Exercise walk-through

6.2
Climate change: causes and impacts

International Baccalaureate · IB Diploma · Environmental Systems and Societies · HL

Independent lines of evidence

Instruments and change

Stations, satellites, oceans, glaciers and biological timing.

Sea level: thermal expansion and land-ice loss; floating sea ice has little direct effect.

Past climates

Ice-core bubbles preserve ancient air; isotopes provide temperature-related proxies.

Tree rings, pollen and sediments require calibration and dating; not all directly measure CO_2.

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Mitigation and adaptation

Mitigation

Reduce emissions or increase net atmospheric removal.

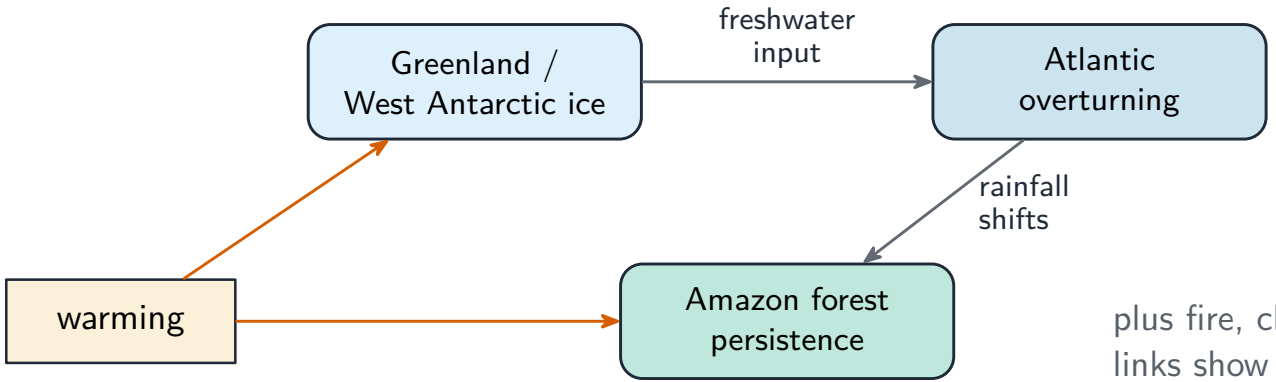
Clean energy, methane-leak reduction and protecting carbon stores.

Adaptation

Reduce exposure or vulnerability to impacts.

Flood defences, warnings and changed planting dates; some actions do both.

Linked tipping elements

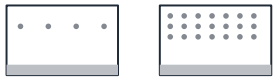


plus fire, clearance, rainfall change;
links show possible influence,
not certain cascades

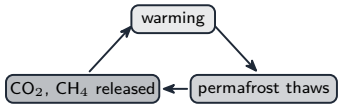
> The links are possible, not certain

Exercises 2.1·2.2

2.1 Distinguish between the natural greenhouse effect and the enhanced greenhouse effect. [2]

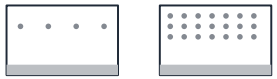


2.2 Explain how thawing permafrost is a positive feedback. [3]



Exercises 2.1·2.2

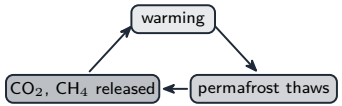
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2.1

natural: greenhouse gases that occur naturally keep Earth about 33 °C warmer than it would be, making life possible; enhanced: extra greenhouse gases from human activity trap more heat and raise the mean temperature further

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2.2

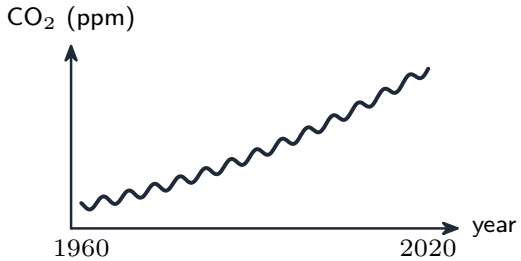
warming thaws frozen soil (permafrost) in the Arctic; dead organic matter in it decomposes and releases CO_2 and methane; these greenhouse gases cause more warming, so more permafrost thaws, and the change grows

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Exercise 3.1 (a)

3.1 The graph shows the CO_2 concentration at Mauna Loa, Hawaii.

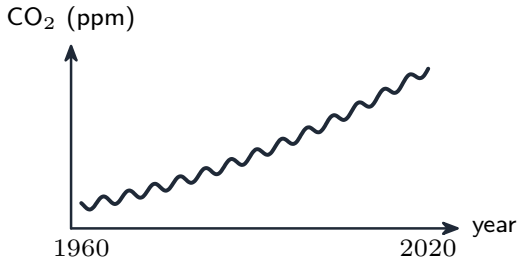
(a) The annual mean was 317 ppm in 1960 and 414 ppm in 2020. Calculate the mean rate of increase per year. [2]



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(a) $414 - 317 = 97$ ppm over 60 years; $97 \div 60 \approx \mathbf{1.6}$ ppm per year

Exercise 3.1 (b)

3.1 The graph shows the CO_2 concentration at Mauna Loa, Hawaii.

(b) Explain the small rise and fall within each year. [2]

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(b) Explain the small rise and fall within each year. [2]

(b) the Northern Hemisphere has most of the land and plants; in its summer photosynthesis takes in CO_2, so it falls; in winter respiration and decay continue but photosynthesis slows, so it rises

Exercise 3.2 (a)

3.2 Low-lying island nations such as Tuvalu are among the most at risk.

(a) Outline **two** impacts of climate change on low-lying islands. [2]



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(a) any two: flooding and loss of land from sea-level rise; salt water entering wells and farmland; stronger storms; coral reef damage that harms fishing and coastal protection

Exercise 3.2 (b)

3.2 Low-lying island nations such as Tuvalu are among the most at risk.

(b) Explain why the impacts of climate change are unequal between countries. [3]

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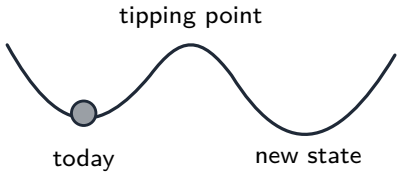
(b) Explain why the impacts of climate change are unequal between countries. [3]

(b) physical exposure differs, e.g. low coasts, dry regions and the Arctic change most; poorer countries have less money and technology to adapt, such as sea walls or irrigation; many depend more on farming and fishing, which are sensitive to climate

Exercise 3.3

3.3 Scientists describe some parts of the climate system as having **tipping points**.

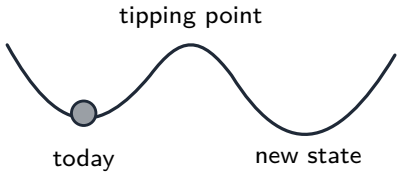
Discuss whether tipping points mean that cutting emissions is now urgent. [5]



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3.3

award up to [5]: a tipping point is a threshold after which a system shifts to a new state that is hard to reverse; examples: Greenland ice sheet, Amazon dieback, permafrost; positive feedbacks could push warming beyond human control; but the exact thresholds are uncertain, and some may be centuries away; conclusion: uncertainty and high risk support urgent action (precautionary principle)