

# Past-paper walk-through

El Nino and La Nina ■ 4.9

eXercise

## Questions in this set

- 2025 Set 1 Q2

## Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

## Question 2

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There is a natural climate phenomenon that occurs in the equatorial Pacific Ocean because of periodic fluctuations in sea surface conditions and atmospheric circulation. This phenomenon happens every few years, resulting in shifts in temperature and precipitation in many parts of the world.

Figure 1 shows temperature and precipitation patterns associated with one phase of this phenomenon in the equatorial Pacific Ocean. Figure 2 shows the associated temperature and precipitation patterns that occur over North America.

Figure 1. Effects of Changes in Sea Surface Conditions in Equatorial Pacific Ocean [Map of the equatorial Pacific Ocean region spanning from Africa/the Indian Ocean on the left to Australia and the western coast of South America on the right, with dashed horizontal reference lines at “30° North” and “Equator 0°”. A large hatched region (diagonal lines, labeled in the legend as “Ocean water cooler than average”) covers the

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western/central Pacific Ocean around and south of Australia and Indonesia. A large solid-shaded region (labeled “Ocean water warmer than average”) lies to the west of the hatched region, overlapping the Indian Ocean/Indonesia area. A solid black patch (labeled “Increased chance of precipitation”) sits over Australia. A bold horizontal arrow points from right (near South America) to left (toward Indonesia/Australia) along the Equator, labeled “Stronger than normal trade winds”. A compass rose (N/S/E/W) is shown in the lower right. Legend: (diagonal hatch) = Ocean water cooler than average; (grey fill) = Ocean water warmer than average; (black fill) = Increased chance of precipitation; ← (bold arrow) = Stronger than normal trade winds.]

Figure 2. Polar Jet Stream and Climate Conditions in North America

[Map of North America showing a thick curved arrow labeled “Polar Jet Stream” that dips from the northwest, curves down over the western/central United States, and rises

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back up toward the northeast (Atlantic Canada), with an arrowhead at the northeast end. A region labeled “A” (dashed-outline circle, dotted fill pattern) is located over the northwestern/western Canada-US border area. A dotted-fill band (same pattern as region A, labeled in the legend as “Increased chance of precipitation”) stretches along the path under the jet stream curve across the northern/central US. A region labeled “B” (dashed-outline box, solid grey fill) sits over the south-central/southeastern United States, within a larger grey-shaded band (labeled “Decreased chance of precipitation”). A diagonally hatched region (labeled “Warmer than average”) covers the southeastern United States. A compass rose (N/S/E/W) is shown in the lower left. Legend: (dotted outline/fill) = Increased chance of precipitation; (solid grey fill) = Decreased chance of precipitation; (dotted fill, different pattern) = Cooler than average; (diagonal hatch) = Warmer than average.]

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**(a)** Identify the sea surface condition for the eastern equatorial area of the Pacific Ocean illustrated in Figure 1.

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**(b)** Based on the information in Figure 1, identify the climate phenomenon associated with the sea surface conditions shown in the equatorial area of the Pacific Ocean.

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**(c)** Based on the information in Figure 2, describe a difference in climate patterns between the regions A and B.

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**(d)** Increases in regional precipitation can lead to increased flooding in certain locations. Describe one reason why there is an increased risk of flooding in urban areas during extended periods of precipitation.



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**(e)** Propose a realistic solution a city could implement to decrease the risk of flooding in urban areas.

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**(f)** Justify the solution proposed in part E by providing an additional advantage other than a reduction in the risk of flooding.

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**(g)** Terrestrial biomes are primarily determined by temperature and precipitation patterns. Describe one difference between the climate of a temperate seasonal forest and that of a savanna.

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**(h)** Droughts are one environmental problem that can affect the frequency and severity of forest fires. Identify the ecological process that occurs following a forest fire that leaves the soil intact.

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**(i)** Describe one way burning forests contribute to atmospheric pollution.

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**(j)** Describe one sustainable forestry practice that could be used to reduce the occurrence or severity of forest fires.

## Solution 2

(a)

### Mark scheme

- The sea surface condition in the eastern equatorial Pacific shown in Figure 1: ocean water is cooler than average.

## Solution 2

**(b)**

### Mark scheme

- The climate phenomenon associated with these cooler-than-average equatorial Pacific sea surface conditions is La Niña.

## Solution 2

(c)

### Mark scheme

- Difference in climate patterns between regions A and B (Figure 2): Region A has an increased chance of precipitation while Region B has a decreased chance of precipitation — i.e., Region A will be wetter while Region B will be drier.

## Solution 2

(d)

### Mark scheme

- One reason for increased flood risk in urban areas during extended precipitation: impervious/paved surfaces (parking lots, roads, buildings, sidewalks) increase runoff and reduce infiltration/absorption; urban areas also have less vegetation, further reducing infiltration/absorption.

## Solution 2

(e)

### Mark scheme

- A realistic city solution to decrease urban flood risk: use permeable pavement; or plant vegetation/establish parks/create rain gardens/build green roofs; or install retention ponds/stormwater basins.

## Solution 2

### (f) Mark scheme

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- Justify the part-E solution with an advantage beyond flood reduction, matched to the chosen solution. Permeable pavement: increased recharge of nearby aquifers/groundwater; decreased pollution in runoff. Vegetation/parks/rain gardens/green roofs: absorbs pollutants; stores carbon dioxide/produces oxygen; decreases erosion; increases/restores wildlife habitat and biodiversity; reduces the urban heat island effect; improves aesthetic enjoyment/quality of life; creates landscaping/park-maintenance jobs. Retention ponds/stormwater basins: decreased pollution in runoff; increased habitat/biodiversity.



## Solution 2

(g)

### Mark scheme

- One climate difference between a temperate seasonal forest and a savanna: temperate seasonal forests have a cooler climate with a stronger/colder winter and four distinct seasons, and receive more annual precipitation (spread throughout the year), whereas savannas are warmer with a distinct rainy season and dry season and do not have four distinct seasons.

## Solution 2

(h)

### Mark scheme

- The ecological process that occurs following a forest fire that leaves the soil intact is secondary succession.

## Solution 2

(i)

### Mark scheme

- One way burning forests contributes to atmospheric pollution: burning trees releases CO<sub>2</sub>, CO, NO<sub>x</sub>, particulate matter, and/or VOCs into the atmosphere.

## Solution 2

(j)

### Mark scheme

- One sustainable forestry practice to reduce the occurrence/severity of forest fires: prescribed burns (remove excess fuel/dead leaves/underbrush); brush removal (removes excess fuel); selective cutting (creates a fire break); agroforestry, where ground crops that might otherwise become fuel are harvested/removed.