AP BIOLOGY • EXERCISE SHEET

3.4 Photosynthesis

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

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

$$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2.$$

Plants use light energy to build glucose from CO_2 and water, releasing O_2.

The light reactions

In the **thylakoid** membranes, light energy splits water (releasing O_2) and makes **ATP** and **NADPH**. Inputs: light, water. Outputs: O_2, ATP, NADPH.

The Calvin cycle

In the **stroma**, the ATP and NADPH power the **Calvin cycle**, which fixes CO_2 into **glucose** (sugar). Inputs: CO_2, 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 CO_2.

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]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **3.4 Photosynthesis** lesson on the **Learn** page;
- read the **Photosynthesis** section of the AP Biology handout on the **Know** page.

Solutions

2.1 $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (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).