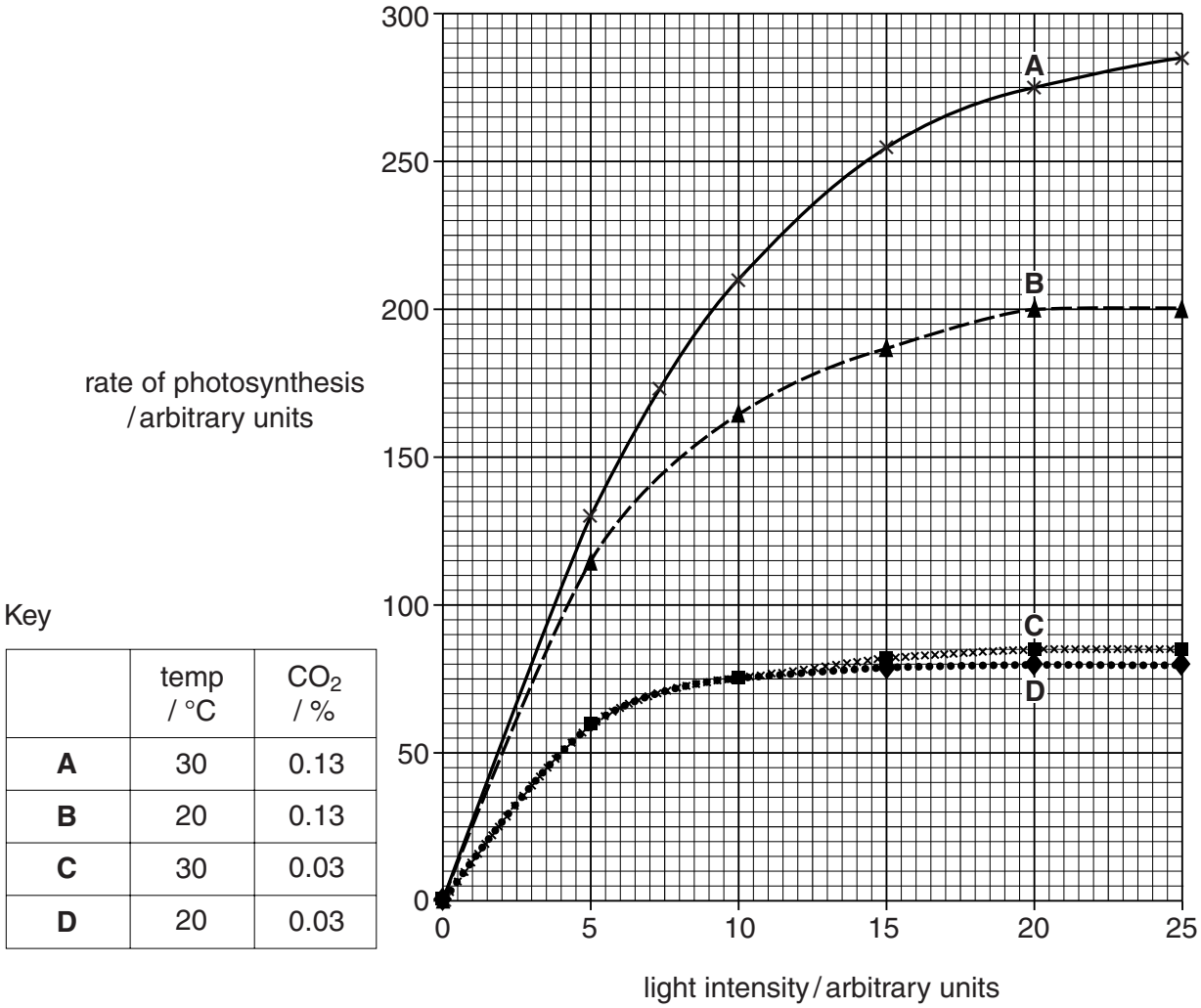
[3]

[Total: 15]

4 **(a)** A researcher carried out four experiments, **A** to **D**, to investigate the effect of light intensity on the rate of photosynthesis of cucumber plants. The experiments were carried out at two concentrations of carbon dioxide and at two temperatures.

The results are shown in Fig. 5.1.



	temp / °C	CO_2 / %
A	30	0.13
B	20	0.13
C	30	0.03
D	20	0.03

Fig. 5.1

(i) Use the results in Fig. 5.1 to identify the limiting factor for the rate of photosynthesis at the light intensities given in Table 5.1.

Write your answers in Table 5.1.

Table 5.1

experiment	light intensity / arbitrary units	limiting factor
A	20	
B	20	
C	20	
D	5	light intensity

[3]

(ii) Define the term *limiting factor*.

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Fig. 5.1 shows that providing plants with more carbon dioxide can increase the rate of photosynthesis.

An investigation was carried out in China using crop residues and animal manure mixed together in composting units that were placed into a glasshouse containing crop plants.

Fig. 5.2 shows a composting unit in which decomposition takes place.

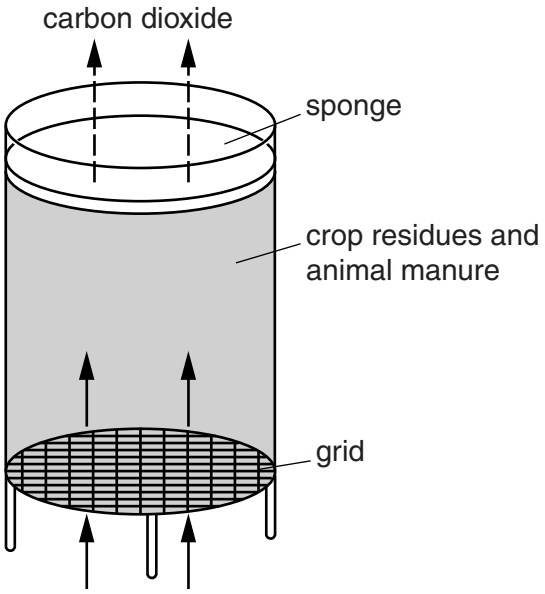

Fig. 5.2

(b) (i) Suggest the reason for using a grid instead of a solid base for the composting unit.

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(ii) The sponge was soaked in sulfuric acid to remove any ammonia gas released by the decomposing material (compost).

Explain how the ammonia was produced.

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(c) Two glasshouses were used in this investigation. One glasshouse contained composting units and the other did not. Each glasshouse contained the same number and type of crop plants.

The concentration of carbon dioxide in both glasshouses was measured at midday.

The results are shown in Fig. 5.3.

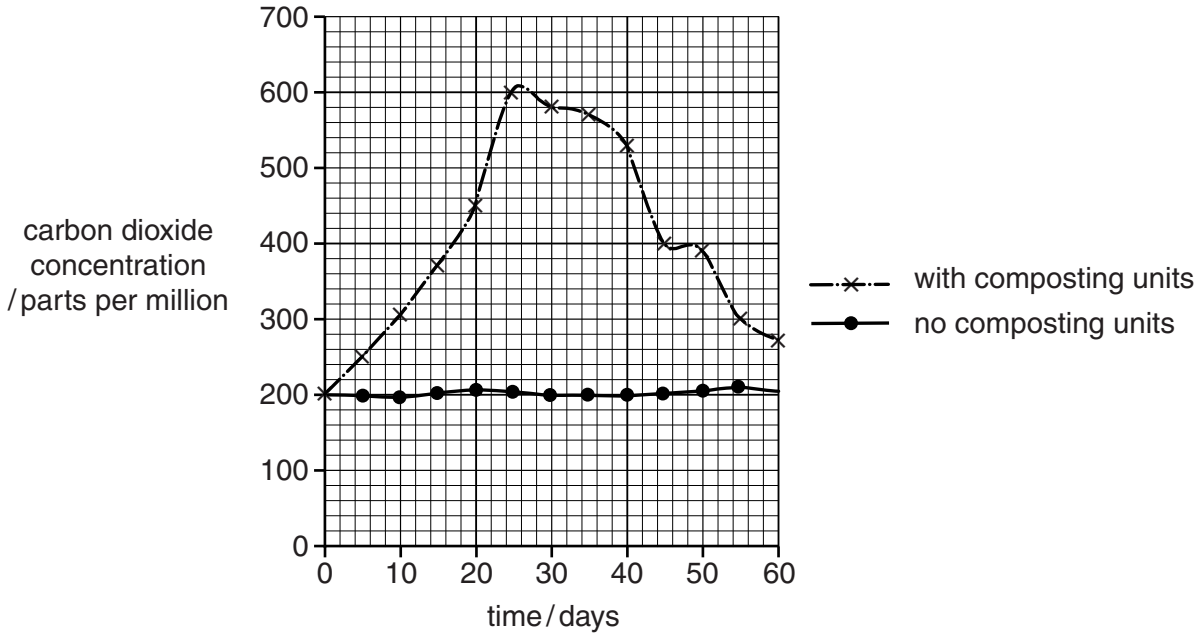

Fig. 5.3

(i) State why a glasshouse without composting units was used in the investigation.

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(ii) Describe the results shown in Fig. 5.3.

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(d) At the end of the investigation the crop plants were harvested and weighed. Table 5.2 gives the results.

Table 5.2

crop plant	mean fresh mass / g per plant	
	no composting units	composting units
Chinese cabbage	115.7	355.8
celery	44.7	133.9
lettuce	95.5	349.4

Use the information in Fig. 5.3 and in Table 5.2 to summarise the results of the study.

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[Total: 18]