

Exercise walk-through

Increases in the Greenhouse Gases ■ 9.4

eXercise

You must be able to

- link human activities to specific greenhouse gases
- compare gases by **global warming potential** 全球变暖潜能
- describe trends in CO₂

Method — Sources of each gas

- **CO₂** — burning fossil fuels, deforestation.
- **Methane (CH₄)** — livestock, rice paddies, landfills, natural gas leaks.
- **Nitrous oxide** — fertilizers, combustion.

Method — Global warming potential (GWP)

GWP compares how much heat a gas traps versus the same mass of CO₂. **Methane** has a much higher GWP than CO₂ (traps far more heat per molecule) but lasts a shorter time.

Method — Rising CO

Atmospheric CO₂ has risen steadily since industrialization (measured continuously, e.g. at Mauna Loa), closely tracking fossil-fuel use.

Method — A worked comparison

A kilogram of methane traps far more heat than a kilogram of CO₂, so even smaller methane leaks matter a lot for warming.

Practice 2.1 ■ 1 mark

Name one human source of methane.

Solution 2.1

Worked steps

Any one: livestock, rice paddies, landfills, natural-gas leaks **B1**.

Practice 2.2 ■ 1 mark

What does global warming potential compare?

Solution 2.2

Method: Global warming potential (GWP)

Worked steps

How much heat a gas traps relative to the same mass of CO₂ **B1**.

Practice 2.3 ■ 1 mark

Which traps more heat per kilogram: CO₂ or methane?

Solution 2.3

Method: A worked comparison

Worked steps

Methane **B1**.

Exam-style 3.1 ■ 1 mark

Compared with CO₂, methane has a

- A** much lower global warming potential
- B** much higher global warming potential per molecule
- C** identical effect
- D** cooling effect

Solution 3.1

- A** much lower global warming potential
- B** much higher global warming potential per molecule 
- C** identical effect
- D** cooling effect

Worked steps

B — a much higher global warming potential per molecule.

Exam-style 3.2 ■ 2 marks

A country has large livestock herds and burns much coal.

- (a) Name the main greenhouse gas from each activity.
- (b) Explain why methane leaks are a concern despite being smaller in volume than CO₂ emissions.

Solution 3.2

Method: A worked comparison

Worked steps

(a) Livestock $\rightarrow$ methane; coal $\rightarrow$ CO₂ **B1** **B1**. (b) Methane has a much higher global warming potential, so even small amounts trap a lot of heat **M1** **A1**.

Exam-style 3.3 ■ 2 marks

Explain why atmospheric CO₂ has risen since the Industrial Revolution.

Solution 3.3

Method: Rising CO

Worked steps

Industrialization greatly increased the burning of fossil fuels (and deforestation), releasing CO₂ faster than natural processes remove it, so it accumulates **M1** **A1**.