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VCE Biology ¾
AOS 2 Revision [2.0]
Experimental SAC 3

40 Marks. 5 Minutes Reading. 60 Minutes Writing.

Section A: SAC Questions (40 Marks)

Question 1 (8 marks)

Practical 1

Effect of Light Colour on Photosynthesis

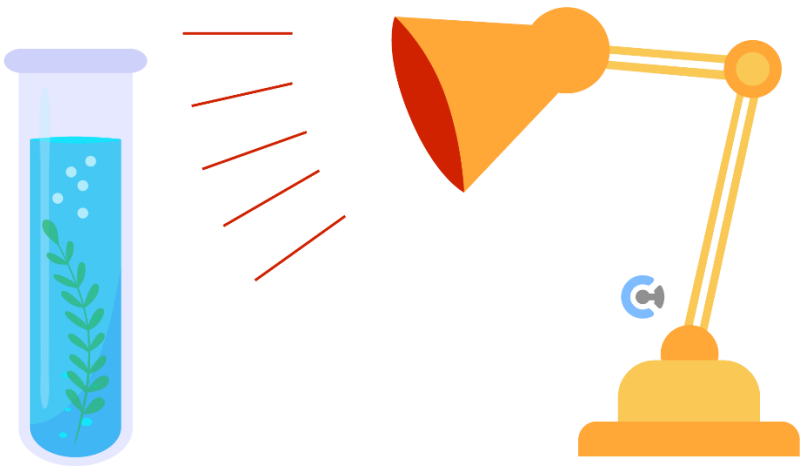
Photosynthesis is the process by which plants use light energy to convert carbon dioxide and water into glucose and oxygen. This process occurs in the chloroplasts of plant cells. Light is required for the light-dependent reactions of photosynthesis.

This experiment investigates the effect of different colours of light on the rate of photosynthesis in Elodea, an aquatic plant. The Elodea is placed into a test tube and is exposed to light from a lamp that is covered with cellophane of different colours. It is left to photosynthesise for 5 minutes. During these 5 minutes, the number of bubbles produced are counted.

Aim: To investigate how different colours of light affect the rate of photosynthesis**.**

Method:

1. Fill a test tube with around 10 mL of water.
2. Use a clean drinking straw to gently blow air into the water for about 30 seconds.
3. Cut a 7 cm piece of Elodea.
4. Place the plant into the beaker containing the water from Step 2, with the cut end facing upwards.
5. Wrap a sheet of coloured cellophane around the lamp and secure it with tape.
6. Place the lamp 10 cm from the beaker.
7. Start the timer and count the number of oxygen bubbles released from the plant in five minutes.
8. Conduct three trials for each colour, as well as white light and no light by repeating Steps 1 to 7.



Results:

	Bubbles produced in 5 minutes			
Light colour	**Trial 1**	**Trial 2**	**Trial 3**	**Average**
White	110	120	115	115
Red	90	95	92	92.3
Blue	130	135	140	135
Green	45	50	48	47.7
Yellow	80	78	82	80
No light	0	0	0	0

a. Explain the purpose of blowing air into the water in Step 2. (2 marks)

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_____

b. Fill in the table below. (2 marks)

	Positive Control	Negative Control
Colour of Light		

c. Explain the difference between a positive control group and a negative control group. In your answer, outline what the results of each control group indicates. (4 marks)

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Space for Personal Notes

Question 2 (12 marks)

Students counted the number of bubbles produced during this experiment.

a. Identify the gas produced during photosynthesis. (1 mark)

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b. What does the number of bubbles produced by Elodea indicate about the rate of photosynthesis? (2 marks)

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Chlorophyll is a green pigment that plays a role in the light-dependent stage of photosynthesis. Its role is to capture light for the photolysis of water. The students' results show that Elodea's rate of photosynthesis decreased when exposed to green light, yet a small number of bubbles were still produced.

c. Explain how photosynthesis is still occurring despite chlorophyll reflecting the green light. (2 marks)

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Some students observed a plateau in the rate of bubble production after 4 minutes.

d. Identify two reasons for this plateau, and describe how they caused the rate of photosynthesis to stop increasing. (4 marks)

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e. What colour of light produced the most bubbles? Using your knowledge of photosynthesis, explain why this is the case. (3 marks)

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Question 3 (9 marks)

Practical 2

Investigating Cellular Respiration in Plants

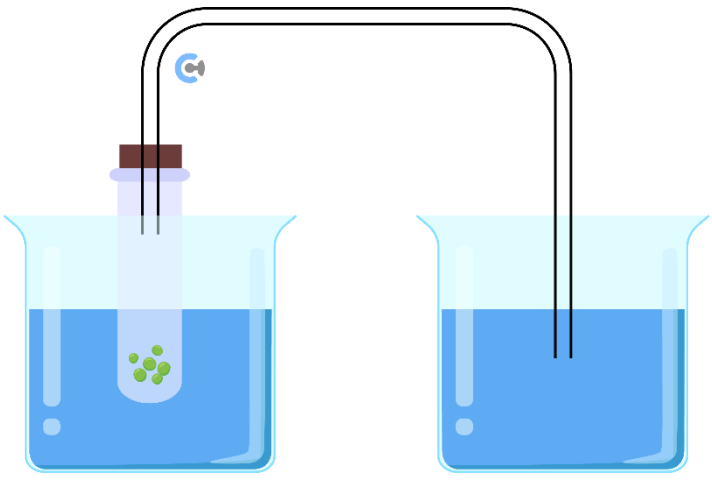
Cellular respiration is the process of breaking down glucose to generate energy in the form of ATP. Plants need to undergo cellular respiration to obtain energy for growth and development. Germinating seeds of plants are often used to observe the rate of cellular respiration in plants as they need to generate ATP energy before undergoing photosynthesis.

In this experiment, the effect of temperature on the rate of oxygen consumption in germinating seeds is investigated. These germinating seeds are placed in water baths of different temperatures. A capillary tube is used to measure how much oxygen the seeds are using for aerobic respiration. As the seeds take in oxygen, the total gas volume inside the sealed tube decreases. This causes liquid in the capillary tube to move towards the seeds. The distance that the liquid moves in the capillary tube is an indication of how much oxygen is consumed by the germinating seeds.

Aim: To determine the effect of temperature on oxygen uptake in germinating seeds.

Method:

1. Add five germinating seeds to a test tube.
2. Add a small amount of potassium hydroxide to the test tube.
3. Seal the tube with a bung and capillary tube.
4. Place the test tube in a water bath that is set to 10°C.
5. Place the other end of the capillary tube into a beaker of water.
6. Start the stopwatch and measure the distance moved by the liquid in the capillary tube every 5 minutes for 15 minutes.
7. Repeat Steps 1 to 6 for different temperatures (20°C, 30°C and 40°C).



Results:

	Distance liquid moved (mm)		
Temperature (℃)	**5 *mins***	**10 *mins***	**15 *mins***
10	0.5	1.0	1.4
20	1.2	2.5	3.7
30	1.8	3.6	5.3
40	1.0	1.9	2.5

CO_2 that is produced by the germinating seeds is absorbed through the addition of potassium hydroxide in Step 2.

a. What stage of aerobic respiration produces carbon dioxide? (1 mark)

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b. Why does potassium hydroxide need to be added to absorb any CO_2 in the flask? (3 marks)

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The distance that the liquid in the capillary tube moves shows how much oxygen was taken in by the germinating seeds.

c. Explain how oxygen consumption gives us an indication of the rate of cellular respiration in these germinating seeds. (3 marks)

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d. Why is it important to use the same number of seeds at each temperature? (2 marks)

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Question 4 (11 marks)

The results of this experiment show that oxygen consumption increased as temperature increased until 30°C. After 30°C, oxygen consumption decreased.

a. Explain why there was a decrease in oxygen consumption at 40°C. (3 marks)

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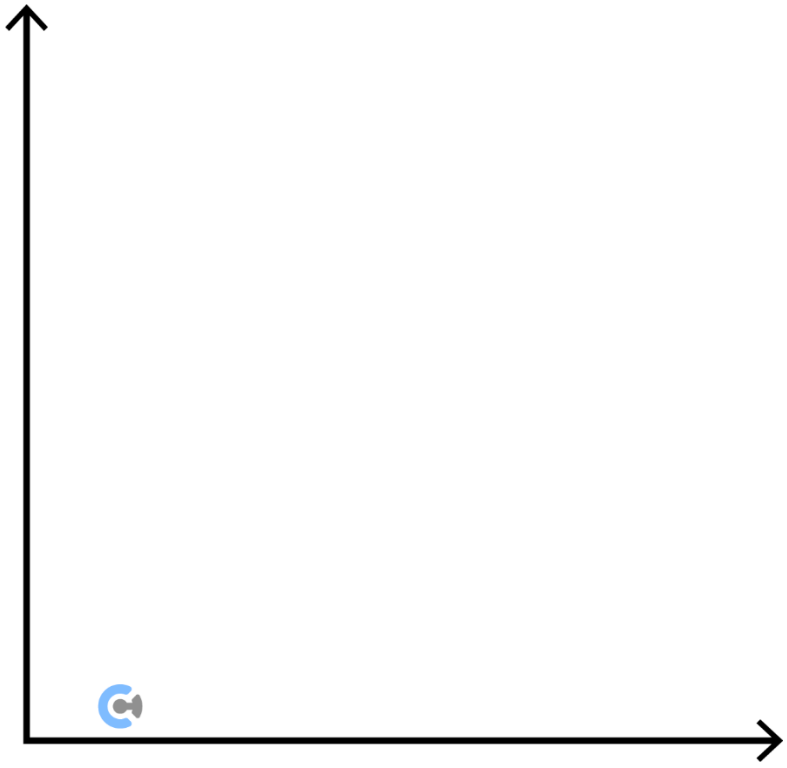
b. Using the trend displayed in the results, draw a graph to show the relationship between temperature and enzyme activity in the seeds. (2 marks)



Alongside aerobic respiration, plant seeds are also able to produce ATP via anaerobic fermentation.

c. Describe how the results of this experiment would differ if anaerobic conditions were used. (2 marks)

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Glycolysis is a common stage in both aerobic respiration and anaerobic fermentation.

d. Fill in the table below. (4 marks)

Glycolysis	
Inputs	
Outputs	
Location	

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