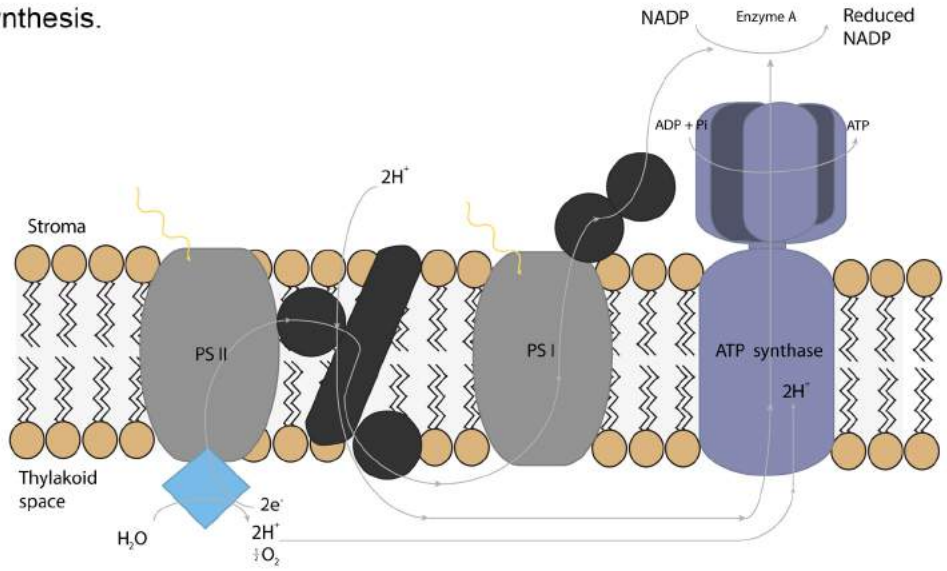
1 This question is about photosynthesis in plants.

(a) Fill in the gaps with the most appropriate term.

Photosynthesis takes place within ..... called chloroplasts. The process is initiated when photosynthetic pigments such as ..... absorb light energy and convert it into ..... energy. Electrons in photosystem II (PS II) become excited and pass down the electron transport chain. This releases energy. Electrons lost from PS II are replaced by the electrons produced when water is split. The splitting of water is called .....

[4 marks]

(b) Figure 1.1 shows the electron transport chain in the light independent stages of photosynthesis.



Outline the fate of the hydrogen ions produced when a water molecule is split.

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[3 marks]

(c) Enzyme **A** is named NADP reductase.

Suggest why.

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[1 mark]

(d) The diagram shows hydrogen ions that enter the thylakoid space through the thylakoid membrane.

Suggest how these ions travel across the membrane.

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[3 marks]

(e) Complete the table below.

You should use the letter **C** if the statement applies to cyclic photophosphorylation, **N** if it applies to non-cyclic photophosphorylation or **B** if it applies to both.

Statement	Letter
water is split	
NADPH is formed	
photosystem I is involved	
ATP is formed	

[4 marks]

[Total: 15]

2 **(a)** Define the terms *autotroph* and *heterotroph*.

autotroph.....

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heterotroph.....

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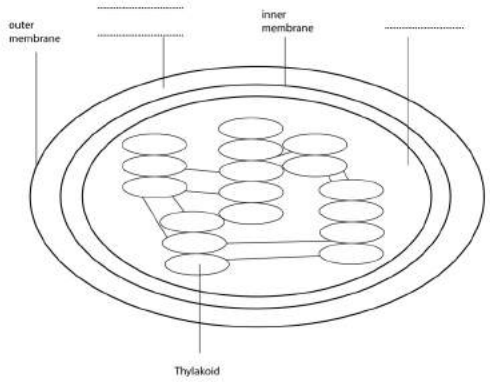
[4 marks]

(b) Photosynthesis is a two-stage process that takes place in chloroplasts.

Figure 2.1 shows an illustration of a chloroplast.



State the approximate size of a chloroplast.

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[1 mark]

(c) Complete the labels on **Figure 2.1**. **[1 mark]**

(d) Explain how the structure how the grana enables them to carry out their functions.

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[4 marks]

(e) Guard cells contain chloroplasts.

The structure of a chloroplast in a guard cell differs from that shown in **Figure 2.1**.

Guard cells only use photosynthesis to produce ATP.

(i) Suggest and explain how the structure of chloroplasts in guard cells is different.

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[2 marks]

(ii) Explain why guard cells need ATP.

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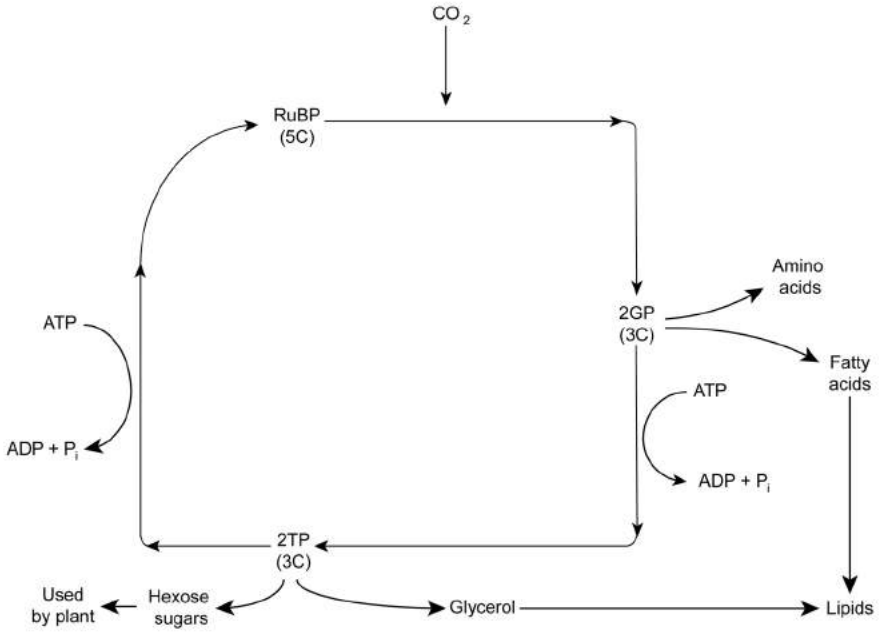
[3 marks]

[Total: 15]

3 **Figure 3.1** outlines the light independent reaction in photosynthesis.



(a) Explain the significance of the products of the light independent reactions for a plant species.

In your answer, the quality of your written communication will be assessed.

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[7 marks]

(f) Some scientists prefer to name the cycle as the Calvin Cycle. They believe that the term 'light independent stages' is misleading.

Suggest why.

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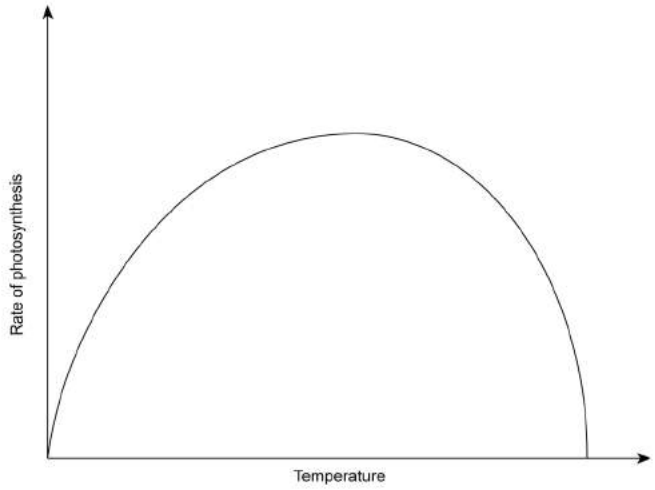
[2 marks]

(g) **Figure 3.2** shows a graph of the rate of photosynthesis against temperature.



Describe the shape of the graph.

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[1 mark]

(h) Explain, in terms of limiting factors and the stages of photosynthesis, the shape of the graph.

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[4 marks]

4 An experiment to measure the effect of light intensity on the rate of photosynthesis is as such.

- Using a syringe, the air spaces in the spongy mesophyll layer of several leaf discs are replaced with sodium hydrogencarbonate solution.
- The disks are placed in a small beaker and left to sink.
- They are then illuminated with different light sources and the time taken for one disc to rise to the top is measured.
- The rate of photosynthesis is then calculated.

Table 4.1 shows the results obtained by a student who conducted the experiment.

Light intensity / lux	Time taken for a disc to rise / s	Rate of photosynthesis / s^{-1}
200	132	
400	96	
600	62	

(a) Tabulate the rate of photosynthesis for the different light intensities.

You should record the values of **two** significant figures. **[1 mark]**

(b) Describe and explain, in detail, the results obtained.

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[6 marks]

(c) Explain why the discs sink and then rise after a period of time of illumination.

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[3 marks]

(d) The student says that she should do replicates to make her results more accurate.

Is she correct?

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[1 mark]

[Total: 11]