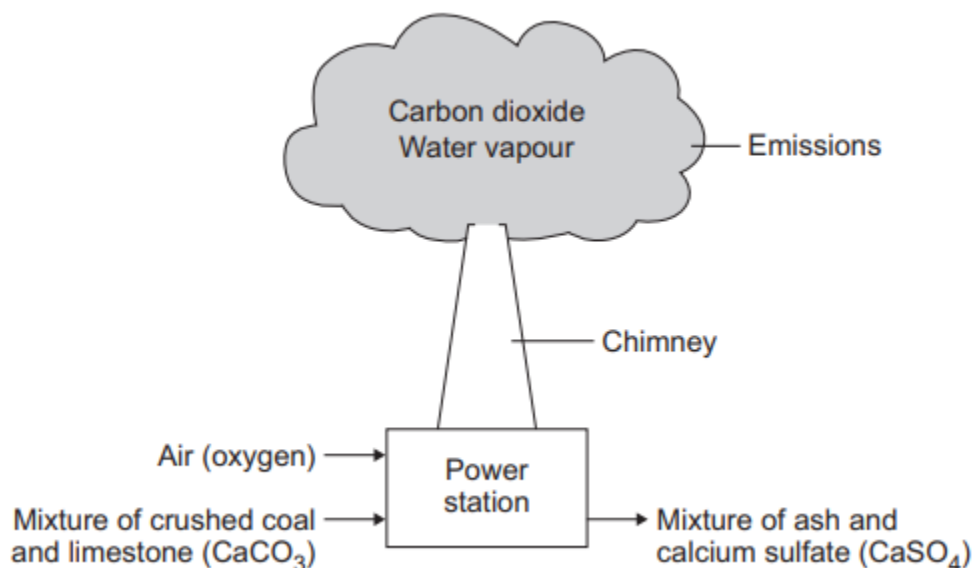


# THE ATMOSPHERE 2

**Q1.** Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone. This prevents sulfur dioxide from entering the atmosphere and causing acid rain. One disadvantage of using limestone in a power station is that it releases 'locked up carbon dioxide' into the atmosphere.



**(a)** How does the limestone used in a power station:

**(i)** release carbon dioxide

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(1 mark)

**(ii)** remove sulfur dioxide?

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(1 mark)

**(b)** The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide. Explain how carbon monoxide would be formed.

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(2 marks)

**(c)** The use of limestone in a power station releases 'locked up carbon dioxide' into the atmosphere.

**(i)** Explain the meaning of 'locked up carbon dioxide'.

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(2 marks)

**(ii)** Why does the release of this carbon dioxide cause an environmental problem?

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(1 mark)

**Q2.** During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %. Over the last 100 years the percentage of carbon dioxide in the atmosphere has increased to about 0.04 %. Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport. Fossil fuels contain carbon that has been locked up for millions of years.

**(i)** Where did the carbon that is locked up in fossil fuels come from?

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(1 mark)

**(ii)** The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %. Explain why.

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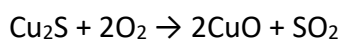
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(2 marks)

**Q3.** Copper is a widely used metal. The main ore of copper contains copper sulfide. Copper can be extracted from copper sulfide in a three stage process. In one of the stages of extraction, the copper sulfide is heated in air.



**(a)** Explain why there would be an environmental problem if the gas from this reaction were allowed to escape into the atmosphere.

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(2 marks)

**(b)** Copper-rich ores are running out. New ways of extracting copper from low grade ores are being researched. Recycling of copper may be better than extracting copper from its ores. Explain why.

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(3 marks)

**Q4.** Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

**(a)** Millions of years ago the Earth's atmosphere was probably just like that of Mars today. The table shows data about the atmospheres of Mars and Earth as they are now.

<b>Mars</b>		<b>Earth</b>	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace
carbon dioxide	95%	carbon dioxide	trace
Average surface temperature $-23^{\circ}\text{C}$		Average surface temperature $15^{\circ}\text{C}$	

Suggest what has caused the main gases in the Earth's atmosphere of millions of years ago to change to the present-day atmosphere.

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(2 marks)

**(b)** Titan is the largest moon of the planet Saturn. It has an atmosphere that, like the Earth's, contains mainly nitrogen. Methane is the other main gas.

<b>Main gases in Titan's atmosphere</b>	<b>Percentage (%)</b>	<b>Boiling point in <math>^{\circ}\text{C}</math></b>
Nitrogen	95	$-196$
Methane	5	$-164$
Average surface temperature $-178^{\circ}\text{C}$		

When it rains on Titan, it rains methane! Explain why.

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(2 marks)

**Q5.** Petrol is a hydrocarbon fuel that burns in air. Air is mainly nitrogen.

In a car engine:

- not all of the petrol burns completely
- after burning, the products pass into the exhaust pipe.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

**A** nitrogen dioxide

**B** carbon monoxide

**C** carbon dioxide

**D** soot (carbon)

The black solid seen inside the exhaust pipe is . . . **1** . . . .

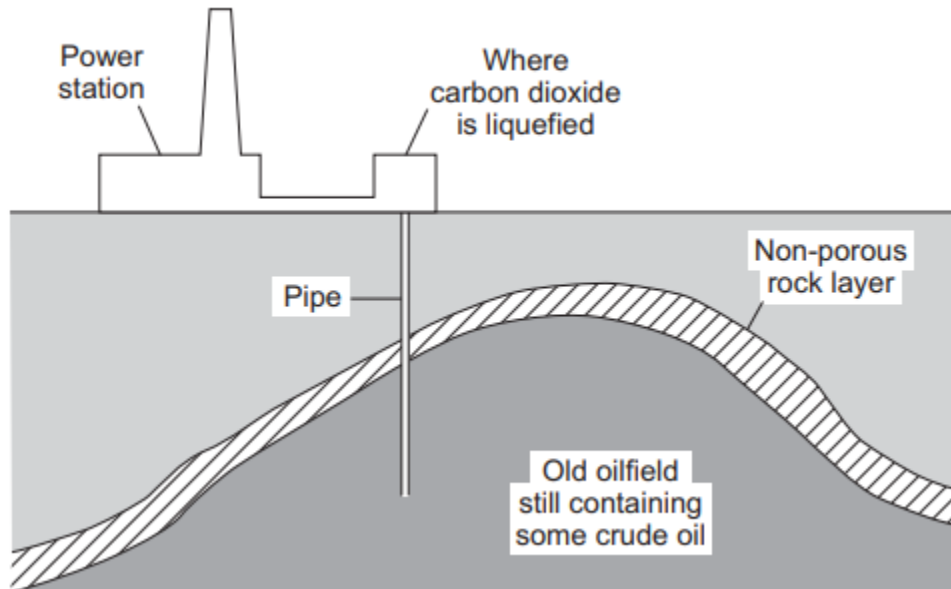
The gas in the exhaust fumes formed by the complete combustion of petrol is . . . **2** . . . .

The poisonous gas in the exhaust fumes formed by incomplete combustion of petrol is . . . **3** . . .

The gas in the exhaust fumes formed by combining two gases from the air is . . . **4** . . . .

(4 marks)

**Q6.** Carbon capture and storage (CCS) is being developed to reduce the amount of carbon dioxide released into the atmosphere by power stations. Carbon dioxide is separated from the waste gases. It is liquefied and then pumped into a storage area underground. There are many old oilfields that could be used as storage areas.



**(a)** The main reason why CCS is being developed is . . .

- 1 to reduce global warming.
- 2 because old oilfields need filling up.
- 3 because carbon dioxide is toxic.
- 4 to store carbon dioxide for future use.

**(b)** A possible additional benefit from CCS is that it . . .

- 1 stops crude oil from rising to the surface.
- 2 could help to extract any remaining crude oil.
- 3 prevents the formation of new crude oil.
- 4 stops the old oilfield from being used as a landfill site.

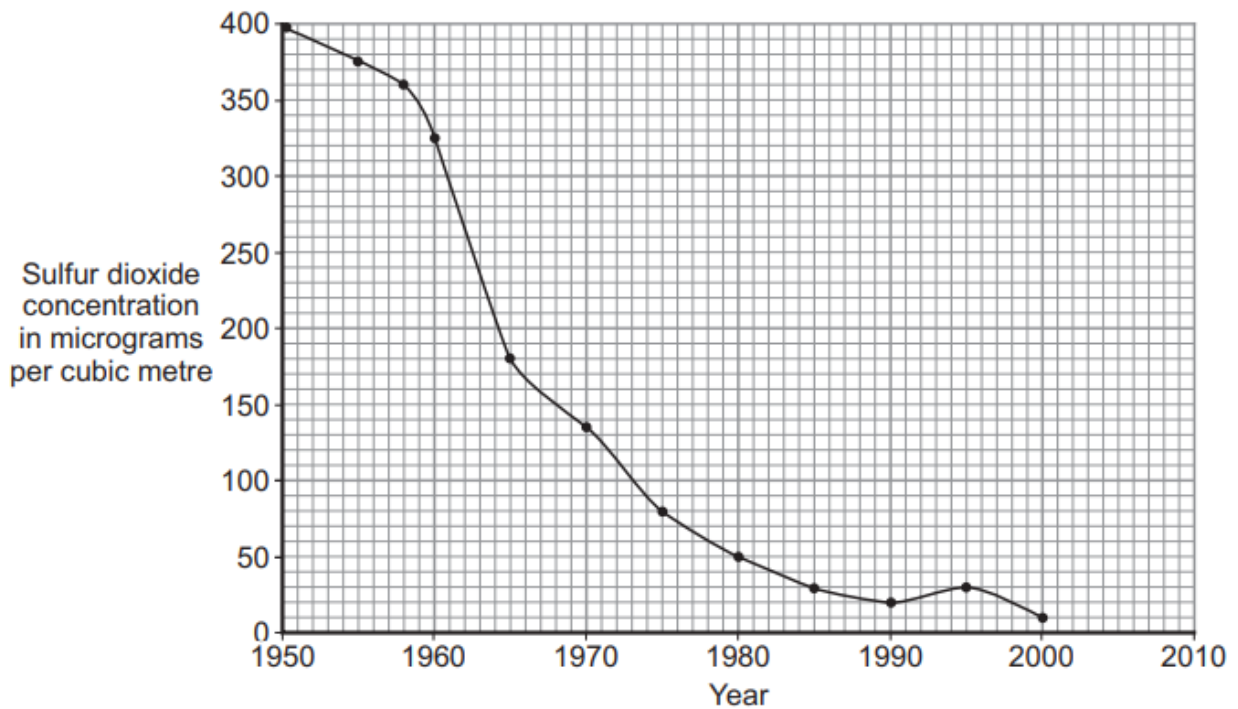
**(c)** The carbon dioxide does not re-enter the atmosphere from the old oilfield . . .

- 1 because of plants that grow deep underground.
- 2 because the pipe to the old oilfield is too narrow.

- 3 because of the non-porous rock layer.
- 4 because it turns into a fossil fuel.
- (d)** Which of the following might be a problem for CCS?
- 1 The carbon dioxide is needed in the atmosphere.
- 2 There are no old oilfields left.
- 3 Nobody will be burning fossil fuels in the near future.
- 4 Earthquakes might occur in the old oilfields.

(4 marks)

**Q7.** The graph shows how sulfur dioxide concentrations in the atmosphere above London changed between 1950 and 2000. The table shows the energy used in London in 1950 and in 2000.



Year	Energy used in arbitrary units							
	Petrol	Diesel	Electricity	Oil	House coal	Other solid fuels	Gas	Total
1950	10	5	20	25	100	110	60	330
2000	60	20	130	10	0	10	310	540

**(a)** The information in the graph and table suggests that sulfur dioxide levels have decreased due to . . .

- 1 an increase in the use of petrol.
- 2 a decrease in the use of coal and other solid fuels.
- 3 an increase in the use of electricity that is generated at coal-burning power stations.
- 4 an increase in the use of diesel.

**(b)** Which one of the following is a reason why a prediction for sulfur dioxide concentration in 2010 might be unreliable?

- 1 Sulfur dioxide has a natural cycle in London of increasing and decreasing.
- 2 Sulfur dioxide dissolves in water to produce acid rain.
- 3 The concentration of sulfur dioxide has, in previous years, both increased and decreased.
- 4 Sulfur dioxide is very difficult to measure in such small concentrations.

**(c)** It was found that the amount of sulfur dioxide from transport increased during years 2000 to 2004, even though many more cars were using low-sulfur fuels. The reason for this could be . . .

- 1 a decrease in the use of transport.
- 2 the introduction of more efficient cars that burn less fuel.
- 3 an increase in the number of cars used in London.
- 4 an increase in the price of crude oil.



**(d)** A newspaper published an article about sulfur dioxide concentrations in the atmosphere above London. It stated that in one five-year period, sulfur dioxide levels had fallen by about 44 %. The five-year period was . . .

- 1 1960 –1965.
- 2 1965 –1970.
- 3 1985 –1990.
- 4 1995 –2000.

(4 marks)

**Q8.** This question is about gases produced when a fuel burns.

Match gases, A, B, C and D, with the numbers 1– 4 in the table.

A carbon dioxide

B carbon monoxide

C sulfur dioxide

D water vapour

<b>1</b>	It is the main cause of acid rain.
<b>2</b>	It is only produced by incomplete combustion of the fuel.
<b>3</b>	It is a cause of global warming.
<b>4</b>	It is produced from hydrogen in the fuel.

(4 marks)

**Q9.** The following report appeared in a village newspaper.

**Stoneface Quarrying Company**

The company plans to re-open a limestone quarry near the village.  
The quarry has not been used for 15 years.  
There is now a large pond at the bottom of the quarry.  
The quarry is a protected habitat for wildlife.  
The pond will be filled in when work begins.  
Everyone is invited to come to a public meeting to discuss the re-opening of the quarry.

Match the outcomes of re-opening the quarry, A, B, C and D, with the numbers 1– 4 in the table.

- A will benefit the quarry owners
- B will benefit people living close to the quarry
- C will cause problems for the quarry owners
- D will cause problems for local people

(4 marks)

Total marks (39)