

3.4 Photosynthesis

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS photosynthesis 光合作用 • light reactions 光反应 • calvin cycle 卡尔文循环

Objective

Build the skills to answer exam questions on **photosynthesis**.

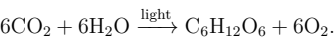
You must be able to:

- write the overall equation and locate the two stages
- describe the **light reactions** 光反应 and the **Calvin cycle** 卡尔文循环
- state the inputs and outputs of each stage

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ The overall reaction



Plants use light energy to build glucose from CO₂ and water, releasing O₂.

■ The light reactions

In the **thylakoid** membranes, light energy splits water (releasing O₂) and makes **ATP** and **NADPH**. Inputs: light, water. Outputs: O₂, ATP, NADPH.

■ The Calvin cycle

In the **stroma**, the ATP and NADPH power the **Calvin cycle**, which fixes CO₂ into **glucose** (sugar). Inputs: CO₂, ATP, NADPH. Output: sugar.

■ A worked link

The two stages connect: the light reactions supply the ATP and NADPH that the Calvin cycle needs to build sugar from CO₂.

2 Practice

Now apply the methods above.

2.1 Write the overall equation for photosynthesis. [2]

2.2 Where do the light reactions occur? [1]

2.3 What gas is released by the light reactions? [1]

3 Exam-style questions

3.1 The Calvin cycle uses ATP and NADPH to make [1]

- **A** oxygen
- **B** sugar (glucose)
- **C** water
- **D** light

3.2 A plant is photosynthesizing.

(a) State the inputs and outputs of the light reactions. [2]

(b) Explain how the two stages of photosynthesis are connected. [2]

3.3 Explain why the release of oxygen comes from the splitting of water, not from carbon dioxide. [2]

Solutions

2.1 $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (with light).

2.2 In the thylakoid membranes of the chloroplast.

2.3 Oxygen.

3.1 B — sugar (glucose).

3.2 (a) Inputs: light and water; outputs: oxygen, ATP, and NADPH. (b) The light reactions produce the ATP and NADPH that power the Calvin cycle to fix CO_2 into sugar.

3.3 The light reactions split water molecules, and the oxygen atoms released come from that water (not from CO_2 , whose carbon and oxygen go into sugar).