FREE SAMPLE: THE RESOURCE BOOKLET AND PARTS (a) AND (b)

ANSWER ALL THREE QUESTIONS

24 marks in all

Theme: rising seas, low-lying islands and coastal cities. Write your answers as short, structured essay paragraphs. Use information from the resource booklet AND your own case studies, and draw your own labelled maps, graphs or diagrams where they help. All facts in the booklet are real and come from the sources shown; the calculations were done by TPH. Each part is marked out of 2 so that you can see which skill you are practising.

RESOURCE BOOKLET · Resource A: how fast is the sea rising?

From 1901 to 2018 the global average sea level rose by 15–25 cm, and it has risen by 2.3 mm a year since the 1970s. By 2018, data collected by Australia's CSIRO had shown that the global mean sea level was rising by 3.2 mm a year, about double the average rate of the 20th century. The rate then accelerated to 4.62 mm a year for the decade 2013–2022. Sea level rise will have its greatest impact in the near term on low-lying Caribbean and Pacific islands, including atolls, and may make many of them uninhabitable later this century. Societies can adapt to sea level rise.

Source: Wikipedia: Sea level rise (retrieved 2026).

Resource B: two low-lying Pacific countries

Tuvalu is a country of low-lying atolls and reef islands with a land area of only about 26 km². Its highest point is 4.6 m above sea level, on Niulakita, and the average elevation of the country is less than 2 m. Funafuti, the capital atoll, is a narrow strip of land between 20 and 400 m wide around a lagoon. Kiribati has 32 atolls and other islands plus one raised coral island (Banaba); its islands rise only one or two metres above sea level. Its land is spread across about 3,441,810 km² of ocean. In the 2020 census about 90% of the people lived in the Gilbert Islands and 52.9% of those lived on South Tarawa.

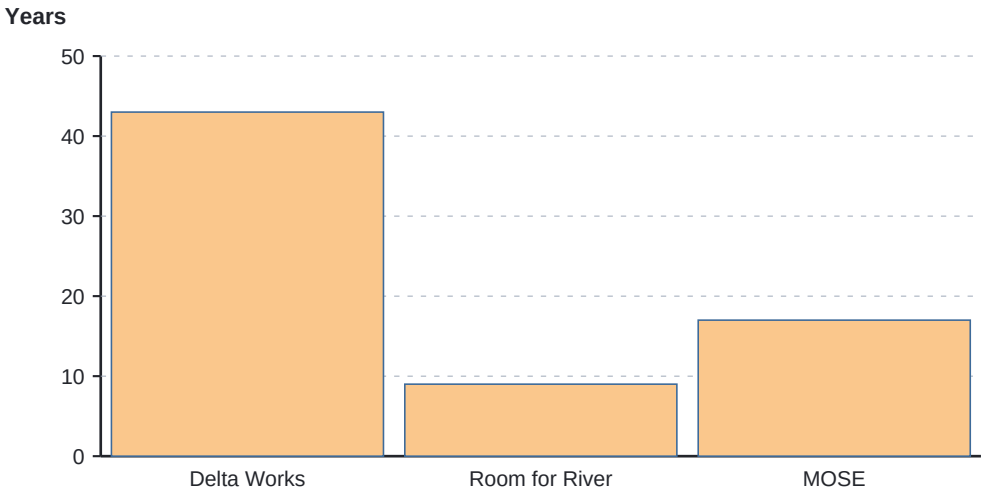
Country	Land area (km²)	Population (census year)
Tuvalu	26	10,643 (2022)
Kiribati	811	119,940 (2020)

Source: Wikipedia: Tuvalu; Funafuti; Kiribati.

Resource C: engineering responses in two rich countries

About 26% of the Netherlands is below sea level, and most of that land (polders) was reclaimed from the sea. After the North Sea flood of 1953 the government built the Delta Works, a system of dams, sluices, locks, dykes and storm surge barriers constructed between 1954 and 1997. Room for the River, active from 2006 to 2015, then gave rivers more space to flood. In Italy the MOSE project is a row of 78 mobile gates on the seabed at the three inlets of the Venetian Lagoon that can be raised to seal it off from the sea. It was started in 2003, missed its original 2011 completion deadline and its 2018 deadline, and had its first full test on 10 July 2020. Its cost is estimated at €5.496 billion, up €1.3 billion from the initial projection.

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Years from start to the end date shown (for MOSE, to its first full test). Calculated from Resource C.

Source: Wikipedia: Netherlands; North Sea flood of 1953; Delta Works; Room for the River; MOSE Project.

Resource D: a city that is sinking

Jakarta, the capital of Indonesia, is built on a low, flat alluvial plain with some land below sea level. Its metropolitan area (Jabodetabek) had a population of nearly 42 million in 2025. Jakarta faces persistent flooding, land subsidence, traffic congestion, air pollution and pressure on water and waste services. In 2022 the government began the legal process of moving the capital to Nusantara in East Kalimantan, a city estimated to cost Rp 523 trillion (US$35 billion), to be built in five phases lasting until 2045. Nusantara is described as replacing Jakarta to save the city from overpopulation and land sinking.

Source: Wikipedia: Jakarta; Nusantara.

Resource E: moving people

On 10 November 2023 Tuvalu signed the Falepili Union treaty with Australia, which entered into force on 28 August 2024. Australia will provide a pathway for 280 citizens of Tuvalu to migrate to Australia each year to enable climate-related mobility, and funds to mitigate the effects of climate change. Around 8,700 Tuvaluans applied for an Australian visa under it in 2025 and 280 visas were granted. In early 2012 Kiribati acquired the 2,200-hectare Natoavatu Estate on Vanua Levu, the second largest island of Fiji; the purchase was confirmed in May 2014. In December 2022 work began on the Funafuti reclamation project, which dredges sand from the lagoon; one platform was designed to be 780 m long and 100 m wide, an area of approximately 7.8 hectares. By 2026, land reclamation had added over 10% to Tuvalu's land area.

Source: Wikipedia: Falepili Union; Climate change in Tuvalu; Kiribati; Tuvalu. The signing date is as given on the Tuvalu page (10 November); the Falepili Union page gives 9 November.

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Resource F: timeline of responses

Event	Year · place
North Sea flood; 1,836 deaths in the Netherlands	1953 · Netherlands
Delta Works begin (built 1954–1997)	1954 · Netherlands
Great flood: a tide of 194 cm submerges Venice	1966 · Italy
Construction of the MOSE barrier begins	2003 · Italy
Room for the River begins (to 2015)	2006 · Netherlands
Kiribati buys a 2,200-hectare estate on Vanua Levu (confirmed in May 2014)	2012 · Kiribati / Fiji
MOSE completes its first full test (10 July)	2020 · Italy
Indonesia begins the legal process to move its capital to Nusantara	2022 · Indonesia
Tuvalu and Australia sign the Falepili Union (10 November)	2023 · Tuvalu / Australia

Source: Wikipedia pages listed above (including North Sea flood of 1953). Dates as given by each page.

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Question One (8 marks)

(a) Use information from Resource A.

Describe how the global average sea level has changed since 1901.

[2 marks]

(b) Use Resources A and B.

(i) Calculate how far the sea would rise in 50 years at the 2013–2022 rate of 4.62 mm a year, and how many years a rise of 1 metre would take at that constant rate.

(ii) Explain why a straight-line calculation like this may understate the risk to Tuvalu.

[2 marks]

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THE WORKED ANSWERS TO PARTS (a) AND (b)

Question 1 (8 marks) [Change over time]

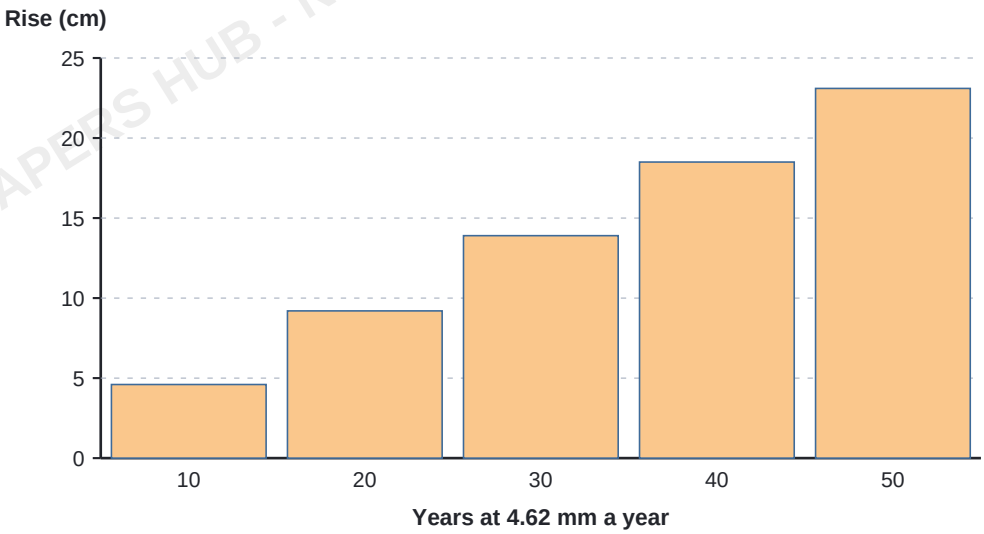
(a) Use information from Resource A. Describe how the global average sea level has changed since 1901.

(a) Answer: Rose 15–25 cm between 1901 and 2018; rate 2.3 mm a year since the 1970s; CSIRO estimate (by 2018) 3.2 mm a year, about double the 20th-century average; 4.62 mm a year in 2013–2022

- Entry step: worth marks in the 1-4 range of the 8-point question score.
- Quotes the total change with units and dates: a rise of 15–25 cm between 1901 and 2018 (117 years, an average of roughly 1.3–2.1 mm a year). [1 mark]
- Describes the change in rate: 2.3 mm a year since the 1970s and 3.2 mm a year by 2018 (CSIRO), about double the 20th-century rate, and 4.62 mm a year for 2013–2022, so the sea is rising faster, not just rising. [1 mark]

> **KEY TAKEAWAY**
> Describe change over time with figures, units and dates, and say whether the rate is steady, speeding up or slowing down.

(b) Use Resources A and B. (i) Calculate how far the sea would rise in 50 years at the 2013–2022 rate of 4.62 mm a year, and how many years a rise of 1 metre would take at that constant rate. (ii) Explain why a straight-line calculation like this may understate the risk to Tuvalu.



Original visual: sea level rise at a constant 4.62 mm a year, calculated by TPH.

(b) Answer: 23.1 cm in 50 years; 216 years for 1 m at a constant rate; the rate has been increasing, so the real time is likely to be shorter

- Scholarship band (5-6): the part needs your own selection of evidence and accurate reasoning.
- (i) 4.62 mm × 50 = 231 mm = 23.1 cm. 1000 mm ÷ 4.62 mm a year = 216.5 years, about 216 years. [1 mark]

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• (ii) Resource A shows the rate has increased (from the 1901–2018 average of about 1.3–2.1 mm a year to 3.2 mm a year by 2018 and 4.62 mm a year in 2013–2022), so a constant rate probably understates future rise. Tuvalu's average elevation is less than 2 m, so floods from king tides and storm surges are an earlier threat than permanent inundation, and the average rise hides the extremes. [1 mark]

KEY TAKEAWAY

A straight-line projection is a start; always say what assumption it makes (a constant rate) and why that may not hold.

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