AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

9.4 Increases in the Greenhouse Gases

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

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 CO_2

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

- **CO_2** —burning fossil fuels, deforestation.
- **Methane (CH_4)** —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 CO_2. **Methane** has a much higher GWP than CO_2 (traps far more heat per molecule) but lasts a shorter time.

Rising CO

Atmospheric CO_2 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 CO_2, 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: CO_2 or methane? [1]

3 Exam-style questions

3.1 Compared with CO_2, methane has a [1]

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

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 CO_2 emissions. [2]

3.3 Explain why atmospheric CO_2 has risen since the Industrial Revolution. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **9.4 Increases in the Greenhouse Gases** lesson on the **Learn** page;
- read the **Increases in the Greenhouse Gases** section of the AP Environmental Science handout on the **Know** page.

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 → methane; coal → 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.