



**Subject: Biology**

**Worksheet : Photosynthesis**

**Name:**

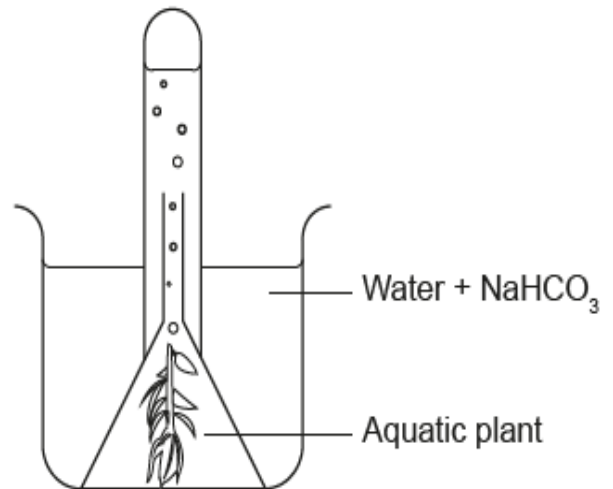
**Date:**

**Grade 9 IB**

**1. The apparatus shown was used to investigate the effect of varying carbon dioxide concentration on the rate of photosynthesis. Carbon dioxide concentrations were varied by adding different amounts of sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) to water.**

**What is the dependent variable in this investigation?**

- A. Temperature
- B. Light intensity
- C. Amount of  $\text{NaHCO}_3$  added
- D. Volume of oxygen produced



**Markscheme**

D

**2. What does an action spectrum for photosynthesis show?**

- A. The range of conditions over which photosynthesis can occur in a plant
- B. The percentage of light absorbed at each wavelength by photosynthetic pigments
- C. The percentage of light absorbed at each energy level by a plant
- D. The relative amount of photosynthesis at each wavelength of light

## Markscheme

D

**3. If a plant is exposed to light, which colour of light would lead to the lowest rate of oxygen release by a green plant?**

- A. Blue
- B. Red
- C. Green
- D. White

## Markscheme

C

**4. What does the  $R_f$  value in thin layer chromatography represent?**

- A. The distance travelled by the pigment front in a fixed time period
- B. The distance from the origin to the solvent front at the end of the experiment
- C. The ratio of distances travelled by the pigment and solvent fronts
- D. The concentration of the pigment applied to the chromatography plate

## Markscheme

C

5a. To investigate whether carbon dioxide is required for photosynthesis, a plant was irrigated using water from which carbon dioxide had been removed and was then placed in the apparatus shown in the diagram. The apparatus was left in darkness for 24 hours to destarch the leaves. Then, after several hours in light, a leaf was removed from the plant and found to contain no

starch when tested. A control was performed using a second plant. A leaf from this plant tested positive for starch.

**Describe the control for this experiment.**



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**Markscheme**

- a. same apparatus with carbon dioxide present;
- b. (control has) no sodium hydroxide/alkali;
- c. control irrigated with untreated water/water with CO<sub>2</sub>;

*“Same apparatus” alone does not get the mark.*

**5b. Outline how the carbon dioxide could be removed from the water used to irrigate the plant.**

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**Markscheme**

- a. boiling (and cooling) the water;
- b. expose the water to a vacuum;

*Allow distillation of water.*

**5c. Suggest how a plastic bag placed around the plant pot prevents carbon dioxide from reaching the plant's leaves.**

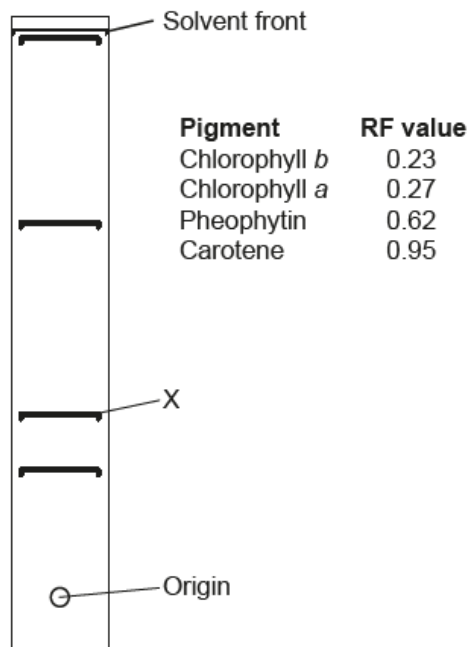
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### Markscheme

- a. to prevent CO<sub>2</sub> from (organisms in) the soil affecting the experiment;
- b. the plastic bag is impermeable to gases;

**5d. A chromatograph was made of the photosynthetic pigments of a leaf of the plant.**

Outline what measurements would be taken to identify pigment X.

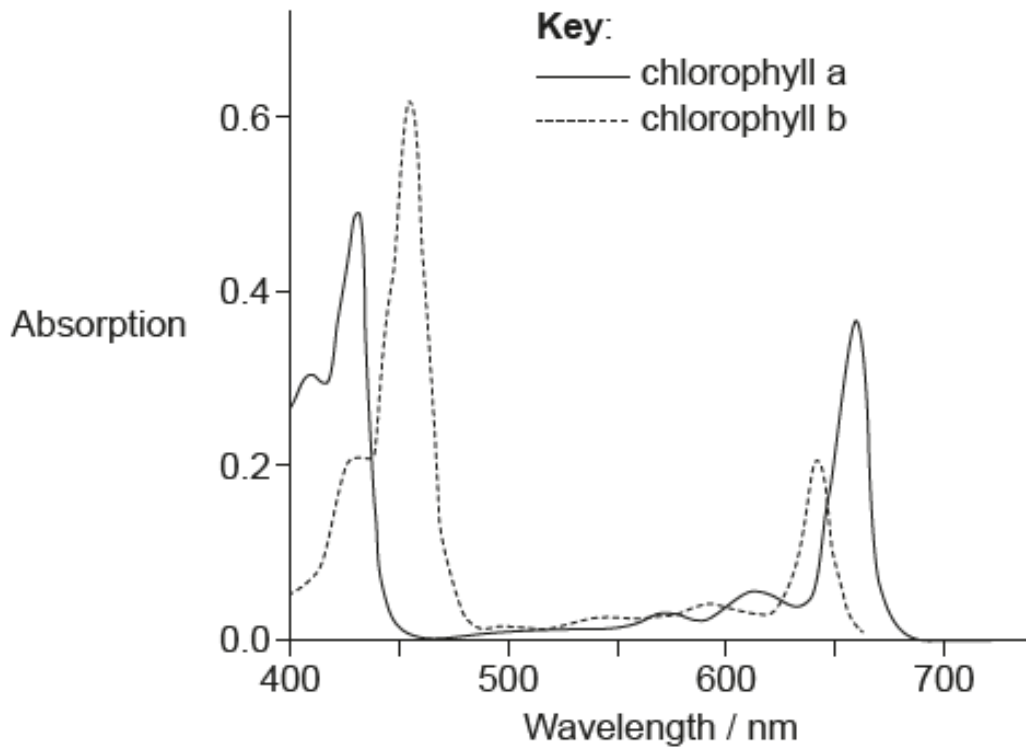


### Markscheme

- a. the distance travelled from the origin/O to the solvent front;
- b. the distance travelled by the pigment (from the origin O to X);

*Accept X to solvent front if the candidate indicates that this allows O to X to be calculated.*

6. The graph shows the absorption spectra of chlorophyll a and chlorophyll b.



**What can be concluded from the graph?**

- A. Both chlorophyll a and chlorophyll b absorb a large amount of green light
- B. Chlorophyll b absorbs red light more efficiently than blue light
- C. Other pigments must absorb light between blue and red in the spectrum
- D. Chlorophyll a and chlorophyll b have different absorption peaks

**Markscheme**

D

7a. A variegated *Pelargonium* plant was grown outdoors in a plant pot. Figure 1 shows one leaf of the *Pelargonium*. The plant was left in the dark for 24 hours to inhibit photosynthesis. After this time, a sketch was made of the leaf to show the colours (Figure 2), then part of the leaf was covered with black card (Figure 3). Following the exposure of the plant to sunlight for six hours, the black card was removed and the leaf tested for starch (Figure 4).



Figure 1

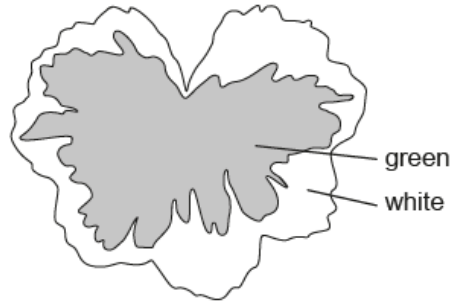


Figure 2

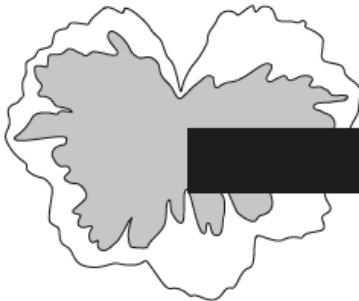


Figure 3

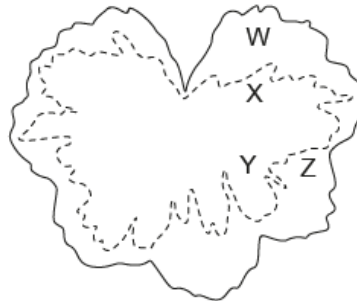


Figure 4

[Source: © International Baccalaureate Organization 2018]

Outline a reason for inhibiting photosynthesis for 24 hours.

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**Markscheme**

to remove any starch already in the leaf

**OR**

so any starch found in the leaf was made during the experiment

**OR**

to prevent further production of starch ✓

**7b. Identify which two areas, W, X, Y or Z, in Figure 4 show that light is required for photosynthesis.**

**Markscheme**

**X AND Y ✓**

*Both needed*

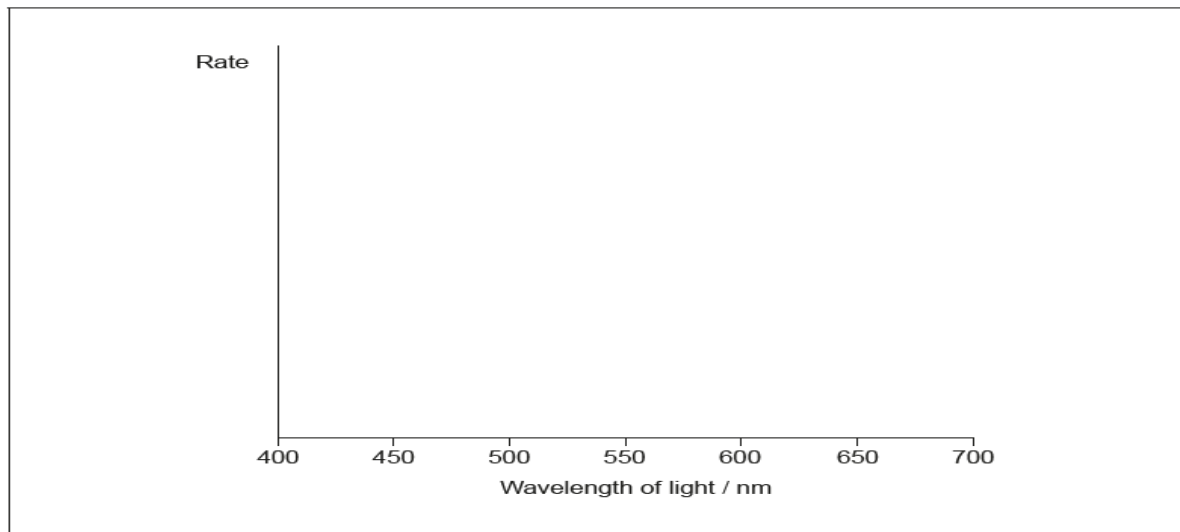
**7c. Identify which two areas, W, X, Y or Z, in Figure 4 show that chlorophyll is required for photosynthesis.**

**Markscheme**

**W AND X ✓**

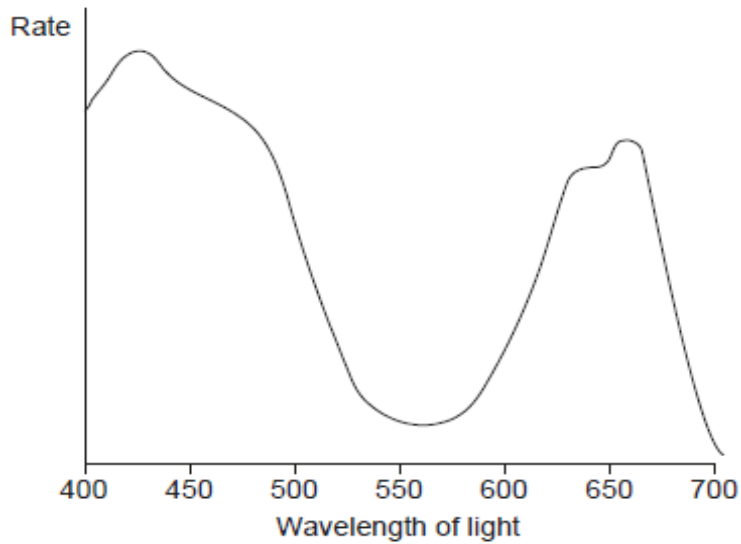
*Both needed*

**7e. Using the axes, sketch the action spectrum for photosynthesis in the green area of the leaf in Figure 1.**



## Markscheme

sketch showing 2 peaks at either end of the spectrum ✓



**7f. Predict how the action spectrum from the white areas of the leaf would differ from the green areas.**

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## Markscheme

it would be a straight line/have no peaks

**OR**

no photosynthesis ✓

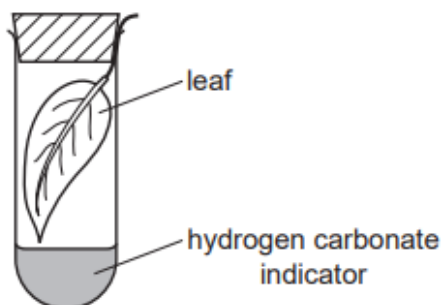
*Accept a labelled horizontal line in the bottom third of the y-axis.*

*Do not accept "lower line" or "lower photosynthesis"*



8.

A green leaf is picked at time 07.00 and immediately placed in a sealed test-tube containing hydrogen carbonate indicator solution. The tube is kept near a window for 24 hours. The table shows how the indicator changes in colour.



colour	amount of carbon dioxide compared to average atmospheric concentration
purple	less than normal
red	normal
yellow	more than normal

Which colour will the hydrogen carbonate indicator be at times 12.00 and 24.00?

	at 12.00	at 24.00
<b>A</b>	purple	yellow
<b>B</b>	red	purple
<b>C</b>	yellow	purple
<b>D</b>	yellow	red

i In an investigation of photosynthesis, 4 leaves are set up as shown in the diagram.

After 24 hours in the light each leaf is tested for starch.

Which tube is used to investigate whether chlorophyll is needed for photosynthesis?

