

2.8 Photosynthesis

Question Paper

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|------------|----------------------|
| Course | DP IB Biology |
| Section | 2. Molecular Biology |
| Topic | 2.8 Photosynthesis |
| Difficulty | Easy |

Time allowed: 50
Score: /38
Percentage: /100

Question 1a

a)
Chloroplasts contain various photosynthetic pigments.

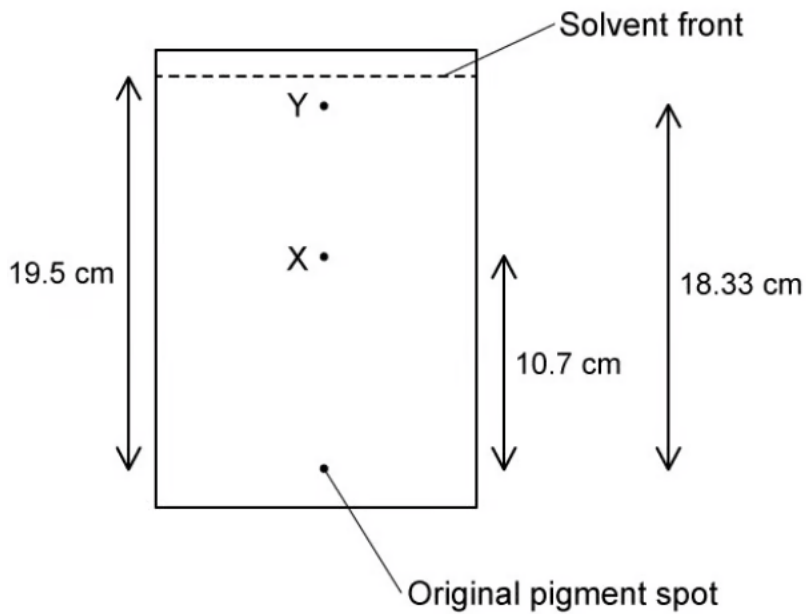
State the role of a photosynthetic pigment.

[1 mark]

[1 mark]

Question 1b

b)
The pigments in a chloroplast can be separated and identified using a technique called thin layer chromatography. After extracting pigments from a spinach leaf a student carried out thin layer chromatography. Some of their results can be seen below.



Use the equation provided to calculate the R_f values for pigments X and Y.

$$R_f = \frac{\text{Distance moved by pigment}}{\text{Distance moved by solvent}}$$

[2 marks]

[2 marks]

Question 1c

c)

The table below contains value ranges for the R_f values of common photosynthetic pigments.

| Pigment | R_f value range |
|---------------|-------------------|
| Carotene | 0.89 - 0.95 |
| Neoxanthin | 0.05 - 0.11 |
| Chlorophyll a | 0.64 - 0.69 |
| Chlorophyll b | 0.53 - 0.62 |
| Pheophytin a | 0.78 - 0.86 |

Use your answers to part b) to identify pigments **X** and **Y** from part b).

[2 marks]

[2 marks]

Question 2a

a)

State why the majority of plants look green to human eyes.

[1 mark]

[1 mark]

Question 2b

b)

The effect of different colours of light on the growth of *Arabidopsis thaliana* (thale cress) seedlings was studied. Three different colours of light were tested and measurements of seedling height, shoot length, and biomass were taken. The results of the study are shown in the table below.

| Colour of light | Wavelength of light / nm | Height of seedlings / cm | Shoot length / cm | Total biomass / g |
|-----------------|--------------------------|--------------------------|-------------------|-------------------|
| Blue | 450 | 2.3 | 2.0 | 2.4 |
| Orange | 600 | 3.5 | 2.8 | 2.8 |
| Red | 630 | 7.4 | 6.1 | 3.7 |

State what can be concluded about the effect of different colours of light on the growth of *Arabidopsis thaliana* from the data shown.

[2 marks]

[2 marks]

Question 2c

c)

Oxygen can be thought of as a waste product of photosynthesis.

Identify the process by which this oxygen is produced.

[1 mark]

[1 mark]

Question 2d

d)

The process in part c) releases oxygen into the atmosphere, increasing atmospheric oxygen concentration.

State **two other** impacts that photosynthesis would have had on the atmosphere of prehistoric earth.

[2 marks]

[2 marks]

Question 3a

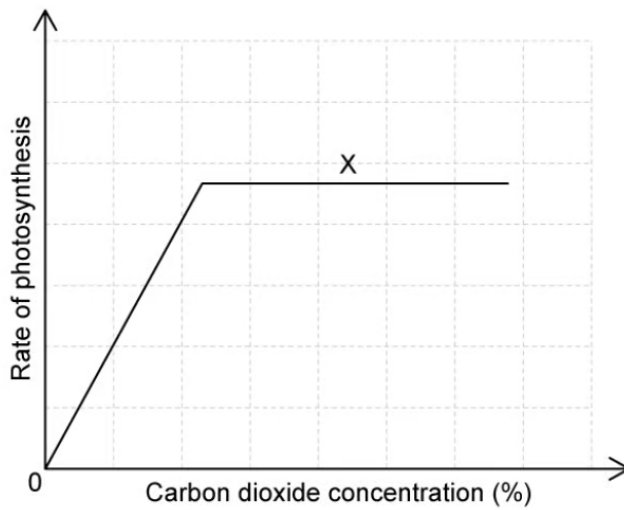
a)
State what is meant by the term **photosynthesis**.

[2 marks]

[2 marks]

Question 3b

b)
The graph below shows the relationship between carbon dioxide concentration and the rate of photosynthesis.



Describe the relationship between carbon dioxide concentration and the rate of photosynthesis shown in the graph.

[2 marks]

[2 marks]

Question 3c

c)

Identify a possible limiting factor at the point labelled **X** in the graph in part b).

[1 mark]

[1 mark]

Question 3d

d)

Sketch a graph of the rate of photosynthesis against temperature.

[3 marks]

[3 marks]

Question 4a

a)

A student makes the following statement:

"Visible light has wavelengths between 200 and 900 μm . Red is the shortest wavelength and violet is the longest."

Identify the errors in this statement.

[3 marks]

[3 marks]

Question 4b

b)

A plant is grown in increasing concentrations of carbon dioxide whilst other factors are kept constant.

Describe what will happen to the rate of photosynthesis as carbon dioxide concentration increases.

[2 marks]

[2 marks]

Question 4c

c)

The plant in part b) is an aquatic plant. Before starting the experiment the student conducting the study boiled and then cooled the water that the plant would be placed in.

Explain why the student did this.

[1 mark]

[1 mark]

Question 4d

d)

Describe how the student could have measured the rate of photosynthesis in the study described in parts b) and c).

[2 marks]

[2 marks]

Question 5a

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

a)

Outline how photosynthesis in early life forms caused changes to early Earth.

[5 marks]

[5 marks]

Question 5b

b)

Describe the process of photosynthesis.

[6 marks]

[6 marks]

