

Photosynthesis as an energy transfer process

Question Paper 10

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 10

Time Allowed : 70 minutes

Score : / 58

Percentage : /100

Grade Boundaries:

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

1 Cereal crops, such as sorghum and rice, are a major source of nutrients all over the world.

(a) Explain why cereal crops are important components of many people’s diets.

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(b) Alpha amylase is an enzyme produced in germinating seeds, where it hydrolyses starch. Fig. 4.1 shows the effect of temperature on alpha amylase in germinating seeds of sorghum and rice.

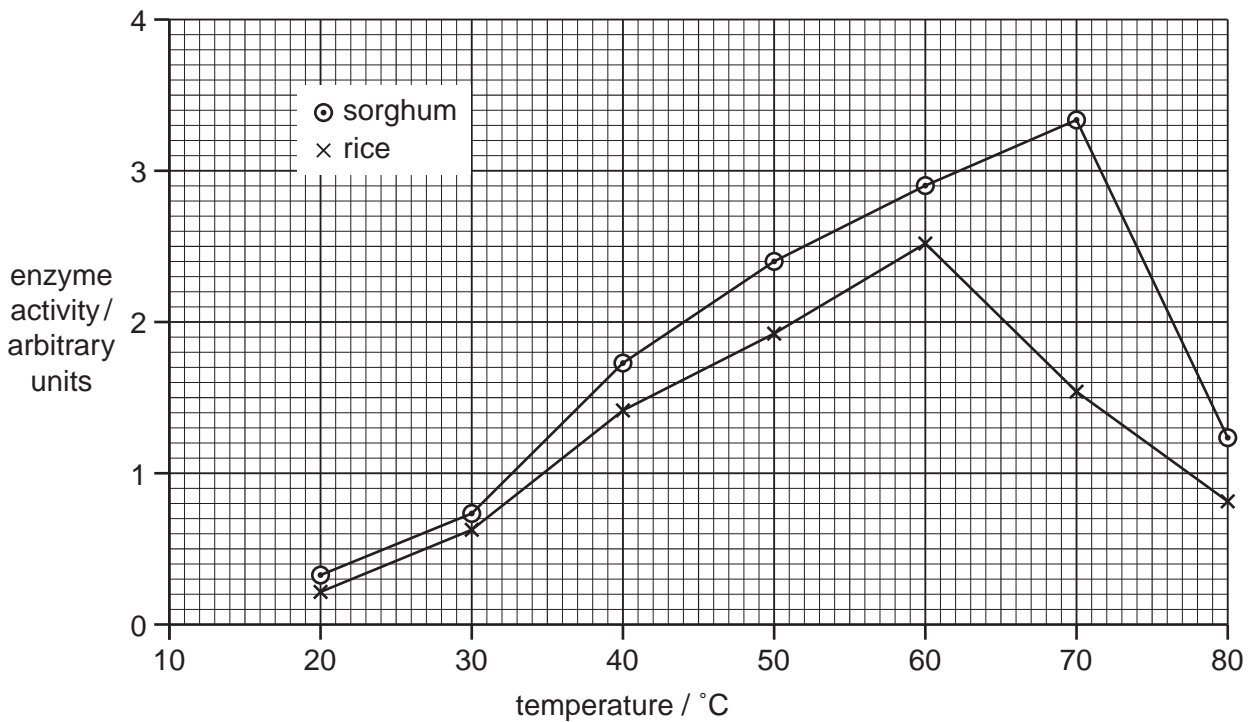


Fig. 4.1

(i) Name the part of the seed that contains starch.

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[1]

- (ii)** With reference to Fig. 4.1, compare the effects of temperature on alpha amylase in sorghum and rice.

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- (iii)** With reference to the types of bonding in proteins, suggest how differences in the tertiary structure of alpha amylase in rice and sorghum could explain the differences in their activities shown in Fig. 4.1.

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(c) Sorghum does not grow well at low temperatures. An investigation was carried out into the response of sorghum to low temperatures at different light intensities.

- Sorghum plants were kept at 25 °C in a light intensity of 215 W m⁻² for several weeks, and then at 10 °C for three days.
- The temperature was then increased to 25 °C again for seven days.
- The investigation was repeated at light intensities of 170 W m⁻² and 50 W m⁻².
- Day length and carbon dioxide concentration were kept constant throughout.

The uptake of carbon dioxide, as mg CO₂ absorbed per gram of leaf dry mass, was measured

- at 25 °C before cooling
- at on each of the three days at 10 °C
- for seven days at 25 °C.

The results are shown in Table 4.1.

Table 4.1

light intensity / W m ⁻²	carbon dioxide uptake / mg CO ₂ g ⁻¹				
	at 25 °C, before cooling	during cooling at 10 °C			at 25 °C (mean over days 4 to 10)
		day 1	day 2	day 3	
215	50.1	3.0	0.4	0.2	0.2
170	48.2	5.5	2.9	1.2	1.5
50	22.4	3.0	1.2	0.7	9.2

With reference to Table 4.1

(i) describe **and** explain the effect of light intensity on the rate of carbon dioxide uptake **before cooling**

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- (ii) describe the effect of light intensity on the ability of sorghum plants to survive cooling.

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[Total: 15]

(c) Fig. 8.2 outlines the main reactions in the light-dependent stage of photosynthesis.

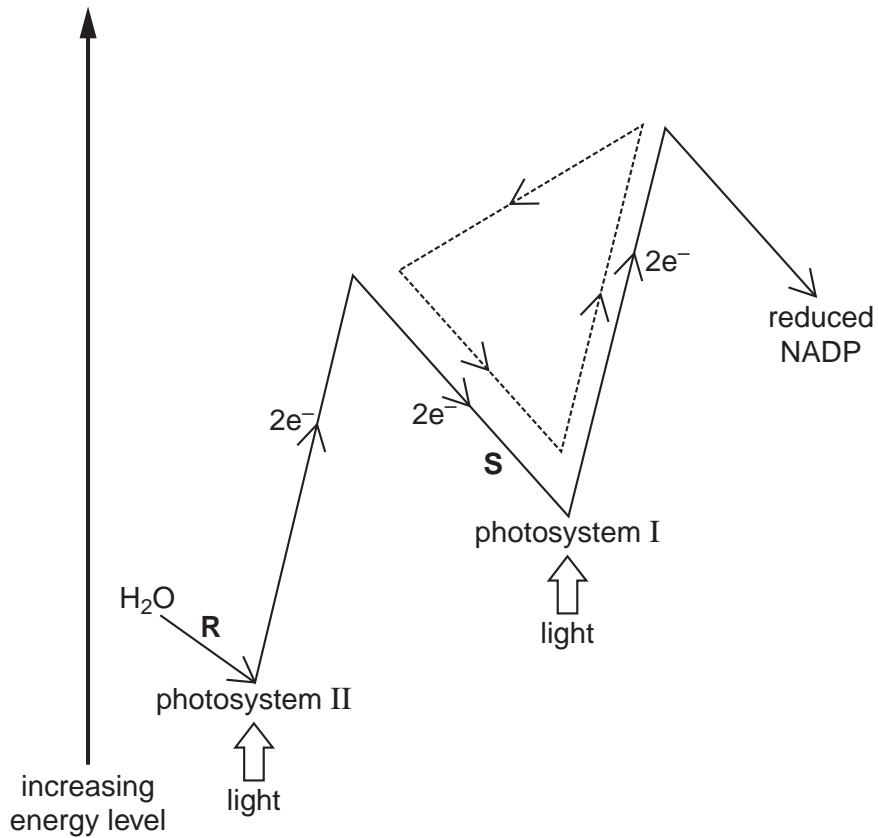


Fig. 8.2

(i) Name the process shown by the dotted arrows (----->-----).

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(ii) Describe what happens to water at R.

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 [2]

(iii) State the product formed as electrons flow along S.

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(iv) Explain briefly the role of reduced NADP in the **light-independent stage**.

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 [2]

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A series of horizontal dotted lines for writing, spanning the width of the page and covering most of its vertical space.

4 (a) Fig. 4.1 shows the male and female flowers of maize.

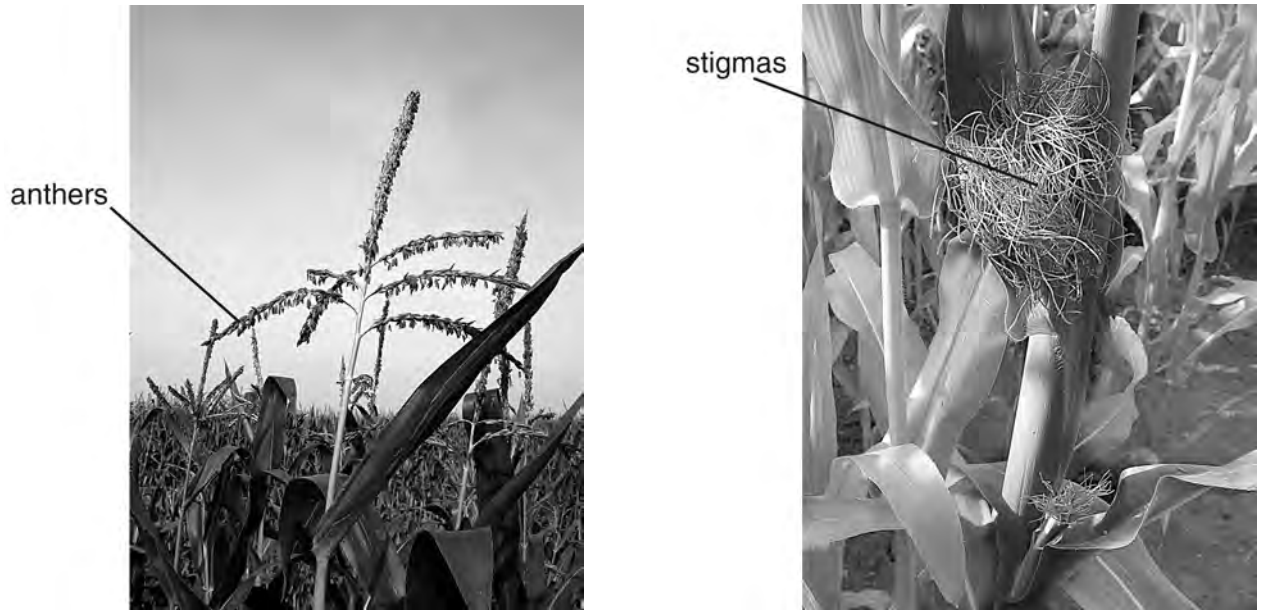


Fig. 4.1

(i) With reference to Fig. 4.1 suggest how the flowering habit of maize encourages wind pollination.

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(ii) In a maize plant, the anthers normally ripen and release pollen before the stigmas are mature and ready to receive pollen. This encourages cross-pollination.

Explain **two** potential advantages of cross-pollination to a plant species.

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(b) The conditions in which wheat and maize are grown affect their ability to photosynthesise.

Fig. 4.2 compares the rate of photosynthesis of wheat and maize at different temperatures.

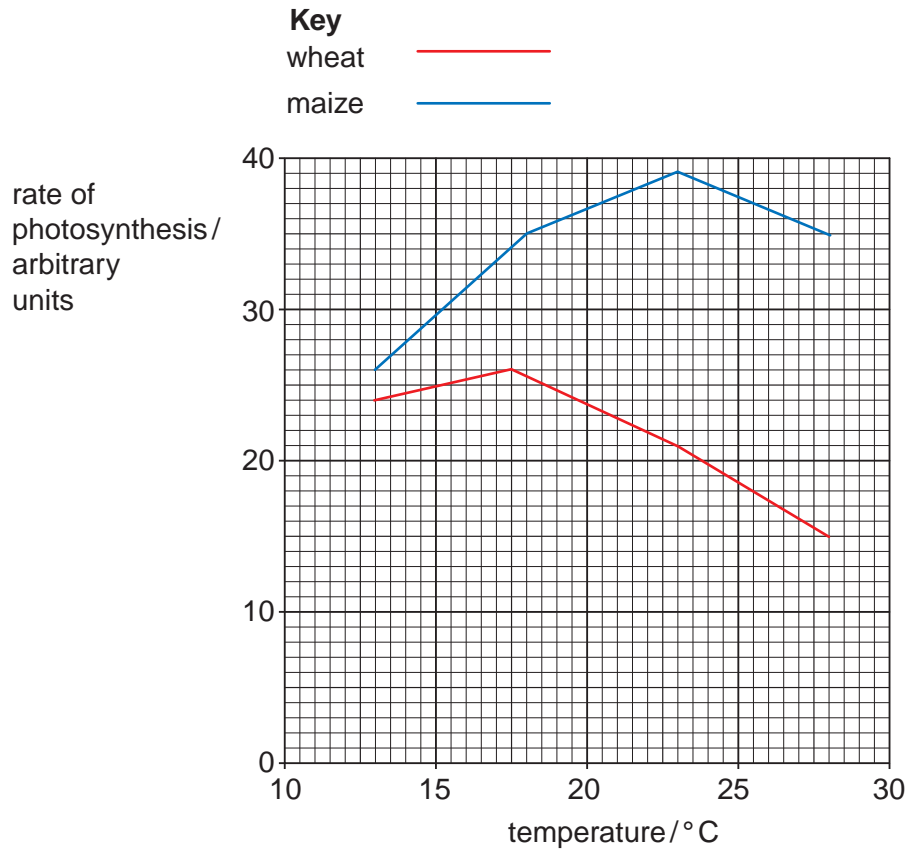


Fig. 4.2

With reference to Fig. 4.2:

(i) **compare** the effect of temperature on the rates of photosynthesis of wheat and maize

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- (ii) explain the difference between the rates of photosynthesis of wheat and maize at 28°C.

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- (c) Cereal grains are a major component of the human diet.

Table 4.1 shows some of the nutrient contents of 100g samples of grains of wheat, white rice and maize.

Table 4.1

	wheat	white rice	maize
protein / g	12.3	7.5	8.9
fat / g	2.0	2.8	4.7
carbohydrate / g	75.0	77.0	74.0
fibre / g	2.3	0.9	2.0
calcium / mg	34.0	28.0	7.0
iron / mg	5.4	1.6	2.7
sodium / mg	2.0	6.0	35.0

- (i) With reference to Table 4.1 suggest reasons for the difference in protein content between wheat and white rice.

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- (ii) State, giving a reason, which type of grain would be beneficial for a person with anaemia.

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[Total: 14]