

# 9.3 The Greenhouse Effect

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 11 marks

## Objective

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Build the skills to answer exam questions on the **greenhouse effect**.

**You must be able to:**

- explain the **greenhouse effect** 温室效应
- name the main **greenhouse gases** 温室气体
- distinguish the natural effect from the enhanced (human) one

## 1 Worked examples

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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.

### ■ How it works

The **greenhouse effect**: the Sun warms Earth, which re-emits **infrared (heat)** radiation. **Greenhouse gases** absorb some of this heat and re-radiate it back, keeping the surface warmer than it would otherwise be.

### ■ The natural effect is essential

The **natural** greenhouse effect keeps Earth's average temperature livable (about 15°C instead of freezing). Without it, Earth would be too cold for life.

### ■ The enhanced effect

Human emissions **add** greenhouse gases, strengthening the effect (the **enhanced greenhouse effect**), trapping more heat and warming the planet.

### ■ The main gases

- **Carbon dioxide (CO<sub>2</sub>)** —burning fossil fuels.
- **Methane (CH<sub>4</sub>)** —livestock, landfills.
- **Nitrous oxide, water vapor, and CFCs.**

## 2 Practice

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Now apply the methods above.

**2.1** What type of radiation do greenhouse gases absorb? [1]

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**2.2** Name two greenhouse gases. [2]

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**2.3** Why is the natural greenhouse effect important? [1]

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### 3 Exam-style questions

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**3.1** Greenhouse gases warm the Earth by absorbing and re-emitting [1]

- **A** visible light
- **B** infrared (heat) radiation
- **C** ultraviolet only
- **D** sound

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**3.2** Human activity is strengthening the greenhouse effect.

(a) Explain the difference between the natural and enhanced greenhouse effect. [2]

(b) State the main gas responsible and its main source. [2]

**3.3** Explain why the natural greenhouse effect is necessary for life on Earth. [2]

### 4 Go further

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

- work through the **9.3 The Greenhouse Effect** lesson on the **Learn** page;
- read the **The Greenhouse Effect** section of the AP Environmental Science handout on the **Know** page.

## Solutions

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**2.1** Infrared (heat) radiation.

**2.2** Any two: CO<sub>2</sub>, methane, nitrous oxide, water vapor, CFCs.

**2.3** It keeps Earth warm enough for life.

**3.1 B** —infrared (heat) radiation.

**3.2** (a) The natural effect keeps Earth livably warm; the enhanced effect is the extra warming from human-added greenhouse gases. (b) CO<sub>2</sub>, mainly from burning fossil fuels.

**3.3** Without greenhouse gases trapping heat, Earth's average temperature would be well below freezing, too cold for most life.