

# 2.8 Photosynthesis

## Question Paper

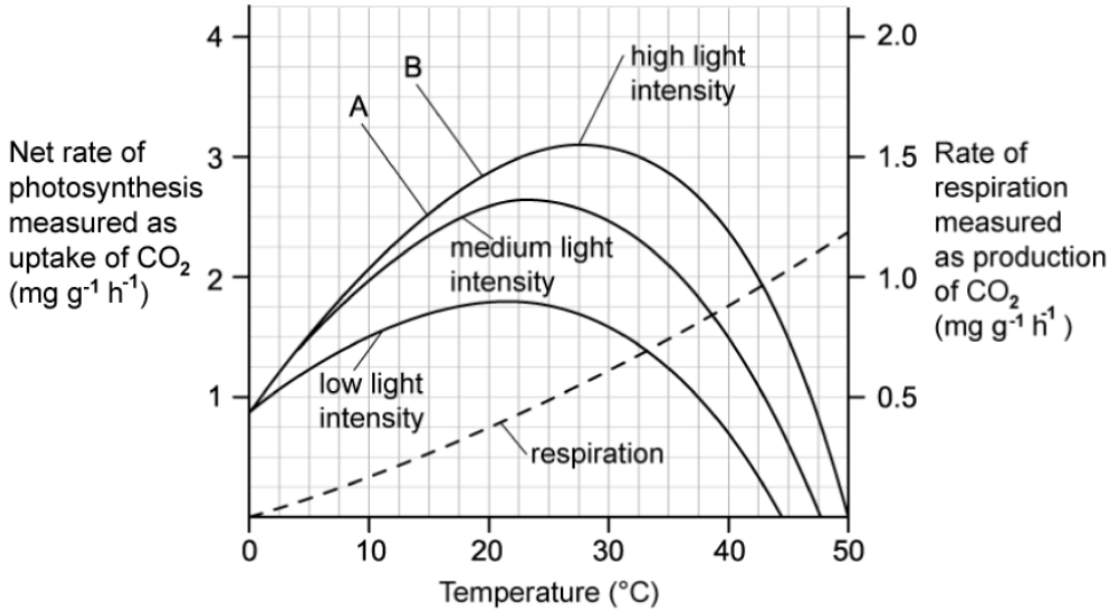
Course	DP IB Biology
Section	2. Molecular Biology
Topic	2.8 Photosynthesis
Difficulty	Medium

**Time allowed:** 60  
**Score:** /47  
**Percentage:** /100

**Question 1a**

- a) Lab technicians wanted to determine the effects of light intensity and temperature on the rate of photosynthesis in Rhododendrons. They recorded the effect of different temperatures on the net rate of photosynthesis at various light intensities. Their experiment also recorded the rate of respiration at the different temperatures. The graph below shows the results from their experiment.

**Figure 1**

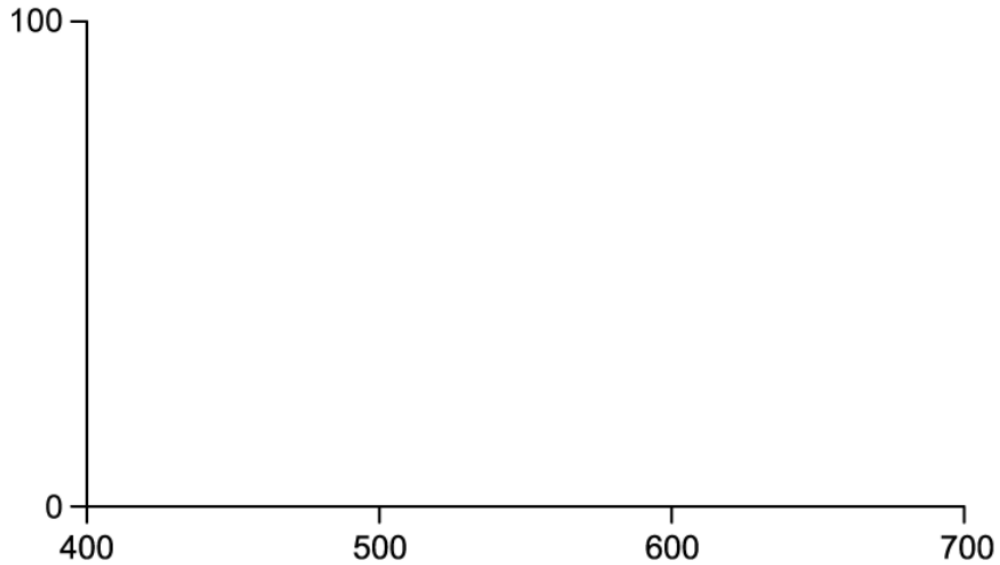


Identify, with a reason, the factor which is limiting the rate of photosynthesis between **A** and **B**.

[2 marks]

### Question 1b

- b) Add labels to the axis below and sketch an action spectrum for photosynthesis of the rhododendron plant exposed to high light intensity.



[2 marks]

### Question 1c

- c) Rhododendrons have been found in several alpine regions. Ecologists noted that in one of the plant's natural habitats the average summer temperature across a 20 year period rose from 21°C to 24°C, while the cloud cover increased.

Describe and explain how these changes would impact the growth of Rhododendrons.

[3 marks]

**Question 1d**

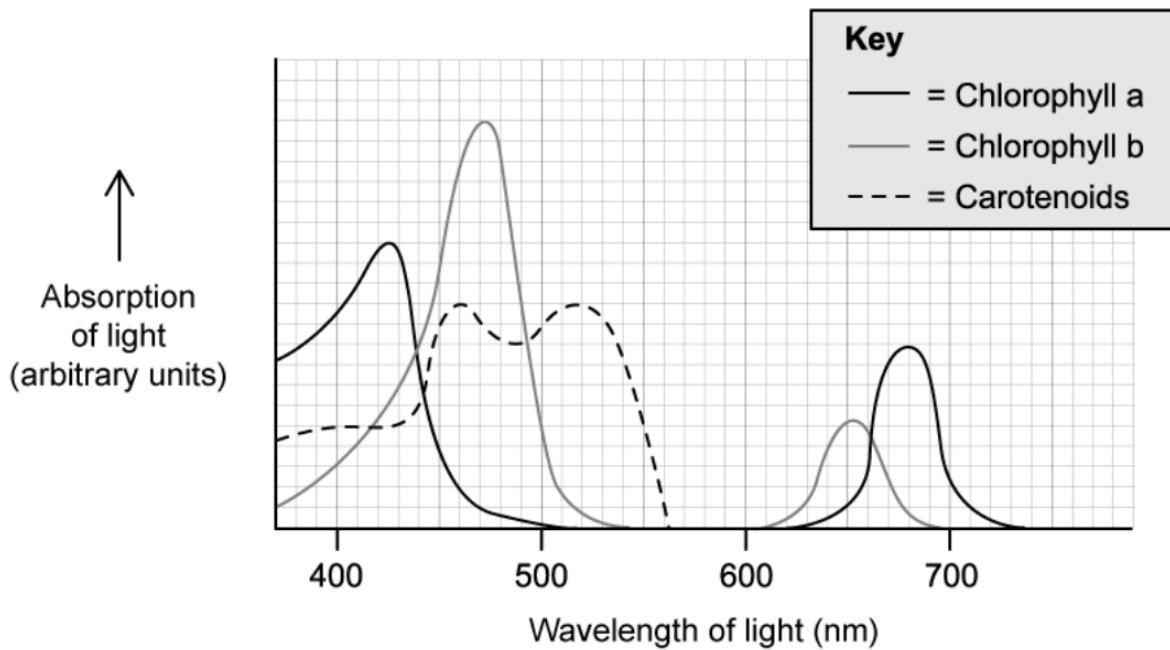
- d) Name **two** variables, other than temperature and light intensity, that could act as limiting factors for the rate of photosynthesis in rhododendrons.

[2 marks]

**Question 2a**

- a) Plants possess a collection of photosynthetic pigments that allow for the absorption of light energy. This group of pigments includes two types of chlorophyll and multiple carotenoids. Different species of plants possess different quantities of each pigment. The combination and quantity of each pigment that each plant species possesses is an adaptation to their habitat and behaviour. The graph below demonstrates how different wavelengths of light are absorbed by chlorophyll a, chlorophyll b and carotenoids from a particular plant species.

**Figure 1**



Explain the absorption of light at different wavelengths by pigment chlorophyll a.

[2 marks]

**Question 2b**

- b) Suggest why it is beneficial for plants to possess multiple photosynthetic pigments such as chlorophyll a, chlorophyll b and carotenoids.

[2 marks]

**Question 2c**

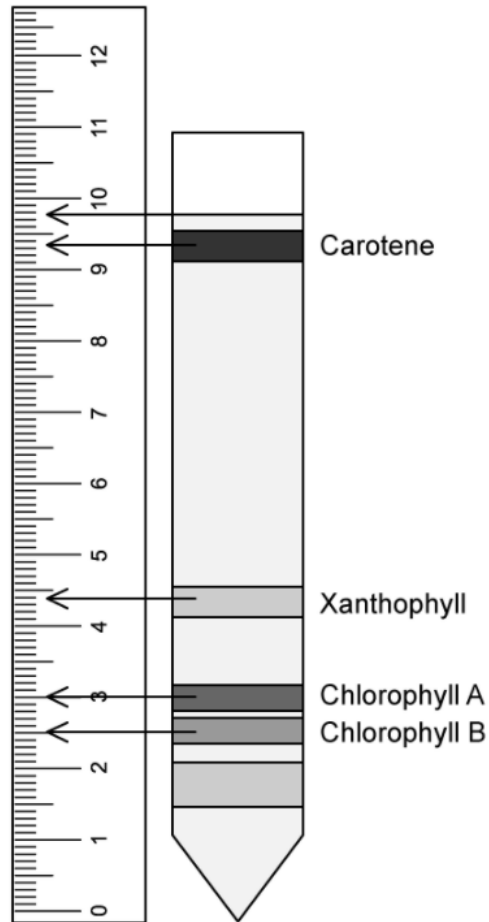
- c) A researcher investigating the wavelengths of light that hit the ground in a woodland area found that the majority of the light energy reaching the ground sat within the 500-600 nm wavelength part of the spectrum. They also noted that a reduced number of species were found on the ground below the tall trees.

Suggest, with reference to the light energy spectrum, why few species of plant would be found below tall trees in woodland areas.

[3 marks]

**Question 3a**

- a) Some students used paper chromatography to separate out the photosynthetic pigments in a leaf. The resulting chromatogram can be seen below.



Using the measurements made by the students, calculate the  $R_f$  values for carotene and chlorophyll B and complete the table below.

Pigment	$R_f$ value
Carotene	
Chlorophyll B	

[2 marks]

**Question 3b**

- b) Explain what the results in part (a) show about the properties of the photosynthetic pigments.

[2 marks]

**Question 3c**

- c) The method used to prepare the photosynthetic pigments for chromatography requires the use of propanone. As a health and safety precaution, a student using this method decided to use water instead of propanone.

State what the student's results would have shown and explain why..

[3 marks]

**Question 4a**

- a) *Triticum aestivum* is a species of wheat which has been genetically modified to synthesize more chlorophyll B as a way of increasing yield for farmers.

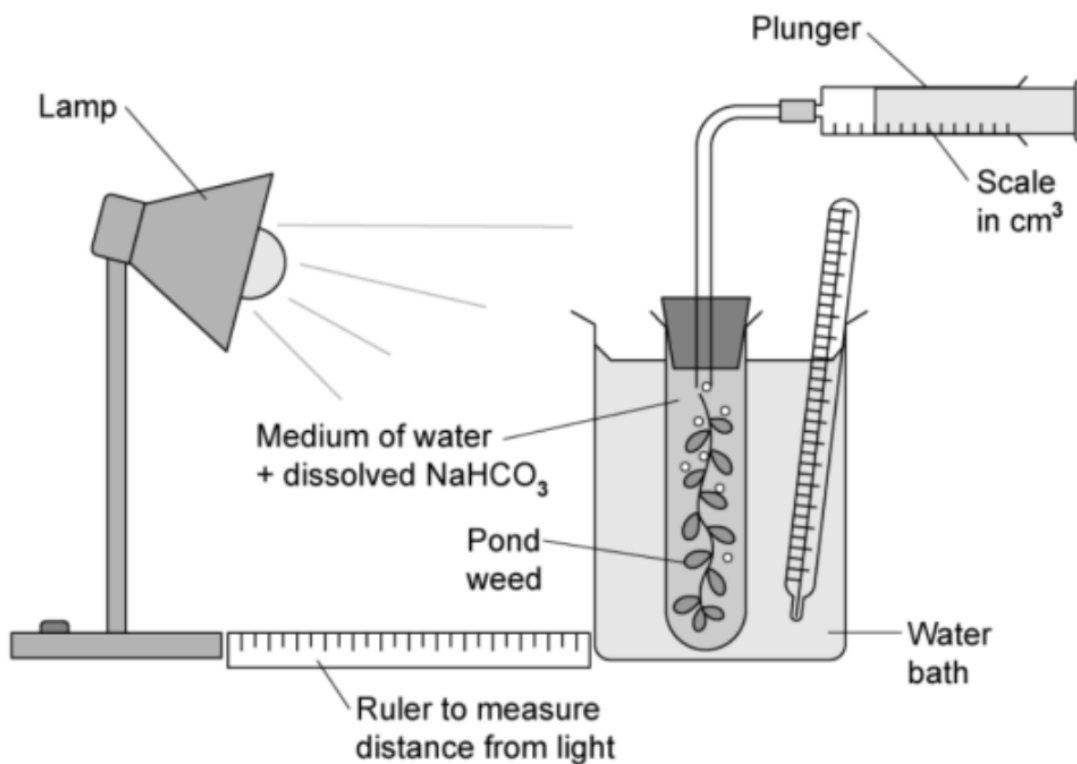
Explain how an increase in chlorophyll B may lead to an increased yield from this genetically modified crop.

[4 marks]



**Question 4b**

- b) A student set up the following investigation to establish the relationship between light intensity and photosynthesis.

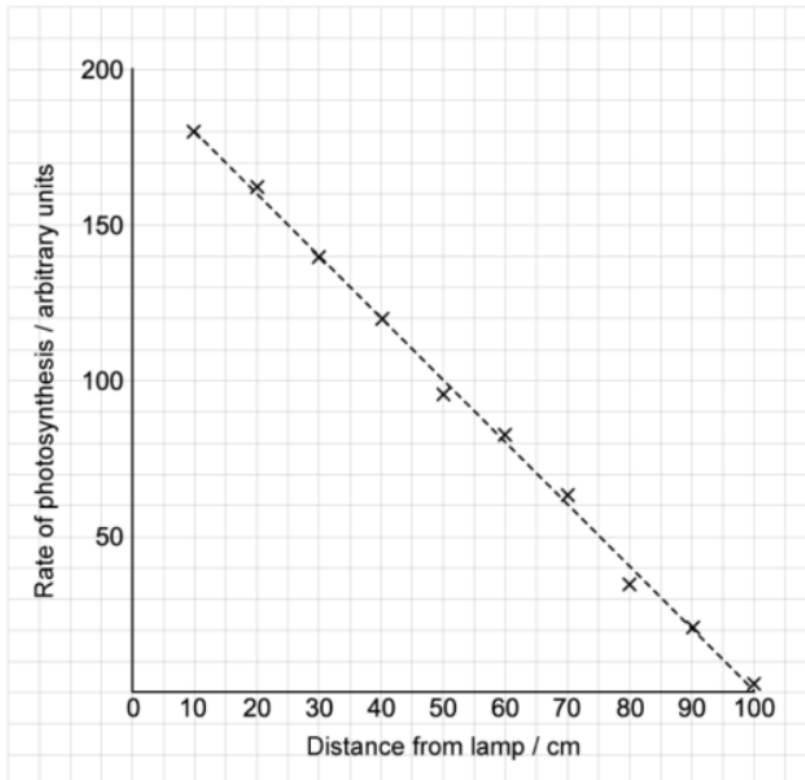


Identify the dependent variable and **one** control variable for this investigation.

[2 marks]

**Question 4c**

c) The graph below shows the results obtained by the student.



A second student suggested that they should position a sheet of blue transparent perspex in between the lamp and the pondweed.

- i) Draw another line on the graph to show how this may alter the results achieved by the students.
- ii) Explain your answer to part (i)

[3 marks]

**Question 5a**

*One mark is available for clarity of communication throughout this question.*

- a) Sketch and annotate a graph to describe the effect of increasing carbon dioxide levels on the rate of photosynthesis.

[4 marks]

**Question 5b**

- b) Outline the process which results in the release of oxygen in photosynthesis.

[4 marks]

**Question 5c**

- c) Describe and explain the changes to the Earth's atmosphere as a result of photosynthesis in early life forms.

[7 marks]