

9.4 Increases in the Greenhouse Gases

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS methane 甲烷 • global warming potential 全球变暖潜能 • global warming potential (gwp) 全球变暖潜能
• greenhouse gases 温室气体

Objective

Build the skills to answer exam questions on **increases in greenhouse gases**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Sources of each gas

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

■ 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.

■ Rising CO₂

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

■ 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.

2 Practice

Now apply the methods above.

2.1 Name one human source of methane. [1]

2.2 What does global warming potential compare? [1]

2.3 Which traps more heat per kilogram: CO₂ or methane? [1]

3 Exam-style questions

3.1 Compared with CO₂, methane has a [1]

- **A** much lower global warming potential
 - **B** much higher global warming potential per molecule
 - **C** identical effect
 - **D** cooling effect
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3.2 A country has large livestock herds and burns much coal.

(a) Name the main greenhouse gas from each activity. [2]

(b) Explain why methane leaks are a concern despite being smaller in volume than CO₂ emissions. [2]

3.3 Explain why atmospheric CO₂ has risen since the Industrial Revolution. [2]

Solutions

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

2.2 How much heat a gas traps relative to the same mass of CO_2 .

2.3 Methane.

3.1 B — a much higher global warming potential per molecule.

3.2 (a) Livestock $\rightarrow$ methane; coal $\rightarrow$ CO_2 . (b) Methane has a much higher global warming potential, so even small amounts trap a lot of heat.

3.3 Industrialization greatly increased the burning of fossil fuels (and deforestation), releasing CO_2 faster than natural processes remove it, so it accumulates.