

Blast-off : Photosynthesis and plant structure Mark Scheme

Page 18: Structure of a Plant

1. Label the parts of the plant:

- **A:** Leaf
- **B:** Stem
- **C:** Root

2. Functions of each part:

- **Leaf:** Carries out photosynthesis to produce food for the plant.
 - **Stem:** Transports water and nutrients between roots and leaves; supports the plant.
 - **Root:** Anchors the plant and absorbs water and nutrients from the soil.
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Page 19: Specialized Leaf Cell Questions

1. **Name of Part X:** Chloroplast
 2. **Pigment in Part X that aids its function:** Chlorophyll
 3. **Name of Part Y:** Cell wall
 4. **Long-chain substance in Part Y from photosynthesis:** Cellulose
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Page 20: Leaf Structure and Photosynthesis

1. Label Structures (A, B, and C):

- **A:** Waxy cuticle
- **B:** Palisade mesophyll
- **C:** Spongy mesophyll

2. Sentence Completion:

- The function of the leaf is to carry out the process of **photosynthesis**. This happens in the **palisade** mesophyll cells of the leaf. These cells are specialized because they contain the structures called **chloroplasts**. The pigment located in these structures is called

chlorophyll. There are **air spaces** in the spongy mesophyll layer, allowing **carbon dioxide** and **oxygen** to circulate in the leaf. Carbon dioxide is a **raw material** in photosynthesis. The **waxy cuticle** on the top surface of the leaf prevents excessive water loss. Water is also a **raw material** in photosynthesis. Gases enter and exit the leaf through pores on the bottom surface, called **stomata**. The products of photosynthesis are **glucose** and **oxygen**.

Page 21: Basic Photosynthesis Questions

1. **Gas entering leaf for photosynthesis:** Carbon dioxide
 2. **Color and role of chlorophyll:** Green; absorbs sunlight to provide energy for photosynthesis.
 3. **Water's role in photosynthesis:** Needed as a raw material, not produced by photosynthesis.
 4. **Sugar made by photosynthesis:** Glucose
 5. **Photosynthesis at night:** No, sunlight is required as an energy source, so it cannot occur at night.
 6. **Substance released into the air by photosynthesis:** Oxygen
 7. **Substance needed for photosynthesis from the soil:** Water
 8. **Importance of photosynthesis for all living organisms:** Photosynthesis produces glucose, which forms the base of food chains, and releases oxygen, which is necessary for respiration in most living organisms.
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Page 22: Leaf Section and Gases

1. **Two adaptations of chloroplasts for photosynthesis:**
 - **1:** Contains chlorophyll, which absorbs sunlight for energy.
 - **2:** Located near the top of the leaf for maximum light absorption.
 2. **Gas movement:**
 - (i) **Gas moving into the leaf:** Carbon dioxide
 - (ii) **Gas moving out of the leaf:** Oxygen
 - (iii) **Pore allowing gas exchange:** Stomata
 3. **Two raw materials needed for photosynthesis and their sources:**
 - **Water:** Absorbed from the soil by roots
 - **Carbon dioxide:** Taken from the air through stomata in leaves
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Page 23: Starch Test Steps

1. **Part of the plant tested for starch:** Leaf
 2. **Chemical used in starch test:** Iodine solution
 3. **Color change when starch is present:** Yellow-red to blue-black
 4. **Role of ethanol in starch test:** Removes chlorophyll from the leaf, making it easier to see the color change with iodine.
 5. **Safety precaution for using ethanol:** Ensure no open flames are nearby, as ethanol is highly flammable.
 6. **Initial step of starch test and its purpose:** Boiling the leaf in water to kill it and halt any further chemical reactions.
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Page 24: Photosynthesis Rate Investigation

1. **Varying light intensity:** Move the light source closer or farther from the plant.
2. **Determining changes in photosynthesis rate:** Count oxygen bubbles produced per minute to observe if the rate increases or decreases.
3. **Importance of thermometer:** Ensures that temperature remains constant so that observed changes in photosynthesis rate are due only to variations in light intensity.

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1. **Name the gas being produced by the plant:**
 - **Answer:** Oxygen
2. **What would happen to the number of bubbles if:**
 - **The lamp was moved further away:**
 - The number of bubbles would decrease. This is because as the light source moves further away, the light intensity reaching the plant reduces, resulting in a slower rate of photosynthesis and, therefore, fewer oxygen bubbles produced.
 - **The lamp was switched off and the experiment left in the dark:**
 - The number of bubbles would eventually stop. Without light, photosynthesis cannot occur, so no oxygen would be produced, and no bubbles would form.

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1. Complete the equation for photosynthesis:

- Carbon dioxide + **water** → **glucose** + oxygen

2. What type of energy is required for photosynthesis?

- **Answer:** Light energy

3. What is the source of this energy?

- **Answer:** The Sun
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Question 2 Explanation on Leaf Test

• **Which parts of Leaf A would turn black?**

- Only the areas of Leaf A that were exposed to light would turn black, while the covered section (under the card) would not turn black.

• **Explanation:**

- When iodine is added, it turns black in the presence of starch. Photosynthesis, which produces starch, only occurs in areas exposed to light. Therefore, the uncovered parts of Leaf A, which received light, would have produced starch and will turn black with iodine. The area covered by the card did not receive light, so photosynthesis did not occur there, and it would not turn black.
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On the provided outline of Leaf A, shade in the exposed areas outside of where the card was positioned to show where it would turn black. The covered area should remain unshaded to represent the absence of starch production.

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To answer the questions accurately, follow these steps:

1. Plotting the Graph:

- Use the given data to create a graph with:
 - **X-axis:** Distance between the pondweed and light source (cm).
 - **Y-axis:** Number of bubbles produced per minute.
- Plot the points for each distance and draw a line or curve connecting them:
 - (10 cm, 20 bubbles)

- (20 cm, 12 bubbles)
- (30 cm, 7 bubbles)
- (40 cm, 3 bubbles)
- (50 cm, 0 bubbles)

2. Describing the Effect of Light Intensity on the Rate of Photosynthesis:

- **Answer:** The data shows that as the distance between the light source and the pondweed increases, the number of bubbles produced per minute decreases. This suggests that a higher light intensity (closer light source) increases the rate of photosynthesis, as indicated by more oxygen bubbles. Conversely, a lower light intensity (greater distance) reduces the rate of photosynthesis, eventually stopping it when light intensity is too low.



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