AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

9.7 Ocean Acidification

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on **ocean acidification**.

You must be able to:

- explain how CO_2 causes **ocean acidification** 海洋酸化
- describe the effect on **shell-building** organisms
- link it to the carbon cycle

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.

How it happens

The ocean absorbs about a quarter of human CO_2. Dissolved CO_2 reacts with water to form **carbonic acid**, **lowering the ocean's pH** (making it more acidic).

Effect on shells

Acidification reduces the **carbonate ions** that organisms need to build shells and skeletons of **calcium carbonate** —corals, shellfish, and plankton struggle to form or maintain their shells, which can even dissolve.

Wider impact

Because shelled plankton are the base of many food webs, acidification threatens whole marine ecosystems and fisheries.

A worked link

More atmospheric CO_2 → more dissolves in the ocean → more carbonic acid → lower pH → harder for oysters and corals to build shells.

2 Practice

Now apply the methods above.

2.1 What gas dissolving in the ocean causes acidification? [1]

2.2 What acid forms when CO_2 dissolves in seawater? [1]

2.3 Which organisms are most harmed by acidification? [1]

3 Exam-style questions

3.1 Ocean acidification makes it harder for organisms to [1]

- **A** swim
- **B** build calcium carbonate shells
- **C** photosynthesize on land
- **D** breathe air

3.2 Rising atmospheric CO_2 is acidifying the ocean.

(a) Explain the chemistry linking CO_2 to lower ocean pH. [3]

(b) State one consequence for marine food webs. [1]

3.3 Explain why ocean acidification and ocean warming are both caused by rising CO_2 but are different problems. [2]

4 Go further

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

- work through the **9.7 Ocean Acidification** lesson on the **Learn** page;
- read the **Ocean Acidification** section of the AP Environmental Science handout on the **Know** page.

Solutions

2.1 Carbon dioxide (CO_2).

2.2 Carbonic acid.

2.3 Shell-building organisms (corals, shellfish, plankton).

3.1 B —build calcium carbonate shells.

3.2 (a) The ocean absorbs CO_2; it reacts with water to form carbonic acid; this lowers the ocean's pH (makes it more acidic). (b) Harm to shelled plankton at the base of the food web disrupts the whole web/fisheries.

3.3 Both come from extra CO_2, but warming is heat trapped by CO_2 in the air, while acidification is CO_2 dissolving into the water and lowering its pH —different mechanisms and effects.