

Exercise walk-through

Ocean Warming ■ 9.6

eXercise

You must be able to

- explain how oceans **absorb heat** and its effects
- describe **coral bleaching** 珊瑚白化
- link warming to sea-level rise and species shifts

Method — Oceans absorb heat

The oceans have absorbed most of the extra heat from the enhanced greenhouse effect, so **ocean temperatures are rising**.

Method — Coral bleaching

Warmer water stresses corals, causing them to **expel** the symbiotic algae (zooxanthellae) that feed and color them — the coral turns white (**bleaches**) and can die.

Method — Other effects

- **Thermal expansion** — warm water expands, raising **sea level**.
- **Species shifts** — marine species move toward cooler (polar/deeper) water.
- Lower **dissolved oxygen** in warmer water.

Method — A worked link

A marine heatwave warms a reef; the corals bleach as they lose their algae, and if the heat persists, the reef dies — losing the habitat for many species.

Practice 2.1 ■ 1 mark

Why are ocean temperatures rising?

Solution 2.1

Method: Oceans absorb heat

Worked steps

They absorb most of the extra heat from the enhanced greenhouse effect **B1**.

Practice 2.2 ■ 1 mark

What happens to corals when water gets too warm?

Solution 2.2

Worked steps

They bleach (expel their symbiotic algae) and can die **B1**.

Practice 2.3 ■ 1 mark

How does ocean warming contribute to sea-level rise?

Solution 2.3

Worked steps

Warm water expands (thermal expansion) **B1**.

Exam-style 3.1 ■ 1 mark

Coral bleaching happens when corals expel their

A symbiotic algae due to heat stress

B skeletons

C predators

D eggs

Solution 3.1

Method: Coral bleaching

A symbiotic algae due to heat stress



B skeletons

C predators

D eggs

Worked steps

A — symbiotic algae due to heat stress.

Exam-style 3.2 ■ 3 marks

A reef experiences a prolonged marine heatwave.

- (a) Explain how bleaching occurs and why it can kill the reef.
- (b) State one wider consequence of losing the reef.

Solution 3.2

Method: A worked link

Worked steps

(a) Heat stress makes corals expel their symbiotic algae, so they lose their food source and color (bleach); if the heat persists they starve and die **M1 M1 A1**. (b) Loss of habitat/biodiversity (or fisheries, coastal protection) **B1**.

Exam-style 3.3 ■ 2 marks

Explain how thermal expansion of the ocean raises sea level.

Solution 3.3

Method: Other effects

Worked steps

As seawater warms it expands and takes up more volume, so the same amount of water rises higher, adding to sea-level rise **M1** **A1**.