

External assessment 2024

Stimulus book

Earth & Environmental Science

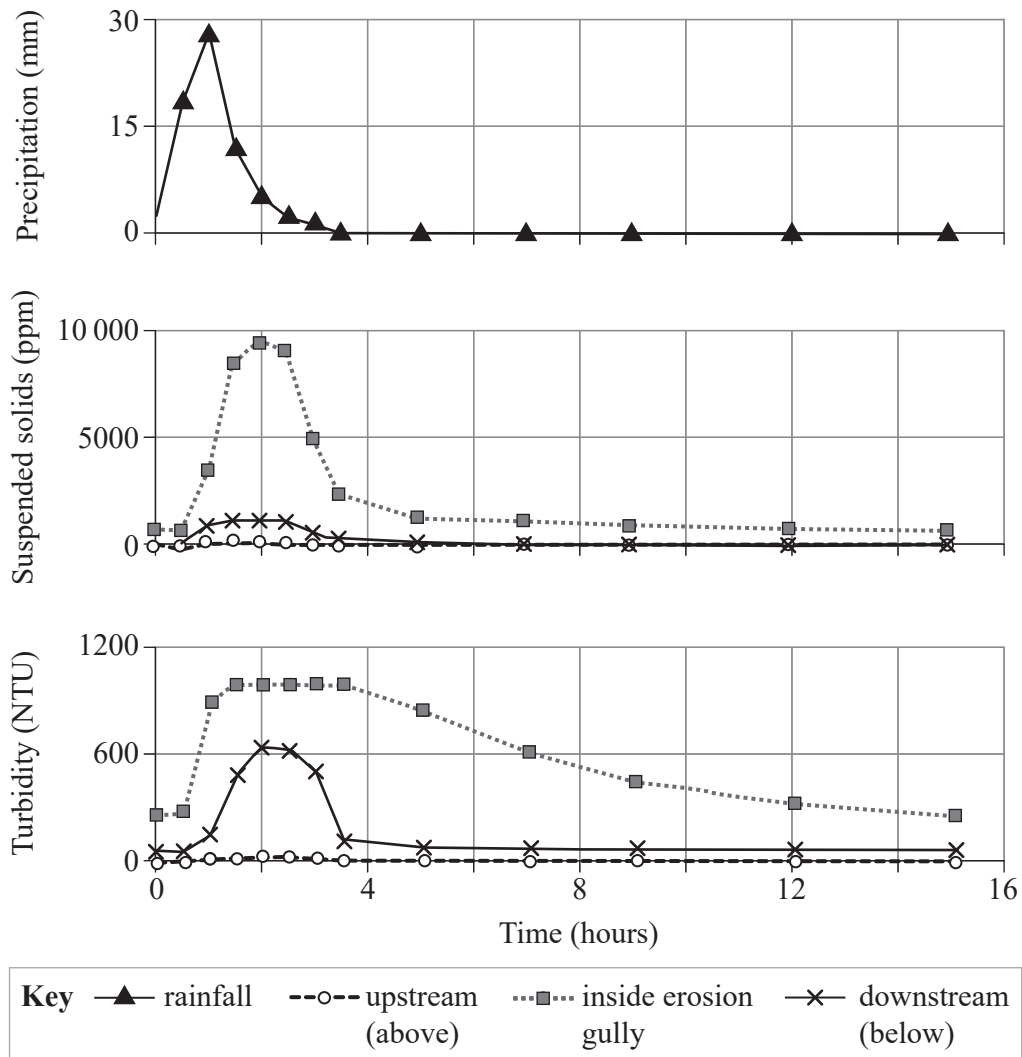
Paper 2

General instruction

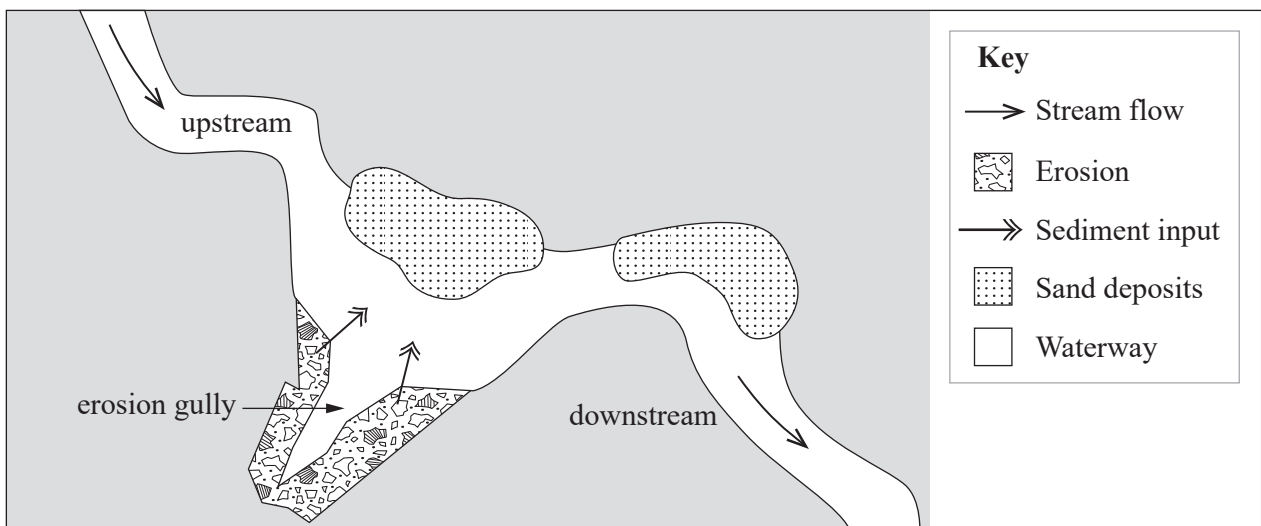
- Work in this book will not be marked.

Stimulus 1

The graphs show recovery of water quality upstream, inside and downstream of an erosion gully following a rainfall event.

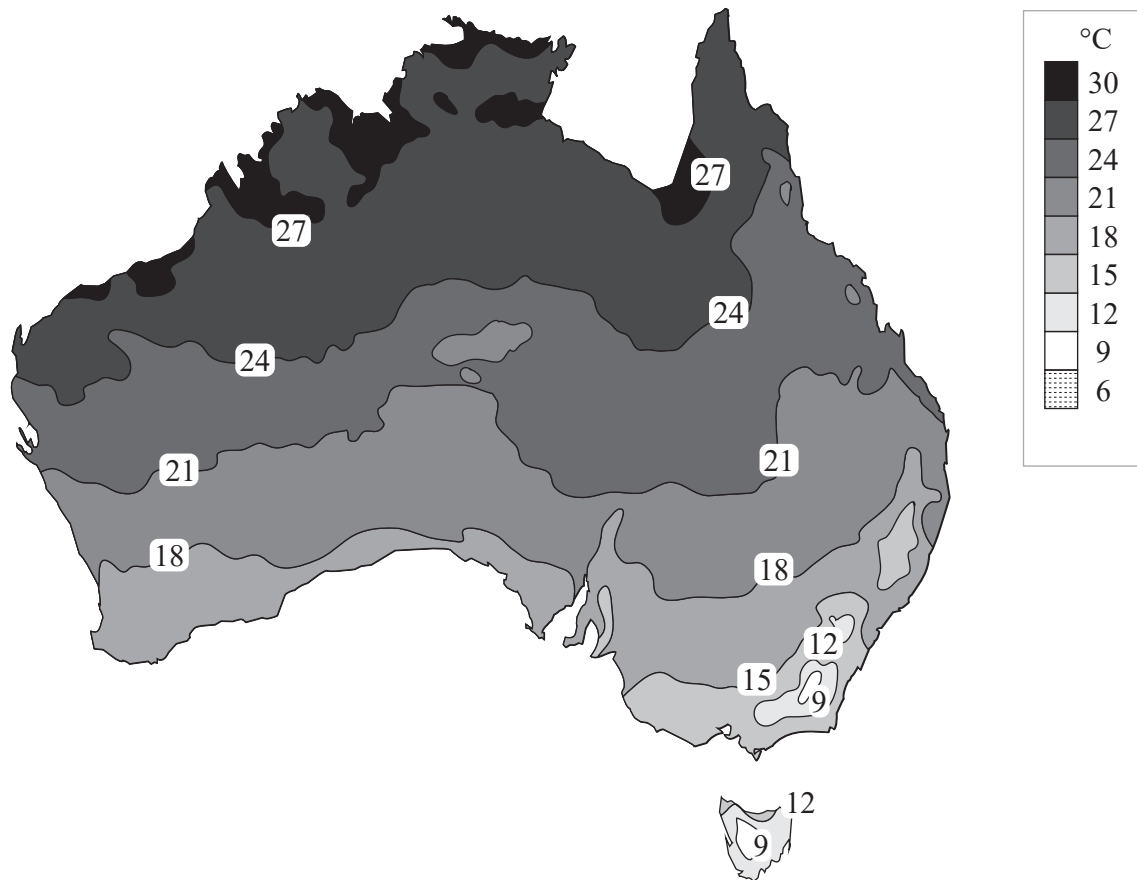


The figure shows an aerial view of the waterway and erosion gully.



Stimulus 2

The map shows average daily mean temperatures based on 30-year averages.



The tables show predicted warming under various atmospheric carbon dioxide (CO₂) representative concentration pathways (RCPs) and the temperature tolerance ranges of four Australian species.

Note: RCPs are modelled scenarios that show different possible trajectories of CO₂ concentration.

Table 1: Summary of representative concentration pathways (RCPs)

RCP	At the end of the century (2100)	
	CO ₂ concentration (ppm)	Warming (°C)
2.6 (low emissions)	420	0.3–1.7
4.5	540	1.1–2.6
6.0	660	1.4–3.1
8.5 (high emissions)	940	2.6–4.8

Table 2: Temperature tolerance range of four Australian species

	Species A	Species B	Species C	Species D
Temperature (°C)	20–38	0–18	15–31	10–25

Stimulus 3

Figures 1 to 3 show information regarding changes in the Amazon rainforest in South America.

Figure 1: Estimated distribution of the Amazon rainforest biome in 1500 and 2020

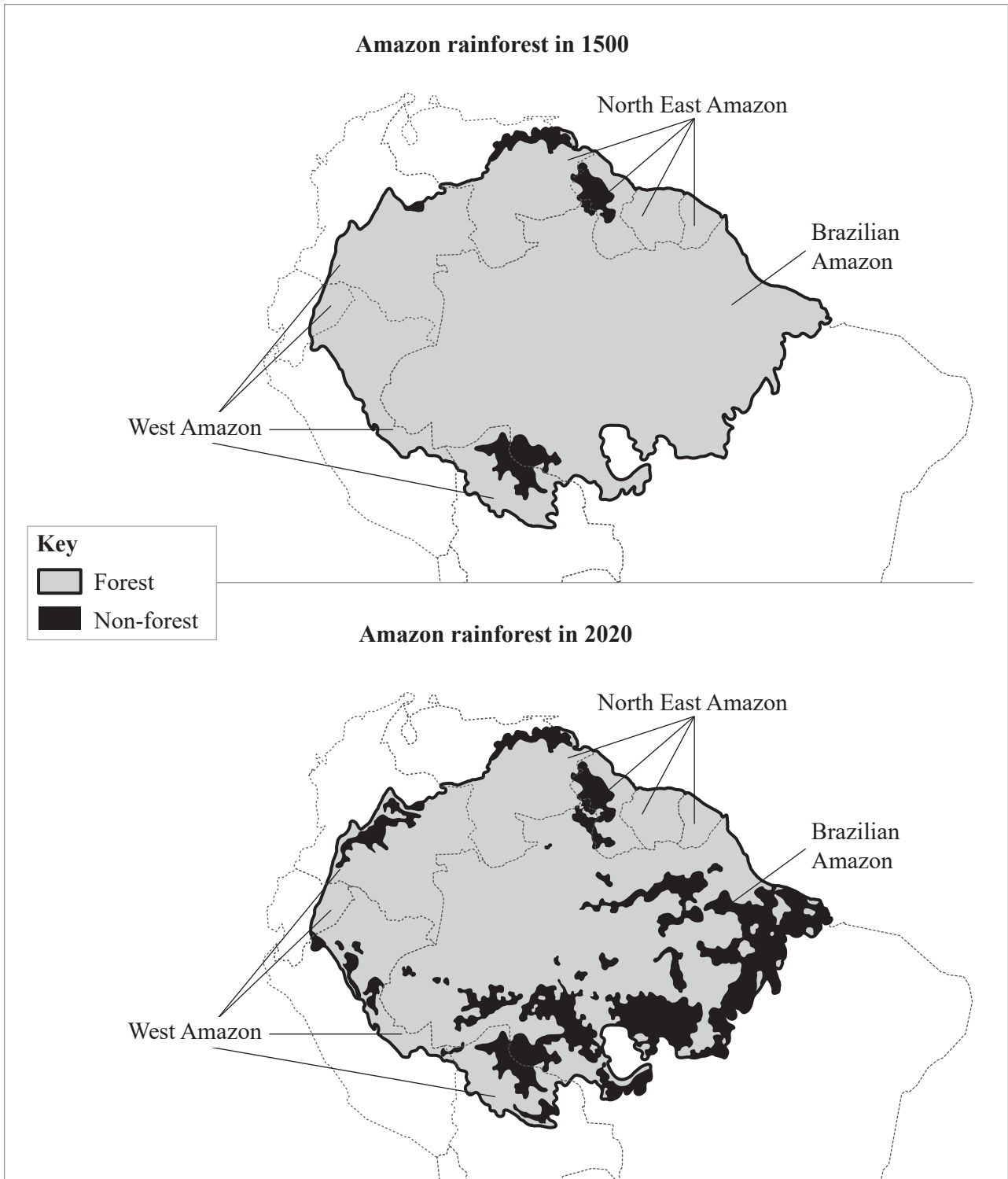


Figure 2: Carbon removals and emissions in the Amazon rainforest by region (2001–20)

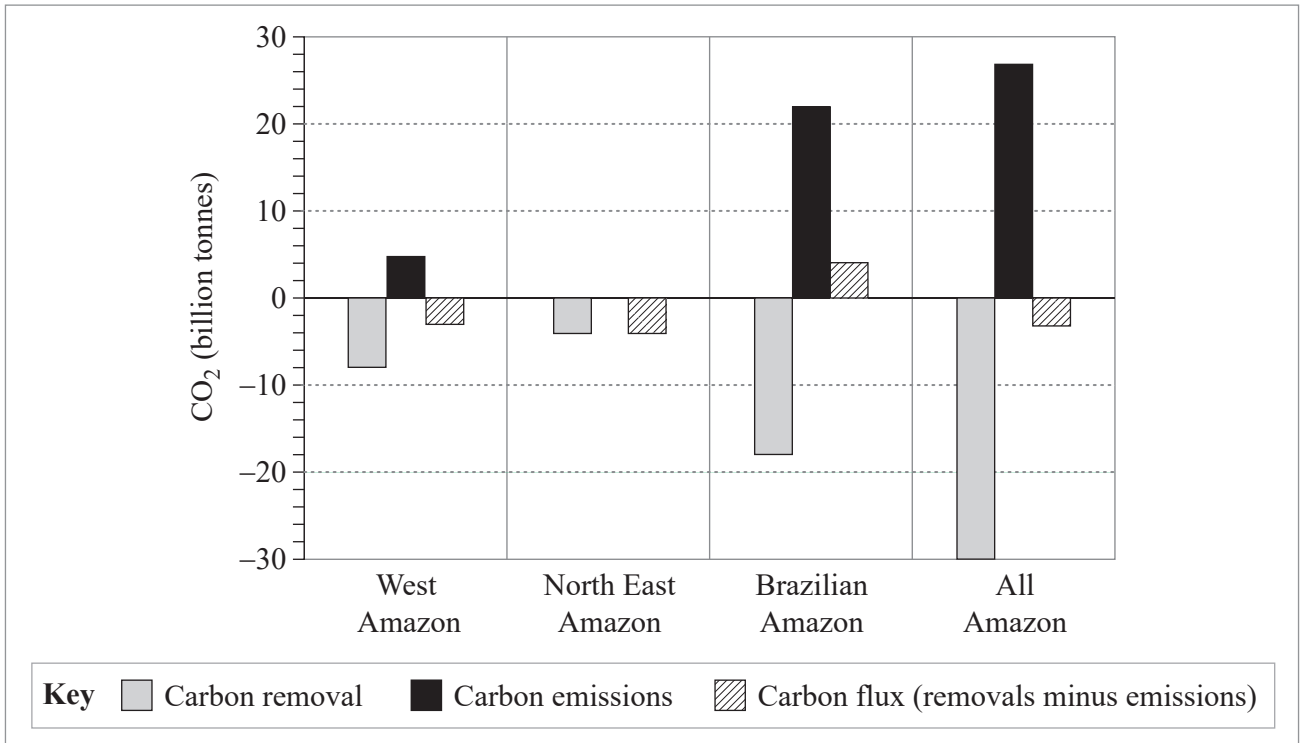
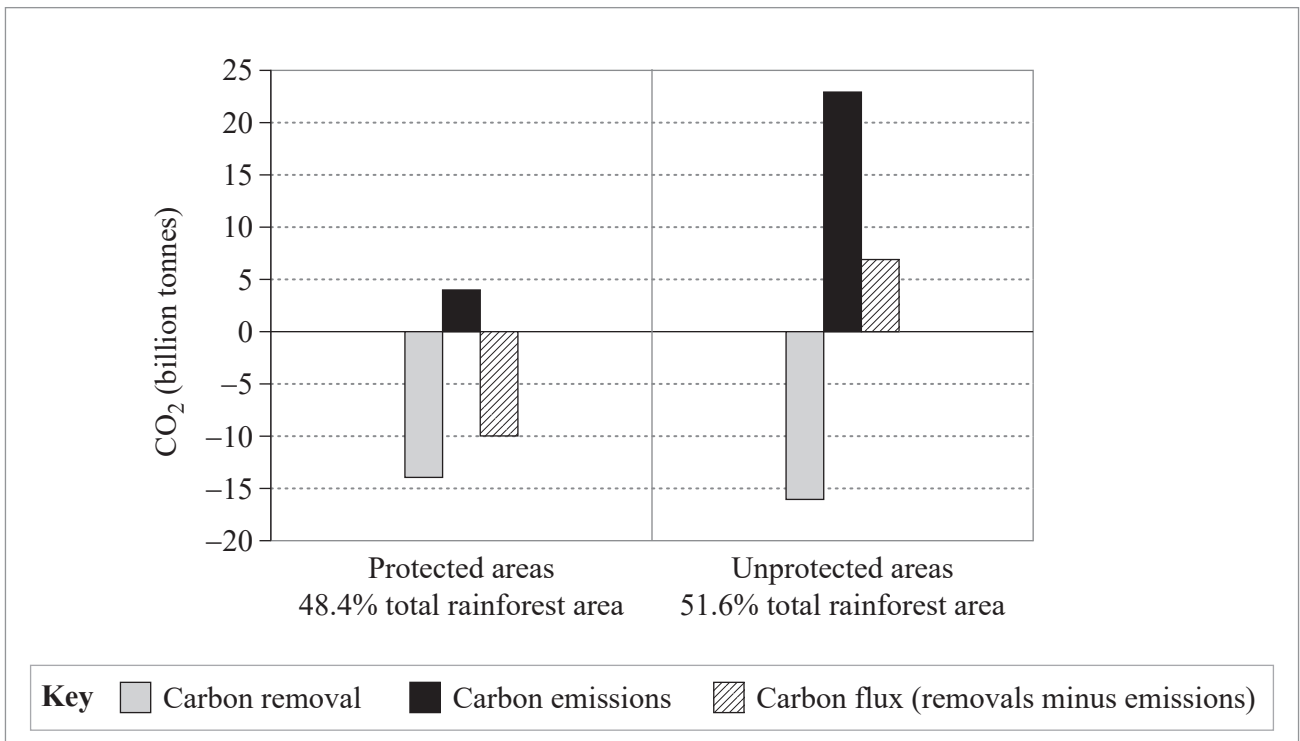


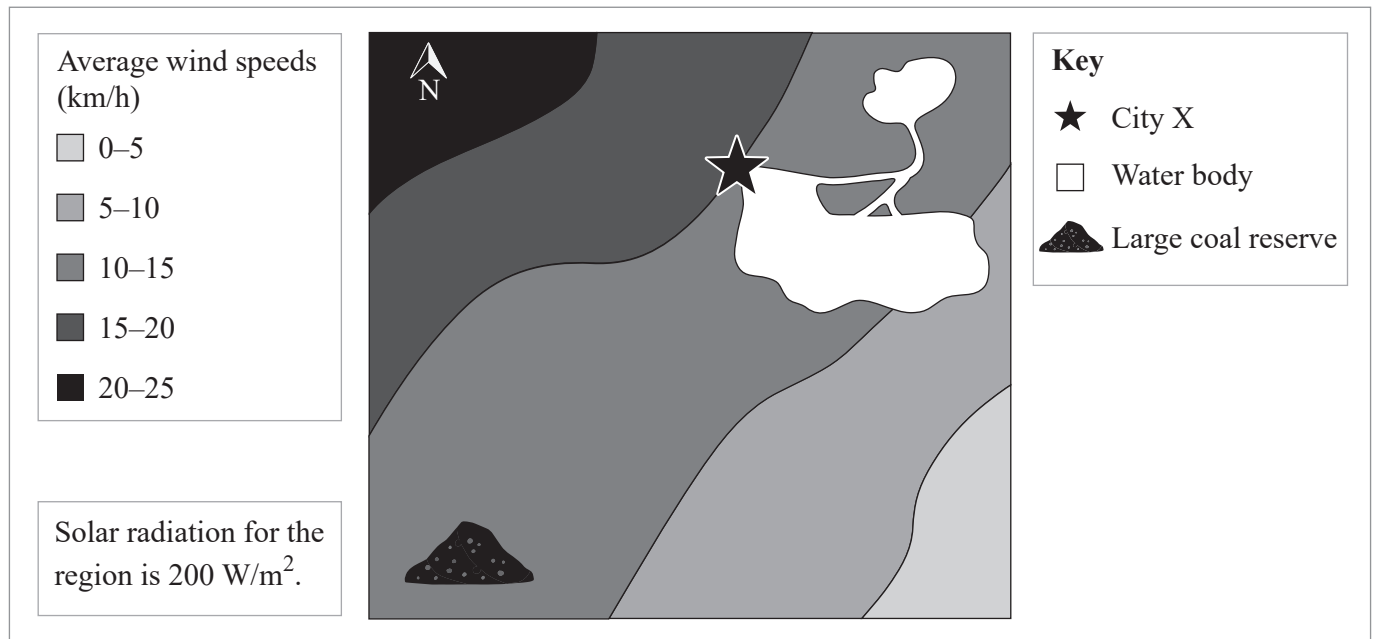
Figure 3: Carbon removals and emissions in protected and unprotected areas of the Amazon rainforest (2001–20)



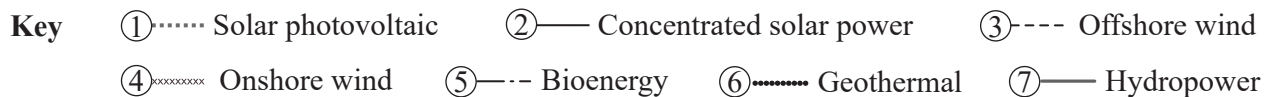
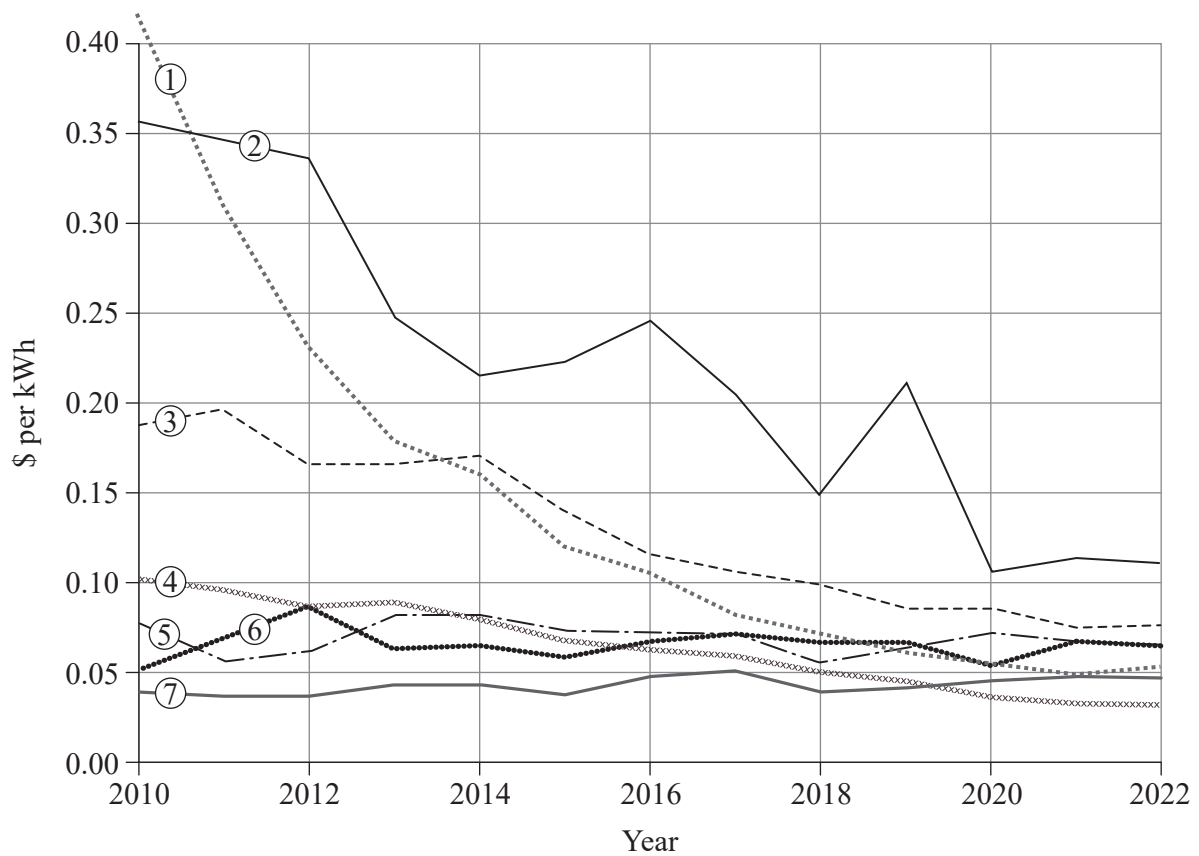
Note: In figures 2 and 3, ‘carbon removal’ refers to the removal of CO₂ from the atmosphere, and ‘carbon emissions’ refers to the emission of CO₂ into the atmosphere.

Stimulus 4

The map shows the location of the planned new city, City X, of 450 000 people.

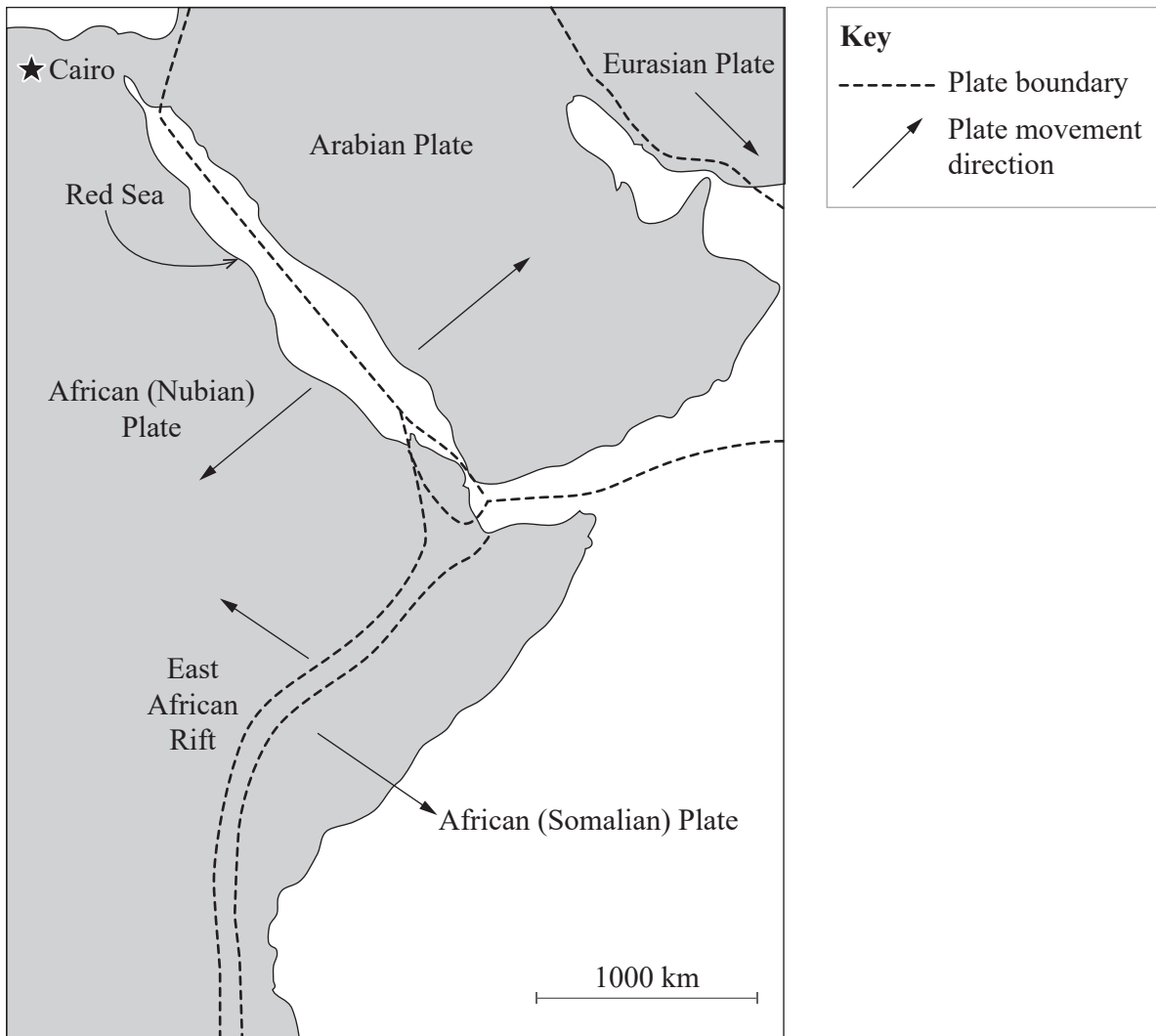


The graph shows the cost of different sources of energy production from 2010 to 2021.



Stimulus 5

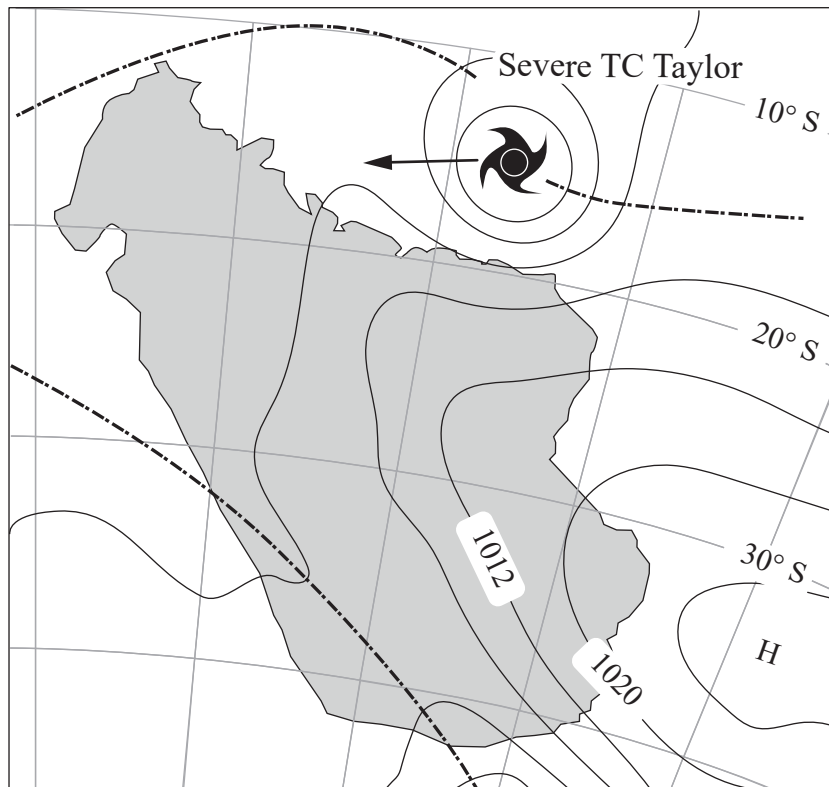
The map shows tectonic plate boundaries and movement direction in the East African Rift region.



Stimulus 6

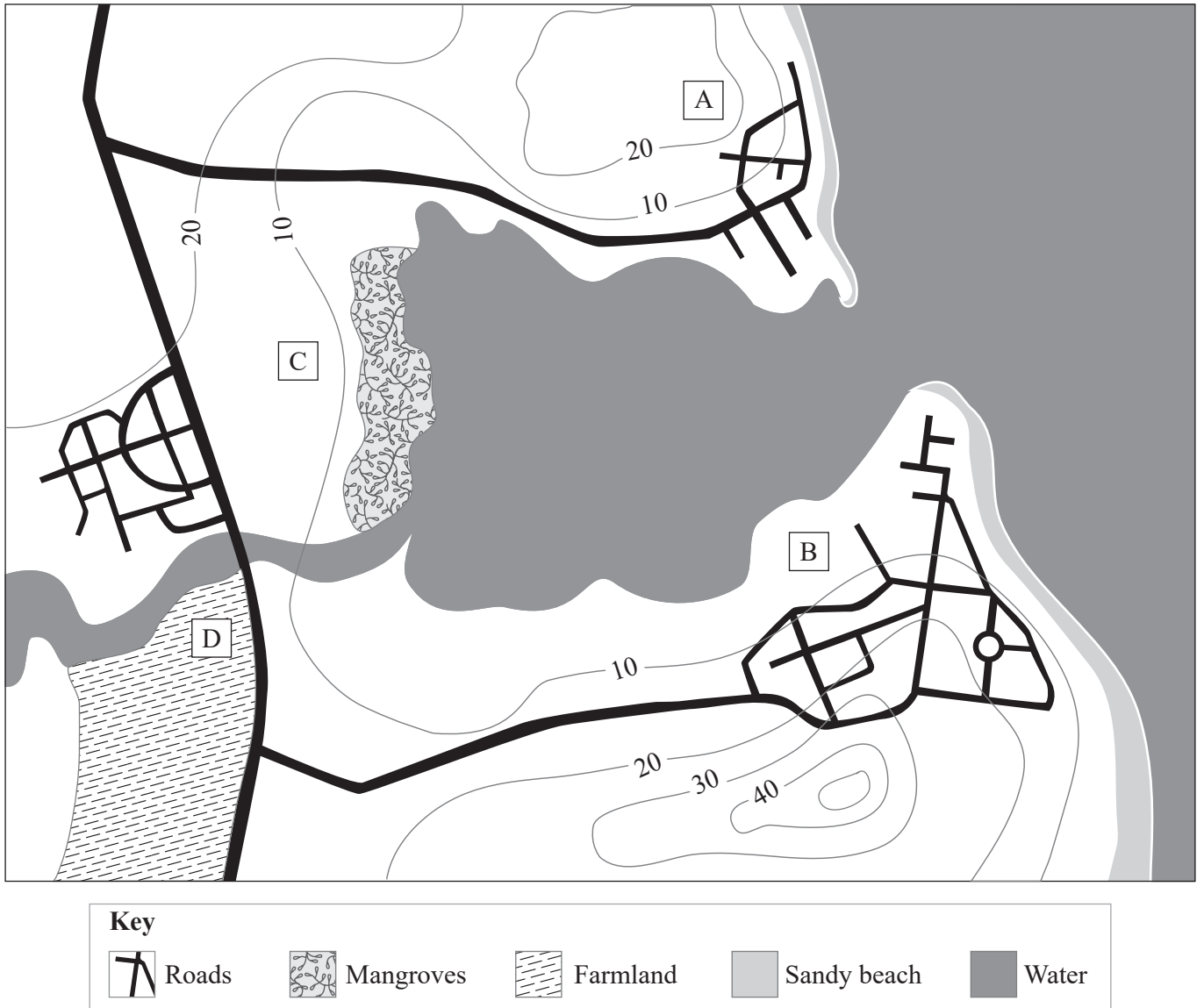
Figures 1 and 2 show information regarding the formation and projected path of tropical cyclone Taylor.

Figure 1: Mean sea-level pressure map, showing projected path of tropical cyclone Taylor



Note: The landmass in figure 1 is a fictional island within Australia's territorial waters.

Figure 2: Topographical map of a section of coastline in the path of tropical cyclone Taylor



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References

Stimulus 1

Data from Fig 4 in Wantzen, K 2006, 'Physical Pollution: Effects of gully erosion on benthic invertebrates in a tropical clear-water stream', *Aquatic Conservation: Marine and Freshwater Ecosystems*, vol. 16, pp. 733–749. <http://dx.doi.org/10.1002/aqc.813>.

Stimulus 2

Map adapted from Bureau of Meteorology 2021, 'Decadal and multi-decadal average temperature maps', *BOM*, Melbourne, CC BY 4.0, <http://www.bom.gov.au/climate/maps/averages/decadal-temperature/?maptype=mxt&periodRange=30-year&period=1961-1990>.

Table 1 adapted from NESP Earth Systems and Climate Change Hub 2019, *Climate Change Impacts on the Gondwana Rainforests of Australia*, workshop report, Earth Systems and Climate Change Hub Report No. 8, NESP Earth Systems and Climate Change Hub, Victoria, CC BY 4.0, https://nespclimate.com.au/wp-content/uploads/2020/02/Gondwana_CC_workshop_report.pdf.

Stimulus 3

Figure 1 adapted from Finer, M & Mamani, N 2022, 'Amazon tipping point – where are we? MAAP: 164', *Monitoring of the Andean Amazon Project (MAAP)*, Amazon Conservation Association, Washington, DC, <https://www.maaproject.org/2022/amazon-tipping-point/>. Used with permission.

Figures 2 and 3 adapted from Finer, M & Mamani, N 2021, 'The Amazon & climate change: Carbon sink vs carbon source. MAAP: 144', *Monitoring of the Andean Amazon Project (MAAP)*, Amazon Conservation Association, Washington, DC, <https://www.maaproject.org/2021/amazon-carbon-flux/>.

Stimulus 4

Graph adapted from Our World in Data 2022, *Levelized Cost of Energy by Technology*, Oxford Martin School, Oxford, UK, CC BY 4.0, <https://ourworldindata.org/grapher/levelized-cost-of-energy?time=2010..latest>.

Stimulus 5

Map adapted from Razashah1, 'ATJ map (color).jpg', *Wikipedia Commons*, CC BY 3.0, [https://commons.wikimedia.org/wiki/File:ATJ_map_\(color\).jpg](https://commons.wikimedia.org/wiki/File:ATJ_map_(color).jpg).



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