Photosynthesis – 2023 Biology A2 9700

1. March/2023/Paper_ 9700/42/No.8

(a) Describe the functions of the internal membranes of the chloroplast in photosynthesis.

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..... [7]

(b) Rubisco activase (RA) is an enzyme that has an effect on the activity of rubisco.

An investigation was carried out on the effect of RA on the activity of rubisco.

- Solutions of rubisco and RuBP were added to two tubes, **A** and **B**.
- RA was added to tube **A**.
- Both tubes were incubated at 25 °C for 6 minutes.
- The activity of rubisco was measured every 30 seconds.

All conditions were kept the same, except for the addition of RA to tube **A**.

The results are shown in Fig. 8.1.

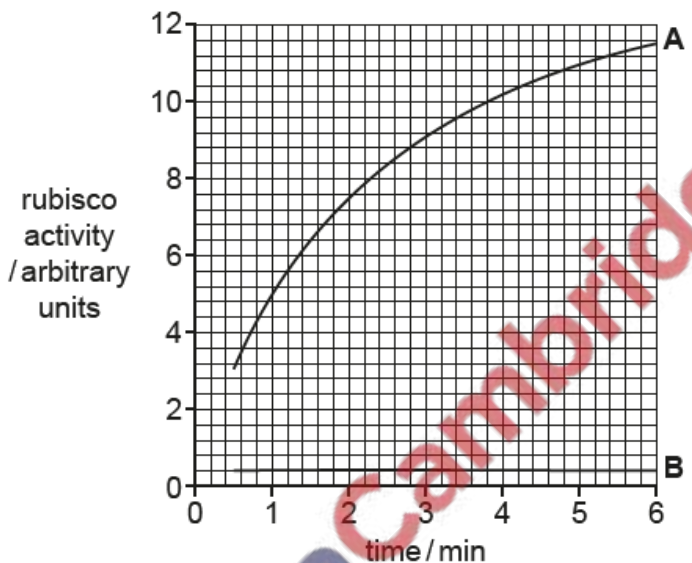

Fig. 8.1

Describe the results shown in Fig. 8.1 **and** suggest an explanation for the effect of RA on the activity of rubisco.

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[Total: 11]

2. June/2023/Paper_ 9700/41/No.1

Fig. 1.1 shows a transmission electron micrograph of part of a chloroplast.

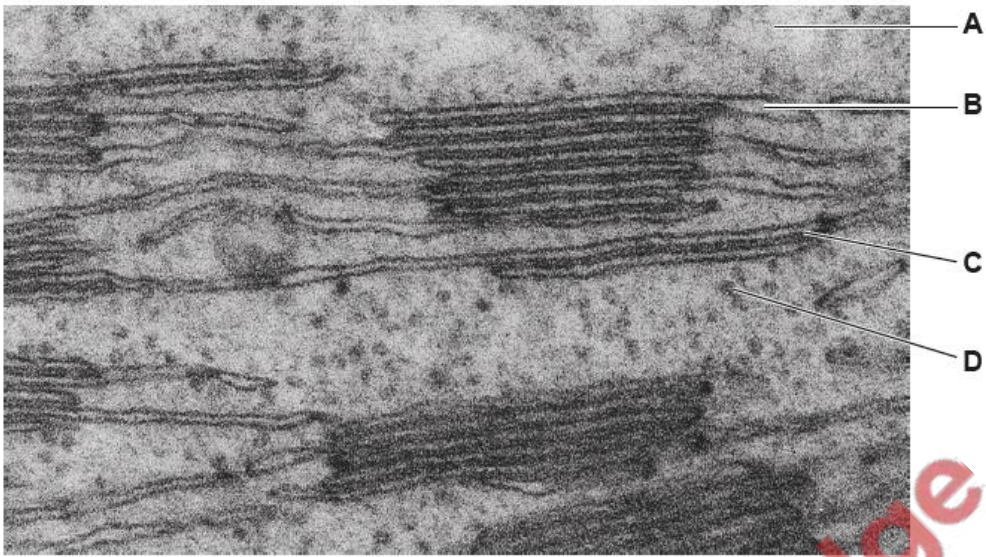

Fig. 1.1

(a) Table 1.1 describes some functions that occur in different parts of a chloroplast.

Complete Table 1.1 by identifying the letter on Fig. 1.1 that is a location matching the description. Each letter may be used once, more than once, or not at all.

Table 1.1

description	letter
accumulates (builds up) a high concentration of protons	
makes triose phosphate	
makes some chloroplast proteins	
pumps protons	

[4]

(b) Membranes of the type labelled **C** in Fig. 1.1 were made into a liquid extract. Chromatography was then used to separate and identify the coloured components (pigments) in this extract. The resulting chromatogram showed that these membranes contain a yellow pigment, an orange pigment, a green-brown pigment and two different green pigments.

(i) Describe how you would carry out chromatography to separate and identify the coloured pigments in the liquid extract of **C**.

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(ii) Explain why membrane **C** has many different coloured pigments to function efficiently.

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..... [3]

[Total: 11]

3. June/2023/Paper_ 9700/42/No.8

(a) In plants such as rice, *Oryza sativa*, rubisco has a low rate of activity, which in turn affects the rate of photosynthesis. The cereal crop sorghum, *Sorghum bicolor*, has a high rate of activity of rubisco.

A genetically modified (GM) variety of rice was produced. Parts of the quaternary structure of rubisco in rice were altered to be the same as the rubisco in sorghum.

The rate of activity of rubisco in non-GM rice and GM rice was measured at different concentrations of atmospheric carbon dioxide (CO_2).

The results are shown in Fig. 8.1.

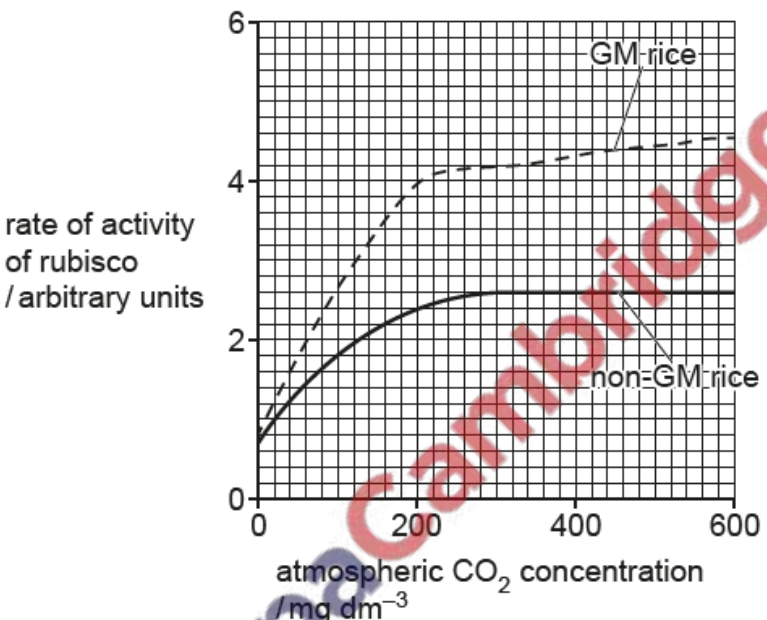

Fig. 8.1

(i) Compare the two curves shown in Fig. 8.1 **and** explain why the curve for non-GM rice levels off.

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..... [3]

(ii) Suggest which part of the rubisco molecule was altered to produce the GM variety of rice.

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..... [1]

(b) Fig. 8.2 shows an outline of the Calvin cycle.

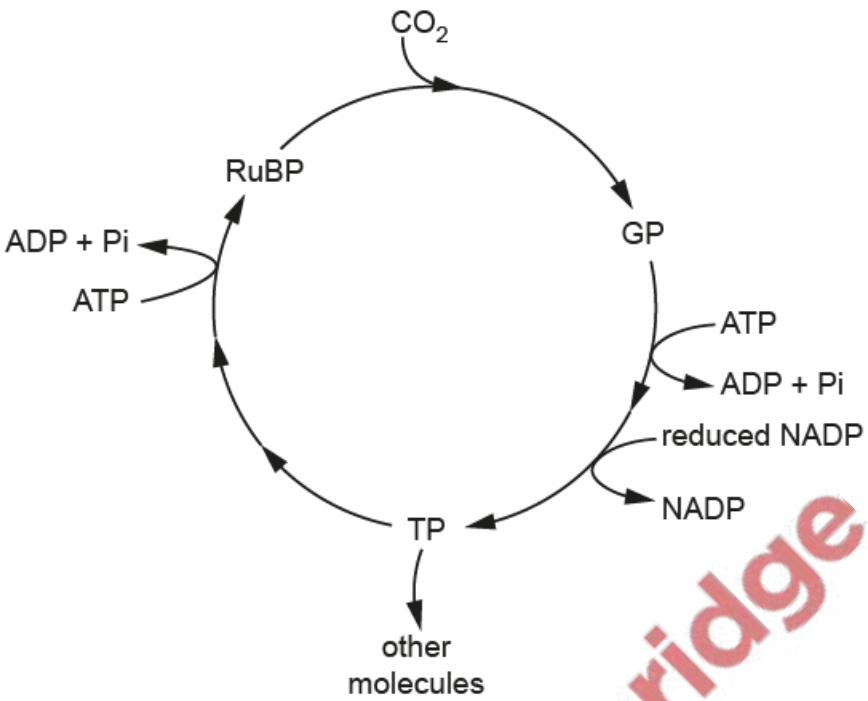

Fig. 8.2

(i) Name the process that involves the enzyme rubisco.

..... [1]

(ii) State the type of reaction that occurs when GP is converted to TP.

..... [1]

(iii) RuBP is regenerated from molecules of TP.

State how many molecules of RuBP are produced from 10 molecules of TP.

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(iv) TP molecules that are **not** involved in the regeneration of RuBP can be used in the synthesis of other molecules.

State **two** molecules that can be produced from these TP molecules.

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[Total: 9]

4. June/2023/Paper_ 9700/43/No.8

(a) Fig. 8.1 is a diagram of a chloroplast.

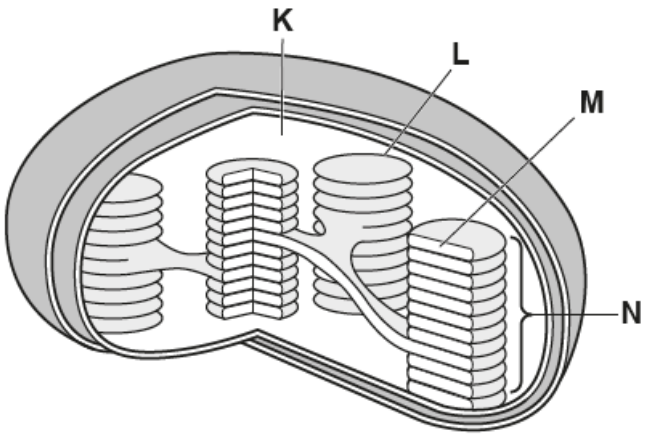

Fig. 8.1

Using the letters **K**–**N**, complete Table 8.1.

Each letter may be used once, more than once, or not at all.

Table 8.1

	letter
high concentration of protons	.....
location of photosynthetic pigments	.....
site of light-independent stage	.....
site of light-dependent stage	.....

[4]

(b) Chlorophyll *a* is the main photosynthetic pigment in plants.

Describe the role of other photosynthetic pigments found in plant chloroplasts.

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(c) The absorption of different wavelengths of light by chloroplast pigments can be represented by an absorption spectrum.

Fig. 8.2 is an absorption spectrum of an extract of chloroplast pigments and an absorption spectrum of whole chloroplasts.

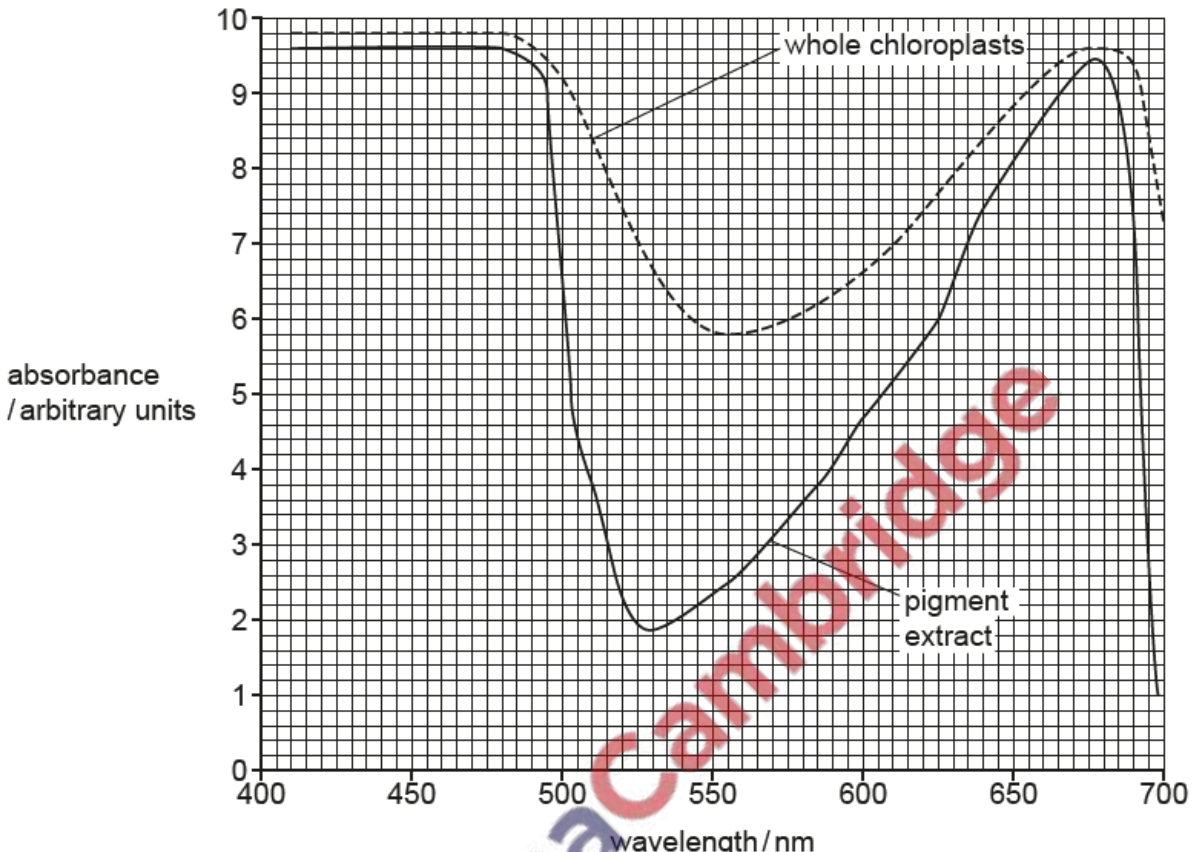

Fig. 8.2

With reference to Fig. 8.2, describe the differences between the two spectra **and** suggest explanations for the differences.

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[Total: 12]