

Exercise walk-through

Ocean Acidification ■ 9.7

eXercise

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

Method — 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).

Method — 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.

Method — Wider impact

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

Method — A worked link

More atmospheric $\text{CO}_2 \rightarrow$ more dissolves in the ocean $\rightarrow$ more carbonic acid $\rightarrow$ lower pH $\rightarrow$ harder for oysters and corals to build shells.

Practice 2.1 ■ 1 mark

What gas dissolving in the ocean causes acidification?

Solution 2.1

Worked steps

Carbon dioxide (CO_2) **B1**.

Practice 2.2 ■ 1 mark

What acid forms when CO_2 dissolves in seawater?

Solution 2.2

Method: A worked link

Worked steps

Carbonic acid [B1](#).

Practice 2.3 ■ 1 mark

Which organisms are most harmed by acidification?

Solution 2.3

Method: Effect on shells

Worked steps

Shell-building organisms (corals, shellfish, plankton) **B1**.

Exam-style 3.1 ■ 1 mark

Ocean acidification makes it harder for organisms to

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

Solution 3.1

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



Worked steps

B — build calcium carbonate shells.

Exam-style 3.2 ■ 3 marks

Rising atmospheric CO_2 is acidifying the ocean.

- (a) Explain the chemistry linking CO_2 to lower ocean pH.
- (b) State one consequence for marine food webs.

Solution 3.2

Method: A worked link

Worked steps

(a) The ocean absorbs CO_2 ; it reacts with water to form carbonic acid; this lowers the ocean's pH (makes it more acidic) **M1 M1 A1**. (b) Harm to shelled plankton at the base of the food web disrupts the whole web/fisheries **B1**.

Exam-style 3.3 ■ 2 marks

Explain why ocean acidification and ocean warming are both caused by rising CO₂ but are different problems.

Solution 3.3

Worked steps

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 **M1** **A1**.