AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

9.6 Ocean Warming

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

Objective

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

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

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.

■ Oceans absorb heat

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

■ 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.

■ 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.

■ 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.

2 Practice

Now apply the methods above.

2.1 Why are ocean temperatures rising? [1]

2.2 What happens to corals when water gets too warm? [1]

2.3 How does ocean warming contribute to sea-level rise? [1]

3 Exam-style questions

3.1 Coral bleaching happens when corals expel their [1]

- **A** symbiotic algae due to heat stress
- **B** skeletons
- **C** predators
- **D** eggs

3.2 A reef experiences a prolonged marine heatwave.

(a) Explain how bleaching occurs and why it can kill the reef. [3]

(b) State one wider consequence of losing the reef. [1]

3.3 Explain how thermal expansion of the ocean raises sea level. [2]

4 Go further

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

- work through the **9.6 Ocean Warming** lesson on the **Learn** page;
- read the **Ocean Warming** section of the AP Environmental Science handout on the **Know** page.

Solutions

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

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

2.3 Warm water expands (thermal expansion).

3.1 A —symbiotic algae due to heat stress.

3.2 (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. (b) Loss of habitat/biodiversity (or fisheries, coastal protection).

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