

This question is about the Earth's atmosphere.

1.1

Carbon dioxide is a greenhouse gas.

What is another greenhouse gas?

[1 mark]

Tick **one** box.

Argon

☐

Methane

☐

Nitrogen

☐

Oxygen

☐

1.2

Greenhouse gases cause global climate change.

Give **two** effects of global climate change.

[2 marks]

1 _____

2 _____

1.3

4.1 kg of a plastic, used to make plastic bottles, has a carbon footprint of 6.0 kg of carbon dioxide.

Calculate the carbon footprint of one plastic bottle of mass 23.5 g

[2 marks]

Carbon footprint = _____ kg of carbon dioxide

[1 mark]

1.5

[6 marks]

[illegible]

2.1

Give the test and result for chlorine gas.

[2 marks]

Scientists think that the Earth's early atmosphere was like the atmosphere found on Venus today.

Table 2 shows the amounts of carbon dioxide and oxygen in the atmospheres of Venus and Earth today.

Table 2

Gas	Percentage (%) in Venus' atmosphere today	Percentage (%) in Earth's atmosphere today
Carbon dioxide	96.50	0.04
Oxygen	0.00	20.95

The percentages of carbon dioxide and oxygen have changed from Earth's early atmosphere to Earth's atmosphere today.

Explain the processes that led to these changes.

[6 marks]

[illegible]

4.1

Explain how carbon monoxide is produced when petrol is burned in car engines.

[2 marks]

Oxides of nitrogen are also pollutants contained in exhaust fumes.

4.2

Describe how oxides of nitrogen are produced when petrol is burned in car engines.

[2 marks]

4.3

Give **two** effects of atmospheric pollution which are reduced by using catalytic converters.

[2 marks]

1 _____

2 _____

This question is about atmospheric pollutants from fuels.

5.1

Fuel burns in a car engine.

Describe how oxides of nitrogen are produced in a car engine.

[2 marks]

This question is about oxygen (O_2) and sulfur dioxide (SO_2).

6.1

Give the test and result for oxygen gas.

[2 marks]

Test _____

Result _____

Butane is a hydrocarbon.

7.1

Two equations for the combustion of butane are:

- $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
- $2\text{C}_4\text{H}_{10} + 5\text{O}_2 \rightarrow 8\text{C} + 10\text{H}_2\text{O}$

Why are different products formed?

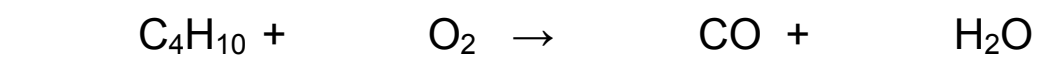
[1 mark]

7.2

One other product of the combustion of butane is carbon monoxide.

Balance the equation.

[1 mark]



Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.

[4 marks]

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Natural gas is mainly methane.

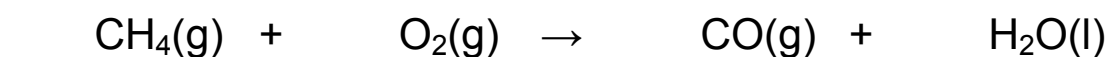
When methane burns it can produce both carbon monoxide and carbon dioxide.

- 8.1 Explain the process by which carbon monoxide can be produced when methane is burned.

[2 marks]

- 8.2 Balance the equation for the combustion of methane to produce carbon monoxide.

[1 mark]



Titan is a moon of the planet Saturn.

Table 3 shows the percentages of the gases in the atmosphere of Titan.

Table 3

Gas	Percentage of gas in atmosphere (%)
Nitrogen	98.4
Methane	1.4
Other gases	0.2

9.1

Some scientists think that living organisms could have evolved on Titan.

Explain why these organisms could **not** have evolved in the same way that life is thought to have evolved on Earth.

Use **Table 3**.

[3 marks]

9.2

Saturn has other moons.

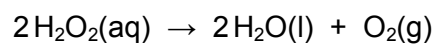
The other moons of Saturn have no atmosphere.

Titan is warmer than the other moons of Saturn because its atmosphere contains the greenhouse gas methane.

Explain how this greenhouse gas keeps Titan warmer than the other moons of Saturn.
[3 marks]

Some students investigated the rate of decomposition of hydrogen peroxide, H_2O_2

The equation for the reaction is:



The catalyst for the reaction is manganese dioxide.

10.1

Describe a test to identify the gas produced in the reaction.

Give the result of the test.

[2 marks]

Test _____

Result _____

11.1

Describe the test for carbon dioxide.

Give the result of the test.

[2 marks]

Test

Result

11.2

Describe the test for hydrogen.

Give the result of the test.

[2 marks]

Test

Result

This question is about the Earth's atmosphere.

12.1

Carbon dioxide is a greenhouse gas.

The greenhouse effect happens in four stages.

The four stages are:

Stage **A** Carbon dioxide stops longer wavelength radiation escaping

Stage **B** Radiation is absorbed by the Earth

Stage **C** Longer wavelength radiation is emitted

Stage **D** Shorter wavelength radiation enters the atmosphere

What is the correct order of stages **A**, **B**, **C** and **D**?

[1 mark]

Tick (✓) **one** box.

C, A, B, D

☐

C, D, B, A

☐

D, B, C, A

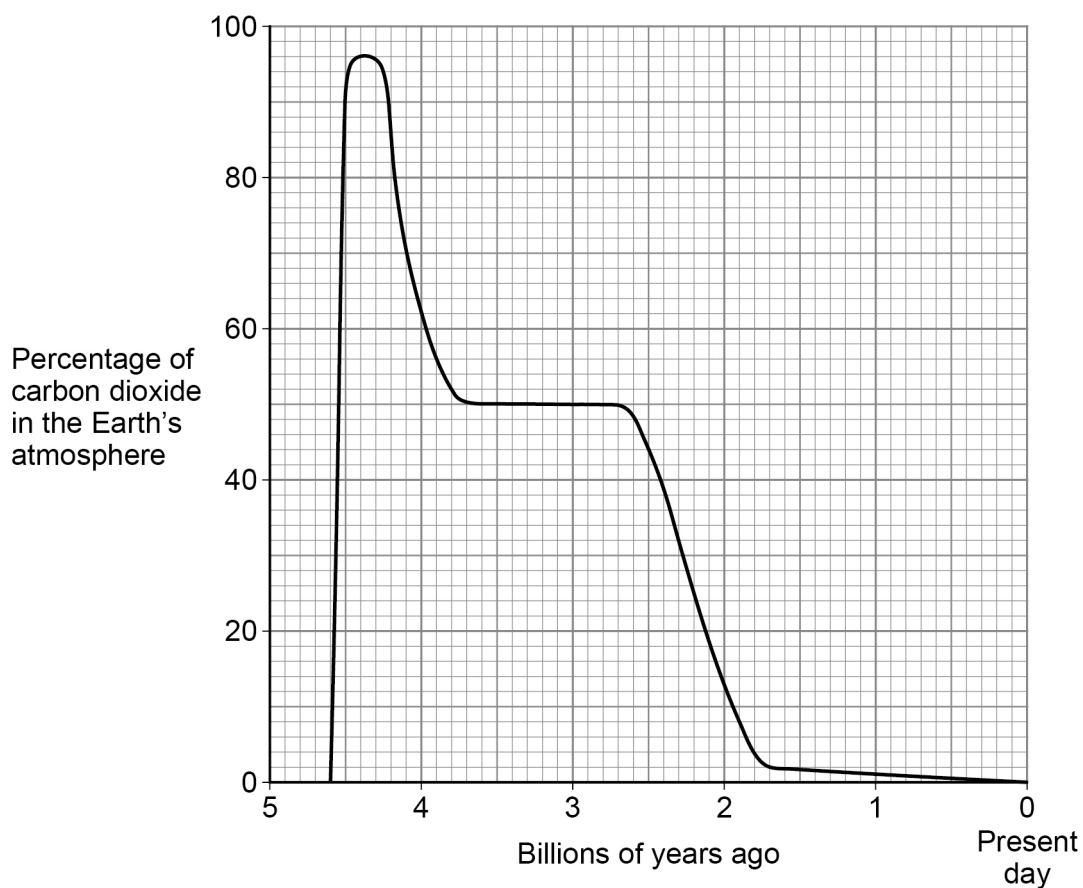
☐

D, C, B, A

☐

Figure 6 shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

Figure 6



12.2

The mass of gas in Earth's atmosphere remains constant at 5.15×10^{18} kg

Determine the maximum mass of carbon dioxide that was in the Earth's atmosphere.

Use **Figure 6**.

[3 marks]

Mass of carbon dioxide = _____ kg

[6 marks]

[illegible]

This question is about atmospheric pollution.

Figure 3 shows a limestone carving which has been damaged by atmospheric pollution.

The carving has been:

- blackened by soot
- eroded where the limestone has reacted with atmospheric pollutants.

13.1

Explain why soot is formed when some fossil fuels are burned.

[2 marks]

13.2

Fossil fuels are burned in car engines.

Explain how reducing the amount of sulfur in fossil fuels reduces the erosion of limestone.

[4 marks]

13.3

Oxides of nitrogen are atmospheric pollutants which are formed in car engines.

Explain why oxides of nitrogen are formed in car engines.

[2 marks]

This question is about algae.

A student:

- placed algae in water containing dissolved carbon dioxide
- shone bright light on the algae.

Gas bubbles were collected as the algae photosynthesised.

14.1

Describe a test that would identify the gas collected.

Give the result of the test.

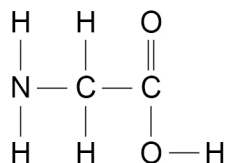
[2 marks]

Test _____

Result _____

Figure 6 shows the displayed structural formula of an amino acid called glycine.

Figure 6



14.2

Scientists think that algae may have used gases in Earth's early atmosphere.

Algae need an element to produce the molecule in **Figure 6** which is **not** present in water or carbon dioxide.

Which **two** gases from Earth's early atmosphere could have provided this element?

[2 marks]

_____ and _____

Atmospheric pollution is emitted by cars.

Some car emissions contain nitrogen dioxide.

15.1

Describe how nitrogen dioxide (NO_2) is produced in the engine of a car that burns fossil fuels.

[3 marks]

Table 3 shows the concentration of nitrogen dioxide in the air in three different areas for 1 week.

Table 3

Concentration of nitrogen dioxide in the air in micrograms per m^3			
Day	City centre	Countryside	Motorway
Monday	35	8	22
Tuesday	37	8	23
Wednesday	37	8	23
Thursday	34	8	23
Friday	37	8	23
Saturday	29	7	20
Sunday	X	6	17

15.2

The mean value for nitrogen dioxide in the air for the whole week in the city centre is 33 micrograms per m³.

Calculate the value (**X**) for the concentration of nitrogen dioxide in the air in the city centre on Sunday.

[2 marks]

X = _____ micrograms per m³

15.3

Each value in **Table 3** has an uncertainty of ± 2 micrograms per m³.

Explain why this uncertainty is **most** significant for countryside data.

[2 marks]

16.1

Nitrogen is obtained from the air.

The mixture of nitrogen and hydrogen must **not** contain carbon dioxide and oxygen.

Explain how a sample can be tested to show that carbon dioxide is **not** present in the mixture.

[2 marks]

When oil is burned, the products of combustion may be released into the atmosphere.

Explain the environmental effects of releasing these products of combustion into the atmosphere.

[6 marks]

[illegible]

17.2

Solar energy may **not** be able to replace the generation of electricity from fossil fuels completely.

Suggest **two** reasons why.

[2 marks]

1 _____

2 _____

This question is about the Earth's atmosphere and the Earth's resources.

- 18.1 After the formation of the Earth's early atmosphere, the amounts of nitrogen and oxygen in the atmosphere changed.

Explain the main changes in the amounts of nitrogen and oxygen in the Earth's atmosphere.

[4 marks]

Nitrogen _____

Oxygen _____

- 18.2 Describe how coal was formed from the carbon dioxide present in the Earth's early atmosphere.

[4 marks]

- 18.3 The combustion of 1.0 kg of coal produces more carbon dioxide than the combustion of 1.0 kg of natural gas.

Suggest why.

[1 mark]

19.1

Chlorine is also used to treat some ground water.

Describe the test for chlorine gas.

Give the result of the test.

[2 marks]

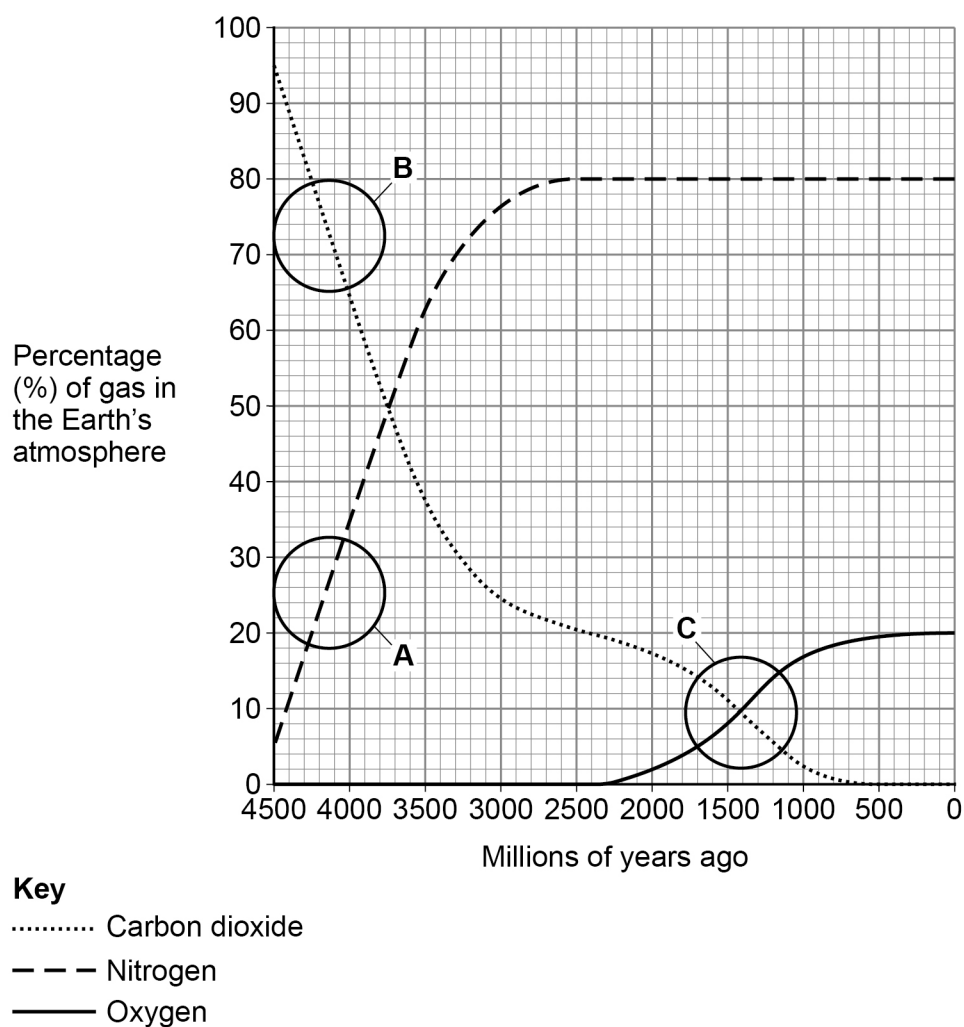
Test _____

Result _____

This question is about the chemistry of the Earth's atmosphere.

Figure 3 shows how the percentages of gases in the Earth's atmosphere may have changed since the atmosphere was formed.

Figure 3



20.1

Explain the change in the percentage of gas in the region labelled **A** on **Figure 3**.

[2 marks]

20.2 Explain the change in the percentage of gas in the region labelled **B** on **Figure 3**.
[2 marks]

20.3 Compare the changes in the percentages of gases in the region labelled **C** on **Figure 3**.
[2 marks]

20.4 What process caused the changes in the percentages of gases in the region labelled **C** on **Figure 3**?
[1 mark]

20.5 Natural gas is a fossil fuel.
Describe how deposits of natural gas were formed.
[3 marks]

21.1 The gases released when a fuel is burned in car engines may include:

- oxides of nitrogen
- carbon monoxide
- water vapour.

Which chemical element do all these gases contain?

[1 mark]

Tick (✓) **one** box.

Carbon

☐

Hydrogen

☐

Nitrogen

☐

Oxygen

☐

21.2 When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

[1 mark]

21.3 When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

[1 mark]

21.4

Explain why water vapour and **not** liquid water is produced when diesel burns.

[2 marks]

21.5

Sulfur is a common impurity in diesel.

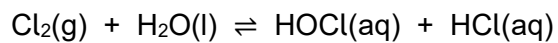
Explain why this causes an environmental problem.

[3 marks]

A stage in the production of potable water is sterilising.

A gas is used to sterilise water.

The equation for the reaction is:



22.1

Describe a test to identify the gas used to sterilise water.

[2 marks]

Test _____

Result _____

An increase of greenhouse gases in the Earth's atmosphere is causing global warming.

Global warming is causing global climate change.

23.1

Give **one** effect of global climate change.

[1 mark]

23.2

Explain how greenhouse gases cause global warming.

[4 marks]

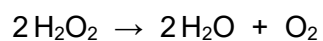
23.3

Explain how planting trees reduces global warming.

[3 marks]

24.1

The equation for the decomposition of hydrogen peroxide is:



Describe a test to identify the gas produced in the reaction.

[2 marks]

Test _____

Result _____

25.1

Hydrogen gas is produced during this reaction.

Describe the test for hydrogen gas.

Give the result of the test.

[2 marks]

Test _____

Result _____

26.1

Give the result of the test when carbon dioxide is bubbled through limewater.

[1 mark]

This question is about greenhouse gases and climate change.

Carbon dioxide and methane are greenhouse gases.

27.1

Which of the following is also a greenhouse gas?

[1 mark]

Tick (✓) **one** box.

Chlorine

☐

Nitrogen

☐

Oxygen

☐

Water vapour

☐

In the past 50 years, there has been an increase in:

- the world population
- the concentration of carbon dioxide in the atmosphere
- the concentration of methane in the atmosphere
- the mean temperature of the atmosphere at the Earth's surface.

Most scientists think this information can be used to explain climate change.

27.2

Explain why the increase in world population may have caused the increase in the concentration of carbon dioxide in the atmosphere.

[2 marks]

27.3

Explain why the increase in world population may have caused the increase in the concentration of methane in the atmosphere.

[2 marks]

27.4

Describe **two** potential effects of the increase in the mean temperature of the atmosphere at the Earth's surface.

[2 marks]

1

2
