Level 3 Earth and Space Science: practice paper 2026

AS 91413 Demonstrate understanding of processes in the ocean system · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) For most of the year, south-east trade winds blow north along the coast of Peru. Cold water rises to the surface near the coast, and the waters off Peru support one of the largest fisheries in the world. Discuss how the wind along the coast of Peru causes upwelling, and why the upwelling makes these waters so productive.

In your answer, consider:

- the Coriolis effect and Ekman transport
- where the upwelled water comes from and what it carries
- how the upwelling affects productivity.

QUESTION TWO

(a) Since the industrial revolution, the average pH of the surface ocean has fallen from about 8.2 to about 8.1, as the ocean takes up some of the carbon dioxide released by burning fossil fuels. New Zealand's shellfish, such as pāua and Greenshell mussels, build their shells from calcium carbonate. Discuss how the ocean takes up carbon dioxide, why this lowers the ocean's pH, and the likely effects on organisms that build calcium carbonate shells.

In your answer, consider:

- the physical (solubility) pump and the biological pump
- the chemical reactions involved
- what a fall of 0.1 in pH means.

QUESTION THREE

(a) In a normal year, the trade winds blow from east to west across the tropical Pacific. During an El Niño, the trade winds weaken, and the sea surface off South America becomes unusually warm. NIWA says El Niño tends to bring New Zealand more westerly and south-westerly winds, with cooler conditions and a greater chance of drought in the east.

Discuss how ocean circulation and the thermocline across the tropical Pacific change during an El Niño, and how this can affect New Zealand's weather.

In your answer, consider:

- the normal pattern of winds, warm water and the thermocline
- how these change when the trade winds weaken
- the effects on upwelling off South America
- the link to New Zealand's weather.

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