

1. In some remote islands, drinking water is made from sea water.

What is the name of the process for making drinking water from sea water?

- A chlorination
- B distillation
- C filtration
- D sedimentation

Your answer

[1]

2(a). Carbon dioxide is one of several greenhouse gases.

It is made by the combustion of fossil fuels such as coal, gas and oil.

Look at the table. It shows the amount of carbon dioxide produced in a large city between the years 2010 and 2016.

Source of carbon dioxide	Carbon dioxide produced (tonnes)		Percentage increase (%)
	in 2010	in 2016	
Homes	500 000	600 000	20
Factories and industry	500 000	750 000	50
Transport	1 000 000	1 000 000	0
Electricity generation	750 000	900 000

Look at the row for electricity generation.

Calculate the percentage increase of carbon dioxide produced.

Percentage increase = % [2]

(b). Analyse the data in the table.

What is the ratio of carbon dioxide produced from Homes to Electricity generation for 2016?

.....
.....
.....
..... [2]

(c). The population of the city increased between 2010 and 2016.

The carbon dioxide produced from Transport has not changed between 2010 and 2016.

Why has the carbon dioxide production from Transport remained the same?

Give **two** conclusions.

[2]

3. These statements explain how scientists think our modern-day atmosphere was formed.

- 1 Plants evolved and used carbon dioxide during photosynthesis to make oxygen.
- 2 As the Earth cooled down water fell as rain resulting in the formation of the oceans.
- 3 The atmosphere today consists of nitrogen, oxygen and a small amount of carbon dioxide.
- 4 Volcanoes gave out ammonia and carbon dioxide as well as methane and water vapour.
- 5 Ammonia was changed by bacteria in the soil into nitrogen gas.

What is the correct order that these events happened?

- A 4, 2, 5, 1, 3
- B 2, 4, 5, 3, 1
- C 4, 1, 5, 2, 3
- D 1, 4, 2, 5, 3

Your answer

[1]

4(a). Carbon dioxide is one of several greenhouse gases.

It is made by the combustion of fossil fuels such as coal, gas and oil.

Look at the table. It shows the amount of carbon dioxide produced in a large city in the years 2010 and 2016.

Between the years 2010 and 2016 the percentage increase of atmospheric carbon dioxide has been about 2.5%. During the same time, the increase in mean global temperature has been only 0.05°C.

Source of carbon dioxide	Carbon dioxide produced (tonnes)		Percentage increase (%)
	in 2010	in 2016	
Homes	500 000	600 000	20
Factories and industry	500 000	750 000	50
Transport	1 000 000	1 000 000	0
Electricity generation	750 000	900 000

Look at the row for electricity generation.

Calculate the percentage increase of carbon dioxide produced.

Percentage increase = _____ % [2]

(b). Some scientists think there is a link between the amount of fossil fuels burnt and climate change.

The data in the table does not support this view.

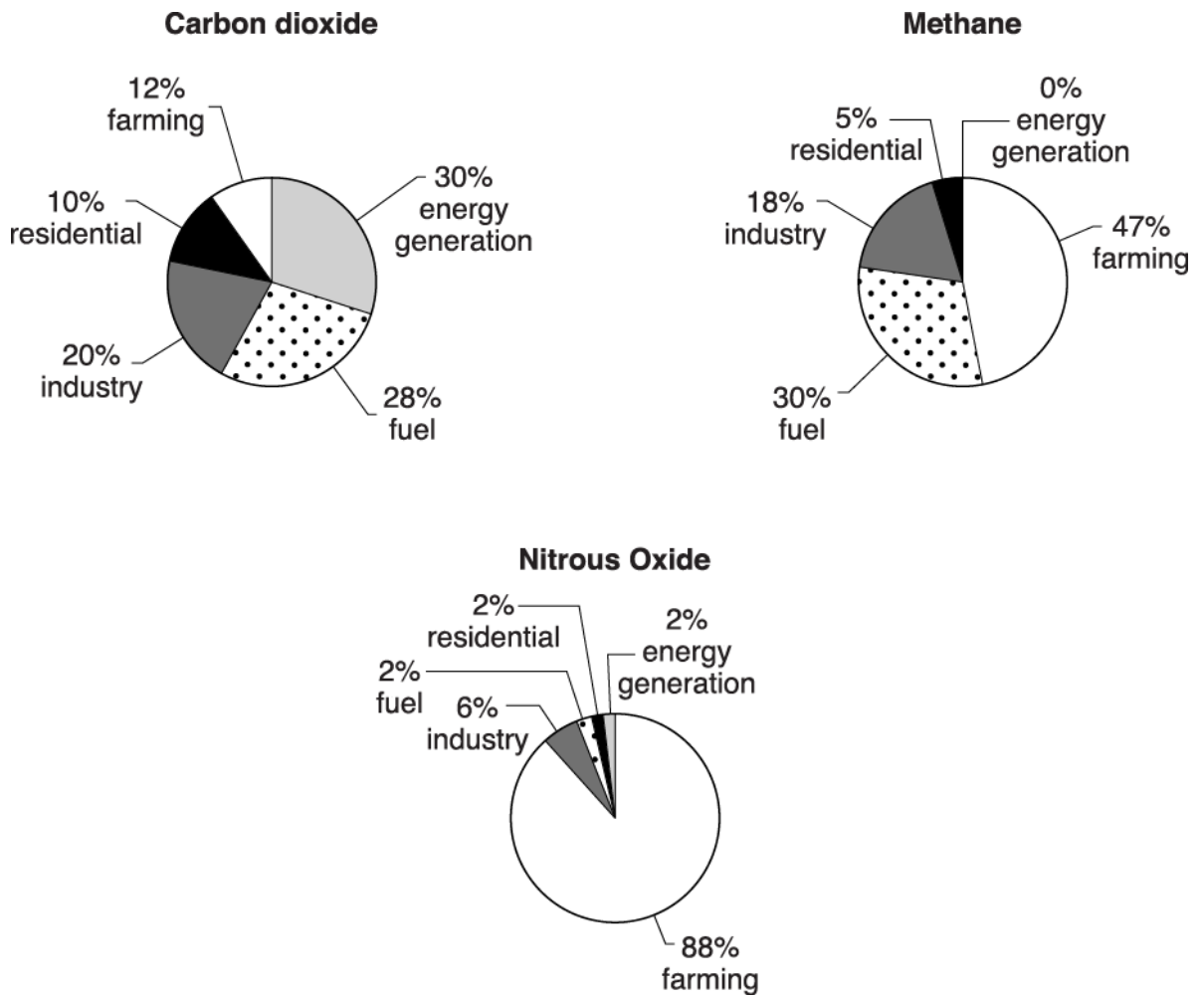
Suggest reasons why.

----- [2]

5. The use of synthetic fertilisers contributes towards the greenhouse effect.

Look at the pie charts about three greenhouse gases.

They show where these greenhouse gases come from.



Suggest which gas is most likely to be made from the use of synthetic fertilisers.

Choose from carbon dioxide, methane or nitrous oxide.

How can you tell?

[2]

6. Air contains oxygen, nitrogen and carbon dioxide.

The percentage by volume of these gases in air hardly changes.

This is because of the balance between the three processes, combustion, respiration and photosynthesis.

Write down the percentage by volume of oxygen and carbon dioxide in air.

Describe the effect of

- combustion
- respiration
- photosynthesis.

on these two percentages.



The quality of written communication will be assessed in your answer to this question.

[6]

8. This question is about fuels.

Crude oil is a fossil fuel.

Crude oil is being used up faster than it is being made.

Write about the problems this will cause in the future.

[2]

9(a). This question is about car engines.

Car engines make carbon dioxide.

Look at the table.

The table shows the amount of carbon dioxide emitted by 5 cars, A, B, C, D and E.

Car	Carbon dioxide emissions in g/km
A	109.0
B	147.3
C	98.8
D	170.6
E	91.7

Henry wants to buy a car.

Henry finds out that car tax is not paid on cars with carbon dioxide emissions lower than 100 g/km.

Henry would not have to pay car tax on some of these cars.

Which cars? Choose from A, B, C, D and E.

[1]

(b). Carbon monoxide and oxides of nitrogen are also made in a car engine.

Write about how carbon monoxide is made in a car engine, and the problems caused by carbon monoxide and oxides of nitrogen.



The quality of written communication will be assessed in your answer to this question.

[6]

10(a) The table shows information about atmospheric pollutants in some countries of the European Union.

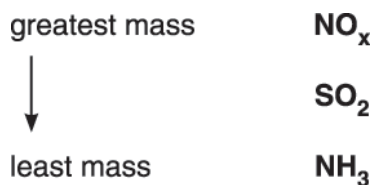
Country	Population in millions	Mass of pollutant made in kilotonnes		
		NO _x	SO ₂	NH ₃
Estonia	1.3	38	83	10
Germany	80	1323	449	548
Poland	39	867	974	271
Slovakia	5.4	89	69	24
Sweden	9.6	161	34	52
United Kingdom	64	1106	406	284
Whole of European Union	508	9200	4600	3600

(i) Look at the table. Which of these countries makes the **greatest** mass of atmospheric pollutants?

Explain your answer.

[2]

(ii) In the European Union the order from **greatest** mass to **least** mass of pollutant made is



Is this trend shown by all the countries in the table?

Explain your answer. Use information from the table.

[2]

(iii) What percentage of the total mass of NH_3 made by the European Union comes from Sweden?

percentage = _____ %

[2]

(iv) The population of Sweden is 1.9% of the population of the European Union.

Compare this percentage with your answer in part (iii).

What conclusion can you make from these results?

----- [1]

(b). This question is about air pollution.

Three atmospheric pollutants are:

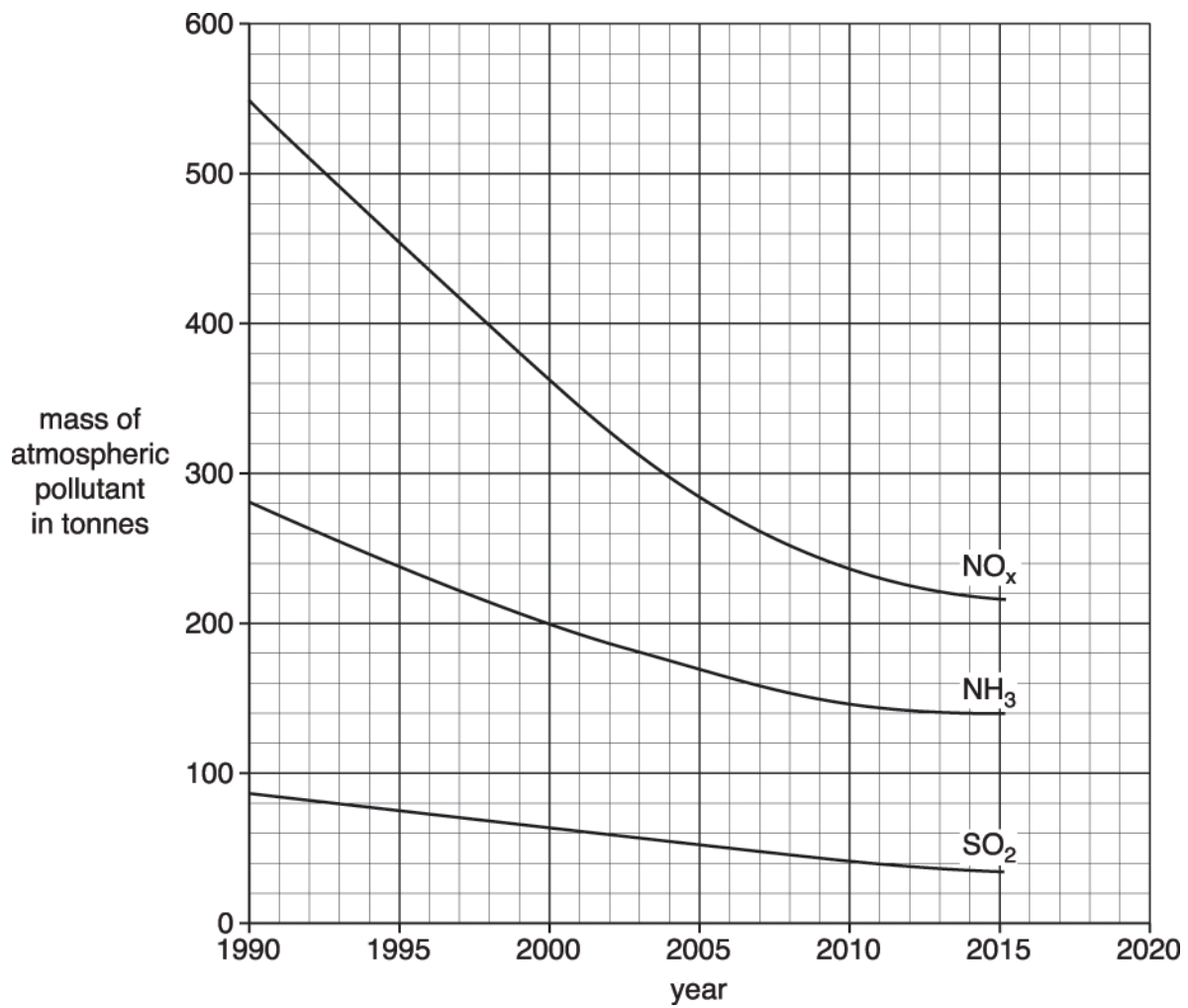
ammonia, NH_3

oxides of nitrogen, NO_x

sulfur dioxide, SO_2 .

Look at the graph.

It shows how the masses of atmospheric pollutants have changed in a city since 1990.



(i) In what year was 200 tonnes of ammonia present in the atmosphere?

[1]

(ii) Describe the general trend in the amount of atmospheric pollutants present in the atmosphere since 1990.

Suggest a reason for this trend.

[2]

11. Crude oil, coal and natural gas are fossil fuels.

These fuels are **non-renewable**.

Explain what is meant by non-renewable.

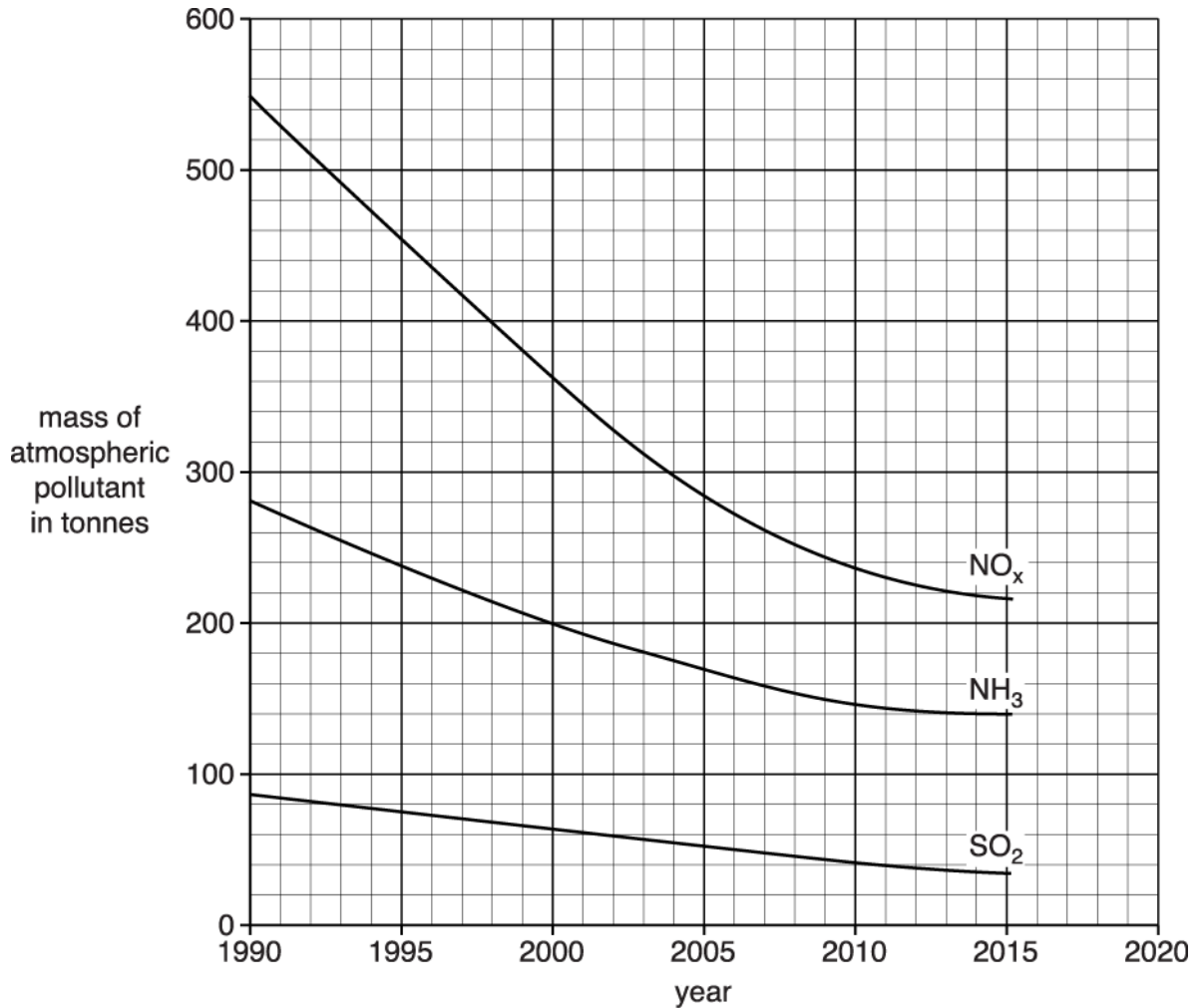
----- [2]

12(a) This question is about air pollution.

Three atmospheric pollutants are ammonia, NH_3 , oxides of nitrogen, NO_x , and sulfur dioxide, SO_2 .

Look at the graph.

It shows how the masses of atmospheric pollutants have changed in a city since 1990.



Which atmospheric pollutant showed the **greatest** change in mass between 1990 and 2000?

Explain your answer.

[2]

(b). The table shows information about atmospheric pollutants in some countries of the European Union.

Country	Population in millions	Mass of pollutant made in kilotonnes		
		NO _x	SO ₂	NH ₃
Estonia	1.3	38	83	10
Germany	80	1323	449	548
Poland	39	867	974	271
Slovakia	5.4	89	69	24
Sweden	9.6	161	34	52
United Kingdom	64	1106	406	284

Whole of European Union	508	9200	4600	3600
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(i) What percentage of the total mass of NH₃ made by the European Union comes from Sweden?

percentage = _____ %

[2]

(ii) The population of Sweden is 1.9% of the population of the European Union.

Compare this percentage with your answer in part (i).

What conclusion can you make from these results?

[1]

(iii) Across the whole of the European Union an average of 9.1 kilotonnes of SO₂ is made for every million people.

In Poland how many kilotonnes of SO₂ are made for every million people?

Give your answer to **two significant figures**.

answer = _____ kilotonnes

[2]

(iv) What conclusion can you make from your answer?

----- [1]

(v) Ann concludes that the amount of atmospheric pollutant made by a country is linked only to its population.

Nick thinks there are **other** factors involved as well.

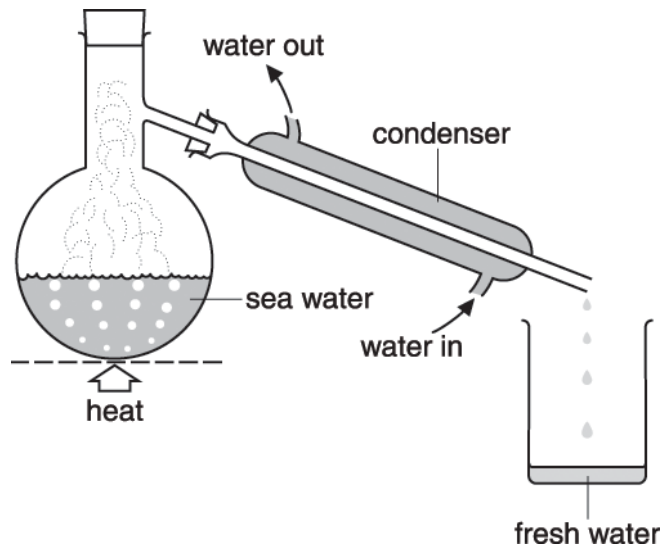
Evaluate the evidence in the table in terms of both of these conclusions.

----- [2]

13. Sea water can be made into drinking water.

One way this can be done is by **distillation**.

Look at the diagram. It shows the apparatus used to distil water in the laboratory.



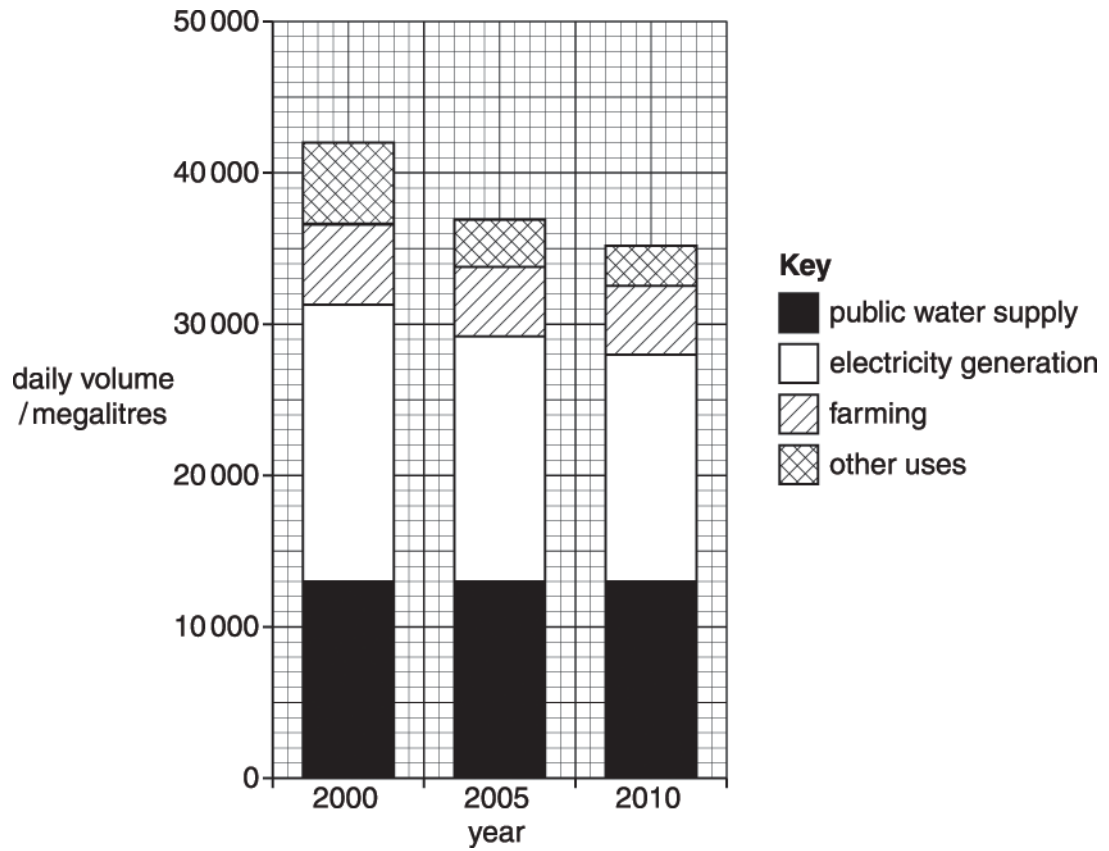
Explain the **disadvantages** of using distillation to make **large amounts** of drinking water.

[2]

14(a) Water is a very important resource in the world.

Look at the bar chart.

It shows the uses of water in the United Kingdom in the years 2000, 2005 and 2010.



(i) The volume of water used each day decreased from the year 2000 to 2010.

Suggest why there has been a **decrease**.

Use information from the bar chart.

----- [1]

(ii) Look at the data for the year 2000.

The volume of water used for **public water supply** was 13 000 megalitres.

Show that the percentage of the water used for the public water supply was 30.95%.

----- [2]

(iii) The **volume** of water used for public water supply did not change between the years 2000 and 2010.

Describe how the **percentage** of water used for the public water supply changed between the years 2000 and 2010.

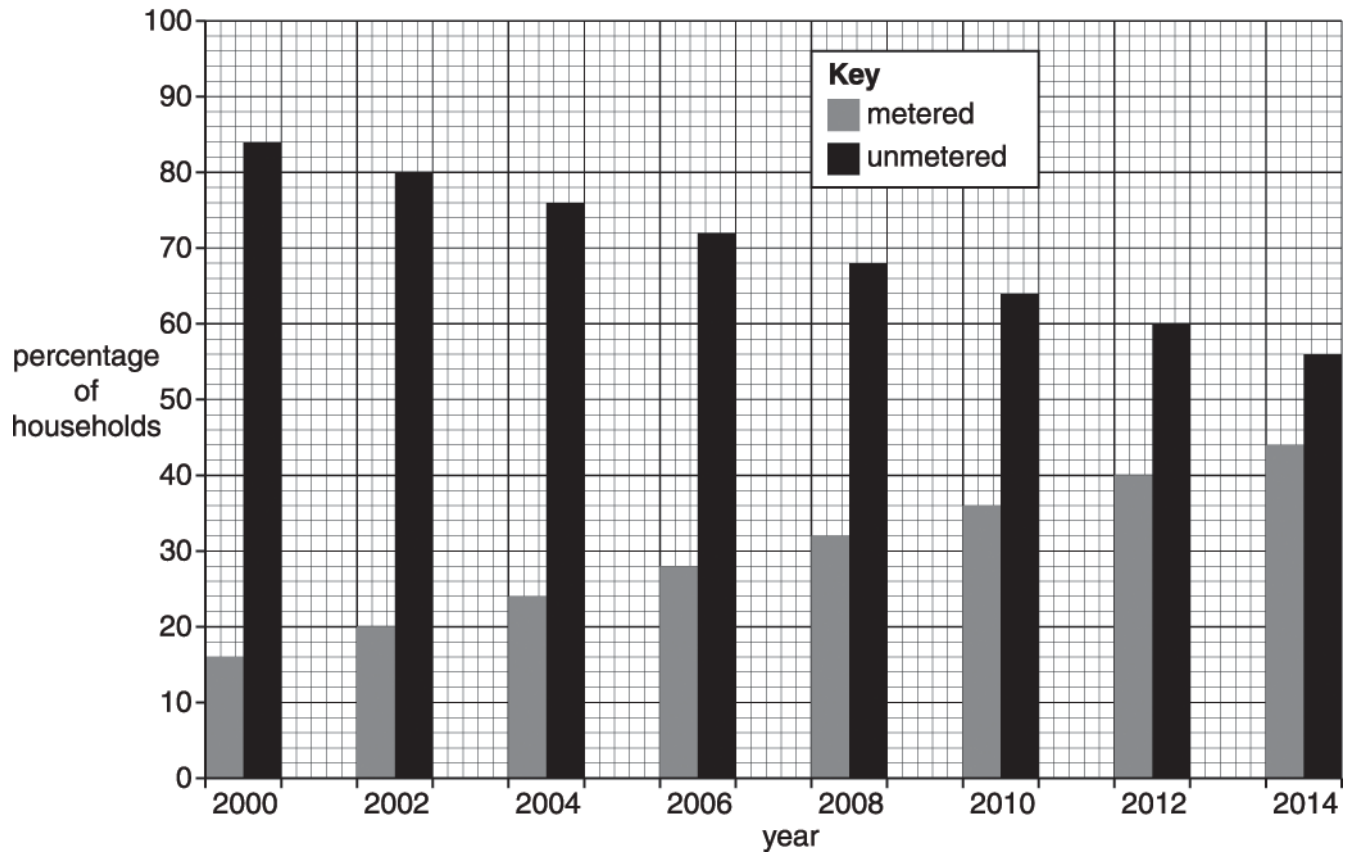
----- [1]

(b). The volume of water used for the public water supply is affected by several factors.

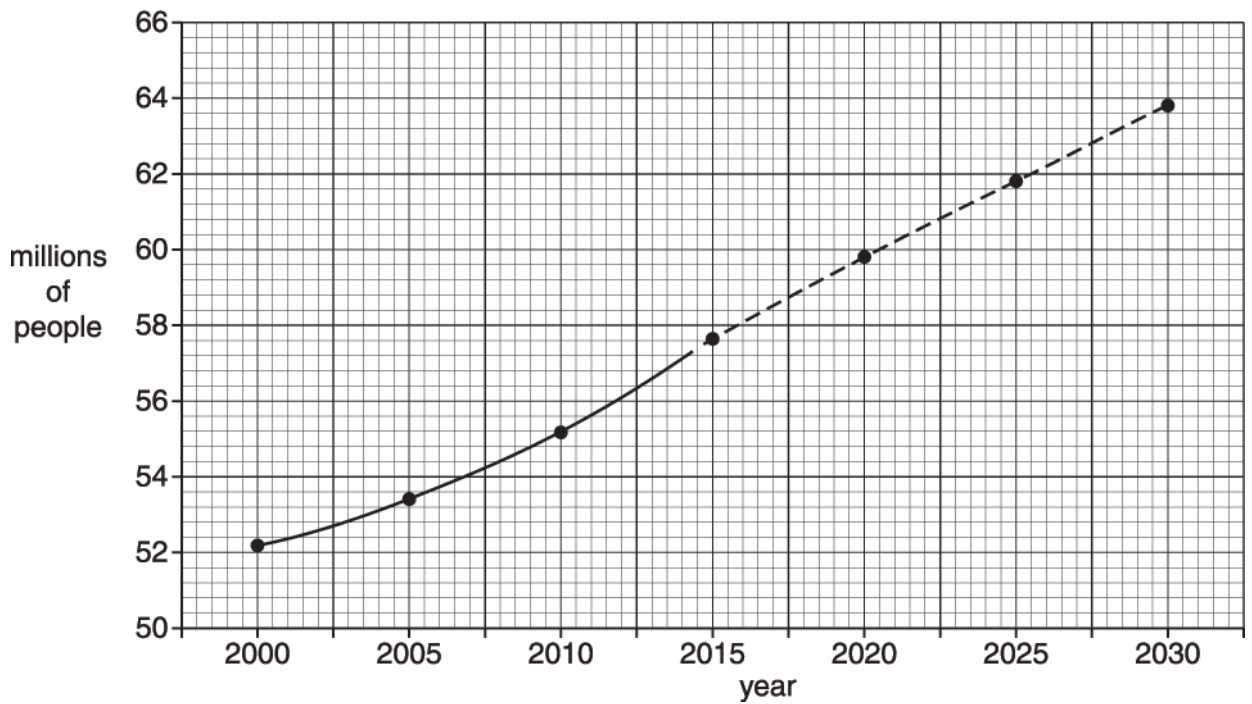
- Number of water meters fitted — people use much less water when they have a water meter fitted in their house
- Population
- Leakage of water from water pipes

Look at the information about these three factors.

Households with water meters in England and Wales 2000 to 2014



Population trends in England and Wales 2000 to 2030



Leakage of water between the years 2000 and 2014

Year	Volume of water lost each day through leakage from water pipes in megalitres
2000	3800
2002	3900
2004	3700
2006	3800
2008	3700
2010	3900
2012	4000
2014	3700

Scientists want to predict the volume of water needed for public water supply in future years.

In 2014, the volume of water needed each day was 16 000 megalitres.

Suggest the future trend in the volume of water needed for public water supply.

Explain your answer.

Use information about the three factors in your explanation.

[3]

(c). Look at the table.

It shows the volume of water available from water resources each year.

It also shows the volume of water used each year.

Country	Population in millions	Water available each year in km ³	Water used each year in km ³
Albania	4	4	3
Bangladesh	161	38	27
China	1390	634	320
Niger	15	1.3	0.8
Saudi Arabia	30	27	18
Sudan	42	20	14
United Kingdom	54	60	30
United States	297	530	171

Some countries have lots of water available per million of its population.

Other countries have very little water available per million of its population.

(i) Which country uses the greatest **percentage** of the available water?

----- [1]

(ii) Write the name of the country most likely to have a shortage of water for its population.

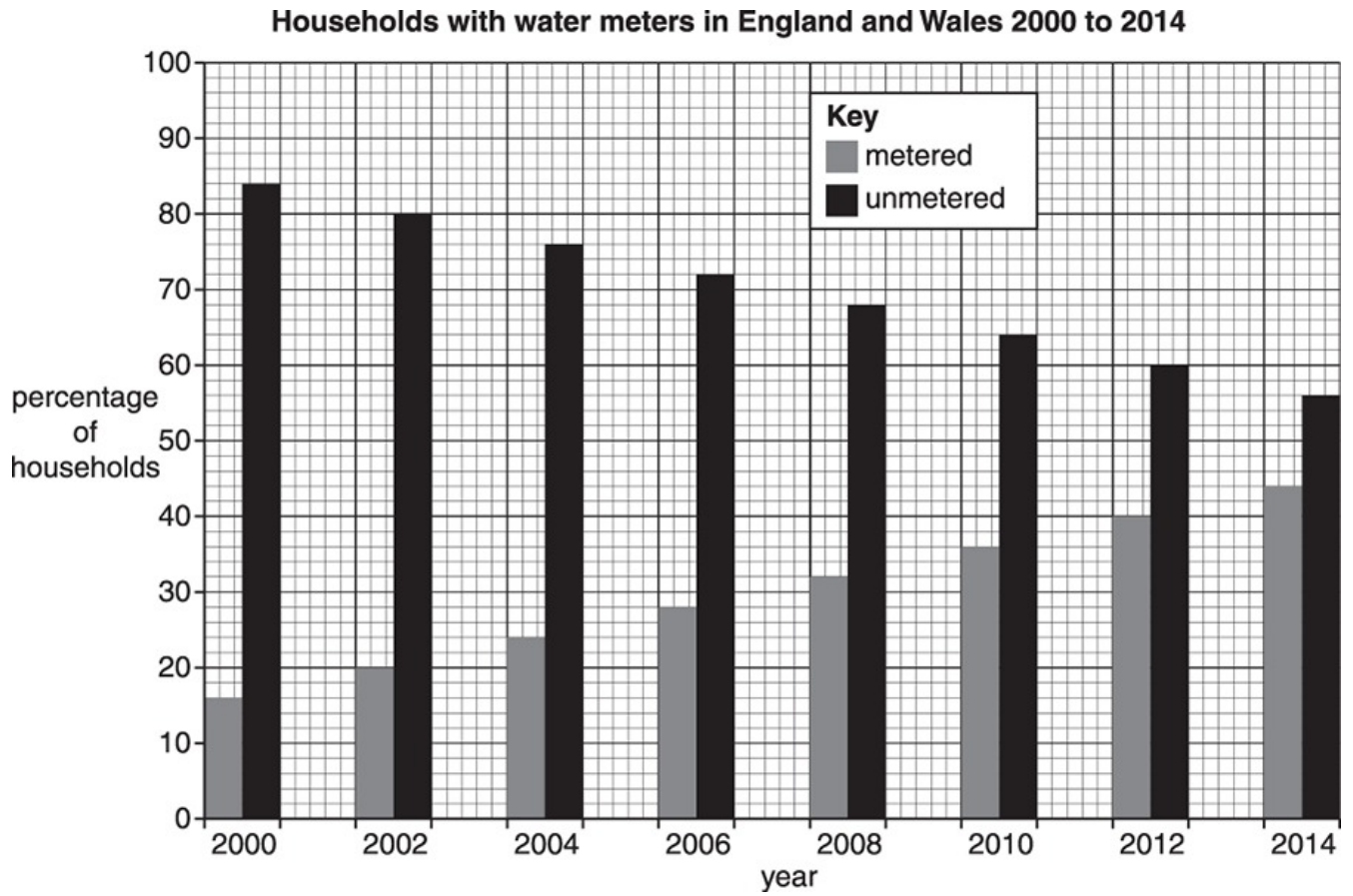
Explain your answer. Use data from the table.

----- [2]

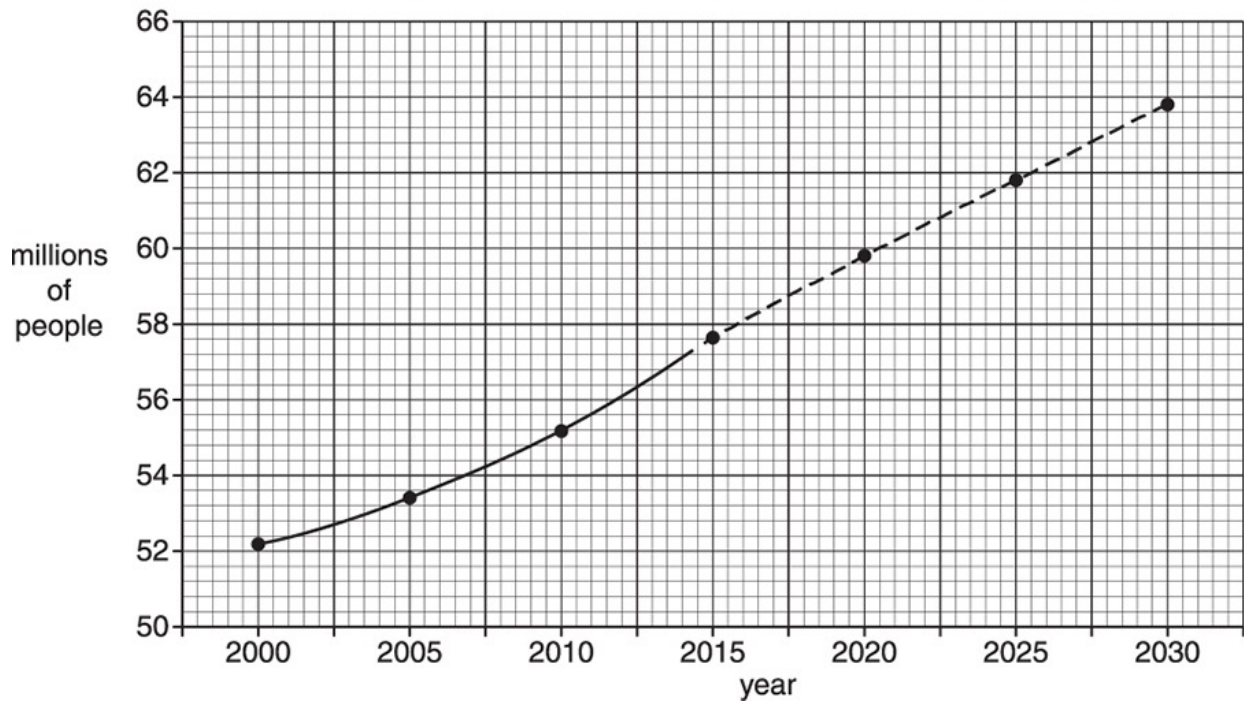
15(a) The volume of water used for public water supply is affected by several factors.

- Number of water meters fitted - people use much less water when they have a water meter fitted in their house
- Population

Look at the graphs about these two factors.



Population trends in England and Wales 2000 to 2030



Scientists predict that the volume of water needed for public water supply may not change much in the future.

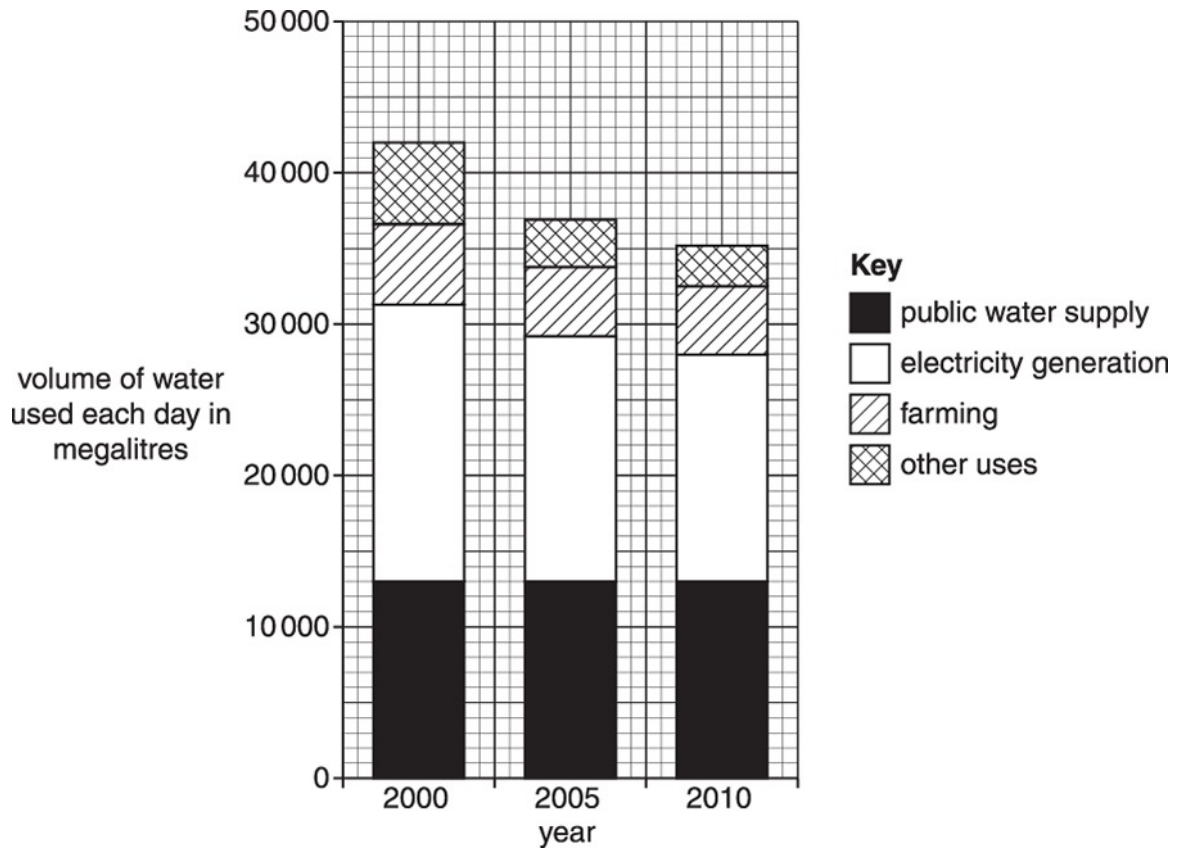
Explain how the data in the graphs support this prediction.

[3]

(b). Water is a very important resource in the United Kingdom (UK).

Look at the bar chart.

It shows the uses of water in the UK for the years 2000, 2005 and 2010.



(i) What was the **largest** use of water in the year 2000?

----- [1]

(ii) The volume of water used for public water supply did not change between the years 2000 and 2010.

Describe **three** other patterns in water use between the years 2000 and 2010.

(iii) Look at the data for the year 2000.

In the year 2000 the volume of water used each day was 42 000 megalitres.

The volume of water used each day for **public water supply** was 13 000 megalitres.

Show that the percentage of the water used for the public water supply was 30.95%.

----- [2]

(iv) The **volume** of water used for public water supply did not change between the years 2000 and 2010.

Describe how the **percentage** of water used for the public water supply changed between the years 2000 and 2010.

----- [1]

16. A power station produces nitrogen dioxide gas.

The owners need to stop the nitrogen dioxide going into the atmosphere.

They can choose two methods:

- use limestone
- use sea water.

Look at the table. It shows some information about each method.

	Limestone	Sea water
Percentage of nitrogen dioxide removed	90%	99%
Waste made	carbon dioxide and a solid waste product	none – sea water is pumped back into the sea
Cost	expensive	cheap
Availability	mined from under the ground	must be pumped in from the coast
Mass needed to remove 1 g of nitrogen dioxide	1.2 g	3000 g

The power station is 100 kilometres from the coast.

The power station makes 9000 g of nitrogen dioxide.

Which method would be more suitable for removing nitrogen dioxide from the waste gases?

Explain your answer.

[2]

17. This question is about the gases in the air.

Clean air is a mixture of gases.

Complete the table to show the percentage of gases in clean air.

Gas	Percentage
-----	78%
-----	21%
carbon dioxide	-----

[2]

18(a)



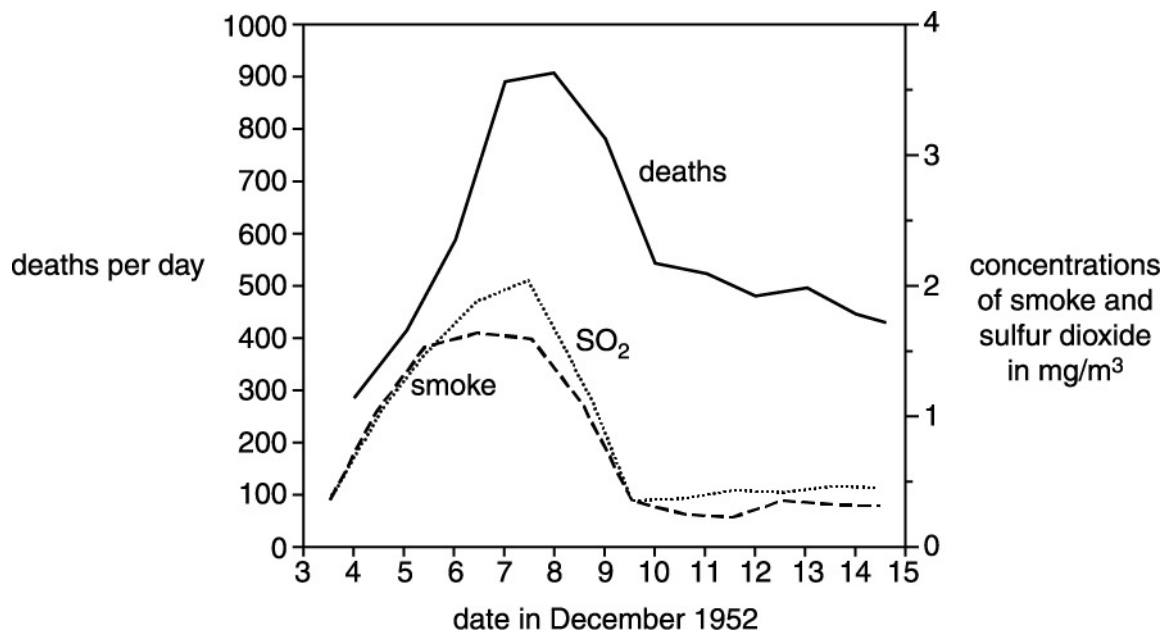
Air quality in the UK has improved over the last 60 years.

In December 1952, air pollution was so bad in London that sometimes people could not see their own feet.

Look at the graph.

It shows the number of deaths each day in London, between 3 December and 15 December 1952.

It also shows the concentrations of smoke and sulfur dioxide.



Describe the relationship between the number of deaths and the concentrations of smoke and sulfur dioxide.

----- [2]

(b). Carbon monoxide is a pollutant sometimes found in air.

Write about a **source** of carbon monoxide pollution and a **problem** caused by carbon monoxide.

----- [2]

(c). Clean air is a mixture of gases.

The gases include nitrogen, oxygen and carbon dioxide.

The percentages of these gases do not vary much.

This is because of **photosynthesis** and **respiration**.

Complete the sentences about photosynthesis and respiration.

Choose words from the list.

carbon dioxide

decreases

increases

nitrogen

oxygen

(i) Photosynthesis increases the percentage of _____ in the air and decreases the percentage of _____ .

[1]

(ii) Respiration _____ the percentage of carbon dioxide in the air and _____ the percentage of oxygen.

[1]

19.



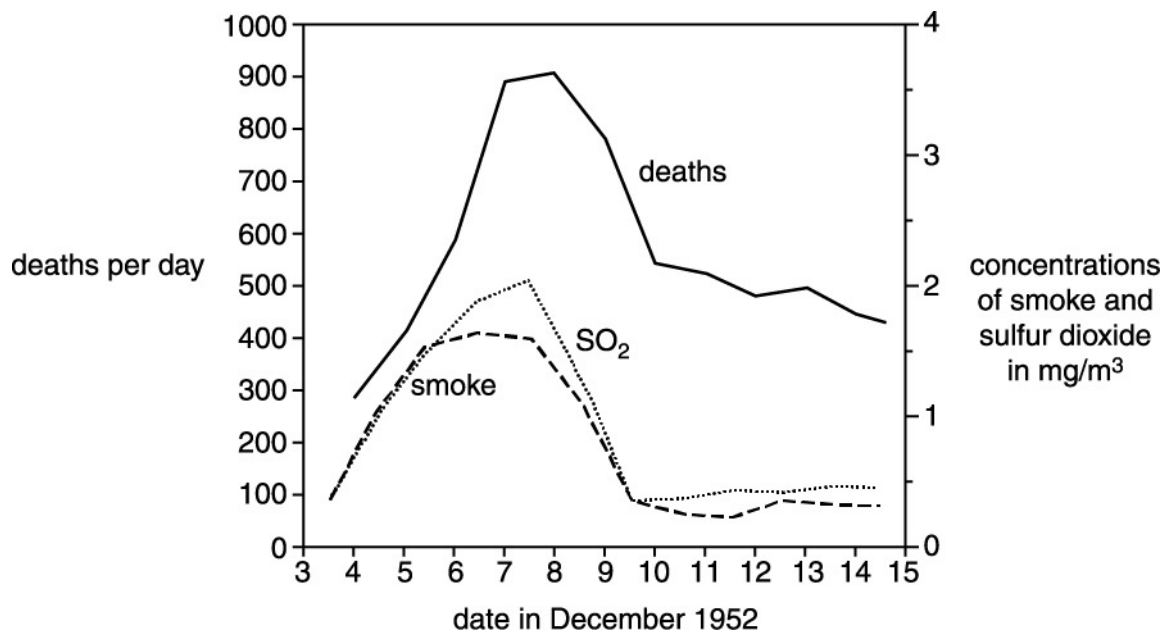
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Describe the relationship between the number of deaths and the concentrations of smoke and sulfur dioxide.

[2]

20. Sulfur dioxide causes acid rain.

Write about **two** environmental problems caused by acid rain.

[2]

21. How was the Earth's early atmosphere formed?

- A Animals breathing
- B Global warming
- C Plants growing
- D Volcanic activity

Your answer

[1]

22. Which type of water is **potable** water?

- A Groundwater
- B Seawater
- C Tap water
- D Waste water

Your answer

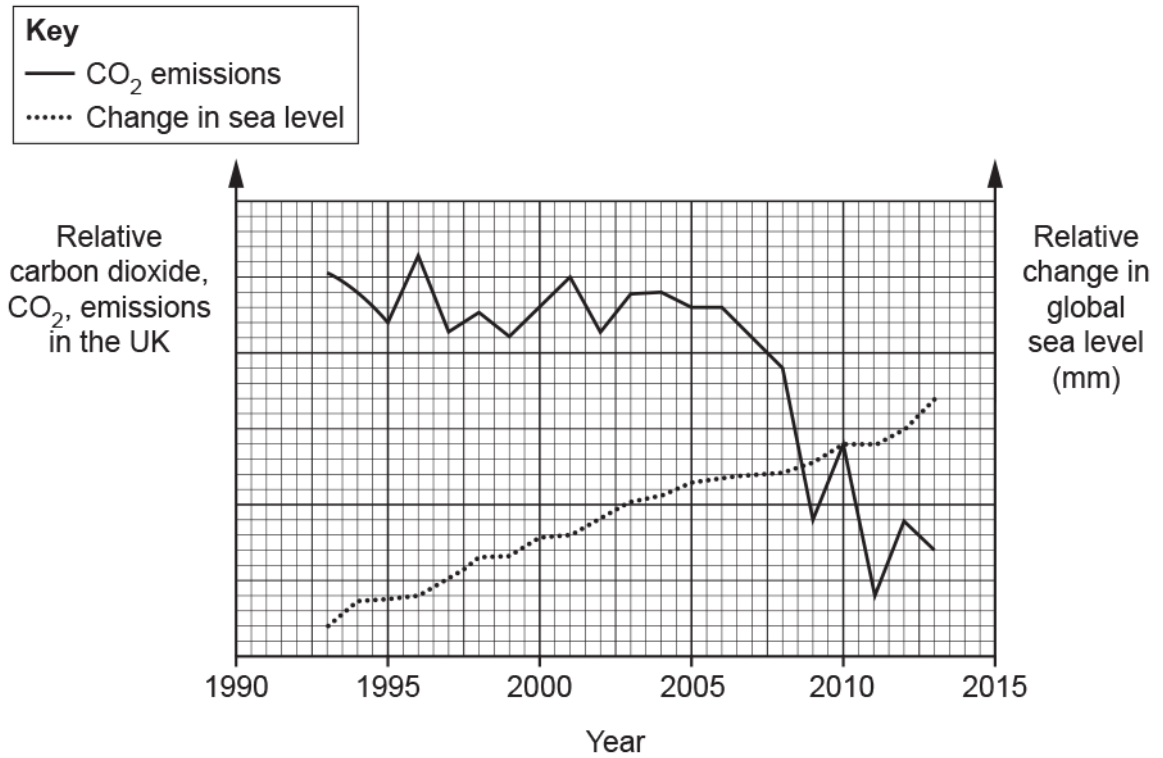
[1]

23(a) Some scientists believe that the increased burning of fossil fuels has contributed to global warming.

The scientists say that global warming is causing ice to melt, which results in sea levels rising.

Other scientists believe that rises in global temperatures are just natural variations.

The graph shows the carbon dioxide, CO₂, emissions by fossil fuels in the UK and the changes in global sea levels between 1993 and 2013.



Evaluate the information shown in the graph.

To what extent does the graph support a link between human activity and global warming?

[3]

(b). There are problems with using information about **CO₂ emissions by fossil fuels** to draw conclusions about the effect of carbon dioxide emissions on **global sea levels**.

Suggest what these problems are.

----- [2]

(c).

(i) Describe **one** effect on the Earth's climate of increased carbon dioxide levels, other than rising sea levels.

----- [1]

(ii) Suggest how we can lower carbon dioxide levels.

----- [1]

24. The table shows the composition of the Earth's early atmosphere compared with the atmosphere today.

	Nitrogen	Oxygen	Argon	Carbon dioxide
Percentage of gas in the early atmosphere	4	0.5	0.5	95
Percentage of gas in the atmosphere today	78	21	0.9	0.04

Which gas has **changed by the largest percentage** from the early atmosphere to the atmosphere today?

- A Nitrogen
- B Oxygen
- C Argon
- D Carbon dioxide

Your answer

[1]

25. Which of these pairs of gases are **both** greenhouse gases?

- A Nitrogen and methane
- B Nitrogen and oxygen
- C Water vapour and methane
- D Water vapour and oxygen

Your answer

[1]

26. Which statement about the greenhouse effect and greenhouse gases is correct?

- A Greenhouse gases absorb all the infrared radiation that is emitted by the Earth's surface.
- B The greenhouse effect is caused by the infrared radiation being absorbed and re-emitted by greenhouse gases.
- C The lower the concentration of greenhouse gases in the Earth's atmosphere, the warmer the Earth becomes.
- D Greenhouse gases are a large percentage of the Earth's current atmosphere.

Your answer

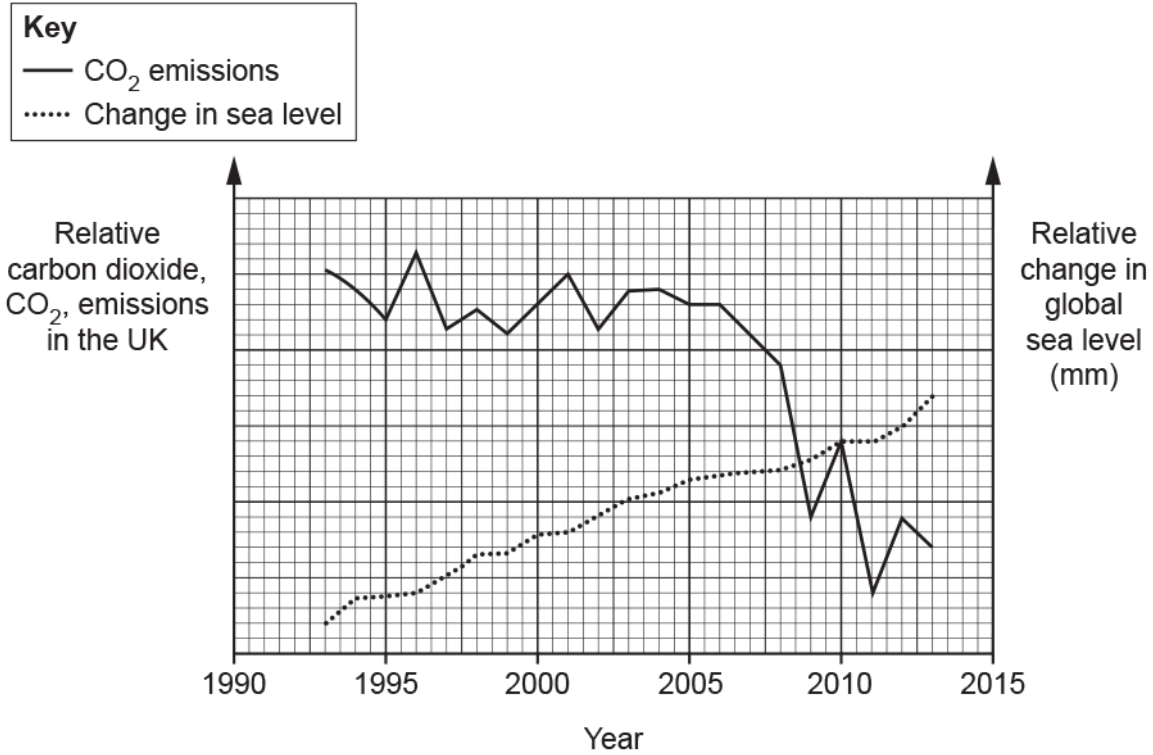
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----- [1]

END OF QUESTION PAPER


Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			B	1	
			Total	1	
2	a		$(150\,000 \div 750\,000) \times 100$ (1) 20 (1)	2	
	b		600 000:900 000 (1) 2:3 (1)	2	
	c		Any two from: Number of vehicles has not increased (1) More use of public transport / cycling / walking / car sharing (1) New cars more efficient with less carbon dioxide being produced (1) Tax lower on low emission vehicles therefore more smaller engine vehicles being used (1)	2	
			Total	6	
3			A	1	
			Total	1	
4	a		$(900\,000 \div 750\,000) \times 100 - 100$ or $((900\,000 - 750\,000) \div 750\,000) \times 100$ (1) 20 (1)	2	
	b		ANY TWO FROM Idea that insufficient data since none of the data refers to climate change or global temperature (1) Idea that the data itself is limited since it is for one city and not a global figure (1) % increase of carbon dioxide in the air is much less than increase in carbon dioxide emissions (1) Idea that the significant % increase of carbon dioxide emitted has had very little effect on the mean global temperature (1)	2	No mark for no on its own

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Total	4	
5			nitrous oxide (1) largest source from farming (1)	2	N ₂ O (1) it is 88% is not sufficient but allow 88% from farming (1) allow fertilisers contain nitrogen and this gas contains nitrogen (1) ignore just quoting numbers Examiner's Comments Most candidates correctly chose nitrous oxide and explained their choice because it is the largest source from farming.
			Total	2	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
6	<p>Level 3  States the correct percentage of both of the gases AND Describes the effect of two of these processes on the percentage of oxygen and carbon dioxide. Quality of communication does not impede communication of science at this level.</p> <p align="right">(5-6 marks)</p> <p>Level 2 States the correct percentage of both of the gases OR Describes the effect of two of the processes on the percentage of oxygen and carbon dioxide OR States the correct percentage of one of the gases And describes the effect of one of the processes on the percentage of oxygen and carbon dioxide.</p> <p>Quality of written communication partly impedes communication of the science at this level.</p> <p align="right">(3 – 4 marks)</p> <p>Level 1 States the correct percentage of one of the gases OR Describes the effect of one of the processes on the percentage of oxygen and carbon dioxide. Quality of communication impedes communication of the science at this level.</p> <p align="right">(1 – 2 marks)</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit.</p> <p align="right">(0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • Percentage of oxygen is any value between 20 and 22% • Percentage of carbon dioxide is any value between 0.03 and 0.04% • Respiration and combustion decrease percentage of oxygen and increase percentage of carbon dioxide • Photosynthesis increases percentage of oxygen and decreases percentage of carbon dioxide <p>Use the L1, L2, L3 annotations in Scoris, do not use ticks</p> <p><u>Examiner's Comments</u></p> <p>This question on carbon dioxide and oxygen in the air was used to assess the quality of written communication in a six-mark question.</p> <p>Candidates could often not recall the percentage of oxygen and of carbon dioxide in air and typically gave values for carbon dioxide in excess of 20%. However many candidates could describe the three processes combustion, photosynthesis and respiration in terms of their effect on the levels of oxygen and carbon dioxide in the air. One common misconception was to refer to breathing rather than respiration and other referred to plants breathing instead of photosynthesis.</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
			Total
6			

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
7	<p>[Level 3] Explains how photosynthesis and combustion and/or respiration keep the percentage of each gas almost constant AND explains two possible changes in the composition of the air due to increasing population. Quality of communication does not impede communication of science at this level. (5 – 6 marks)</p> <p>[Level 2] Identifies two of the three processes of photosynthesis, combustion, respiration AND explains a possible change in the composition of the air due to increasing population OR explains how photosynthesis and combustion and/or respiration keep the percentage of each gas almost constant. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Identifies two of the three processes of photosynthesis, combustion and respiration OR explains a possible change in the composition of the air due to increasing population. Quality of communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A*</p> <p>Indicative scientific points for processes may include:</p> <ul style="list-style-type: none"> • Photosynthesis increases percentage of oxygen and decreases percentage of carbon dioxide • Respiration and combustion decrease percentage of oxygen and increase percentage of carbon dioxide • Idea of a balance between respiration and/or combustion with photosynthesis <p>allow burning for combustion ignore breathing (for respiration) ignore references to nitrogen</p> <p>Indicative scientific points for change in composition may include:</p> <ul style="list-style-type: none"> • More carbon dioxide or less oxygen because more energy production using fossil fuels • More carbon dioxide or less oxygen because increase in population leads to more deforestation • More carbon dioxide or less oxygen because more transportation using fuels that burn • Increased population leads to more carbon dioxide or less oxygen due to more respiration <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks</p> <p><u>Examiner's Comments</u></p> <p>This question tested ideas about gases in the air and human influences on the atmosphere.</p> <p>This 6 mark question was targeted at all grades up to, and including, grade A* and discriminated well. At level 3 (5 ? 6 marks) all aspects of the question needed to be addressed and candidates were required to explain how photosynthesis and</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					combustion and/or respiration keep the percentage of each gas constant. They also had to explain two possible changes in the composition of the air due to increasing population. When candidates did not gain full credit it was usually because they focused on just carbon dioxide without describing how the oxygen varied, thereby limiting their marks. The use of 'carbon' instead of carbon dioxide appeared in many answers as did 'breathing' instead of respiration.
			Total	6	
8			<p>any two from: all the readily extractable resources will be used up in the future (1)</p> <p>will have to find replacements / AW (1)</p> <p>idea of not enough fuel to power vehicles or homes / make electricity / make chemicals (1)</p> <p>conflict between making petrochemicals and fuels (1)</p> <p>UK dependent on oil and gas from politically unstable countries / AW (1)</p>	2	<p>allow (all) it / oil / coal / fossil fuels will run out / be used up (1)</p> <p>allow crude oil will have to be extracted from more inaccessible areas (1)</p> <p>allow crude oil will become very expensive / may lead to rationing / may lead to conflicts (1)</p> <p>Examiner's Comments</p> <p>This question focused on crude oil.</p> <p>Many candidates were able to explain the problems of not having sufficient crude oil in the future.</p>
			Total	2	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
9	a	C and E (1)	1	<p>both required for 1 mark</p> <p>Examiner's Comments</p> <p>This question was well-answered, with most candidates correctly identifying both cars.</p>
	b	<p>Level 3 (5–6 marks) Candidates recall that carbon monoxide is made by incomplete combustion or when there is not enough oxygen supplied to the fuel AND recognises a problem of both carbon monoxide AND of oxides of nitrogen. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Candidates recall that carbon monoxide is made by incomplete combustion / when there is not enough oxygen supplied to the fuel AND recognises a problem of carbon monoxide OR of oxides of nitrogen. Quality of written communication partly impedes communication of science at this level.</p> <p>Level 1 (1–2 marks) States that carbon monoxide is made from burning petrol / fuel in a car engine OR gives a problem caused by carbon monoxide OR gives a problem caused by oxides of nitrogen. Quality of written communication impedes communication of science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to grade E</p> <p>Relevant points at levels 2 and 3 may include:</p> <ul style="list-style-type: none"> • carbon monoxide is made by incomplete combustion or when there is not enough oxygen supplied to the fuel <p>AND</p> <ul style="list-style-type: none"> • carbon monoxide is poisonous • carbon monoxide can kill humans <p>AND</p> <ul style="list-style-type: none"> • oxides of nitrogen cause photochemical smog • oxides of nitrogen cause acid rain • acid rain kills plants, kills aquatic life, erodes stonework and corrodes metals • oxides of nitrogen or smog causes respiratory problems e.g. asthma <p>allow level 2 (3 marks) if answer includes correct problems of both carbon monoxide and oxides of nitrogen but no reference to incomplete combustion.</p> <p>Relevant points at level 1 may include:</p> <ul style="list-style-type: none"> • carbon monoxide and /or oxides of nitrogen made when fuel / petrol / diesel burn • carbon monoxide is poisonous • carbon monoxide can kill humans • oxides of nitrogen cause photochemical smog • oxides of nitrogen cause acid rain

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					<p>Use the L1, L2 and L3 annotations in scoris; do not use ticks</p> <p>Examiner's Comments</p> <p>This question was marked using a level of response approach. Most candidates stated that petrol burned in a car engine or that carbon monoxide was poisonous, thereby accessing Level 1. Level 2 required candidates to recall that incomplete combustion takes place and to give a problem associated with carbon monoxide or oxides of nitrogen. In addition, at Level 3 candidates needed to quote a problem associated with both carbon monoxide and oxides of nitrogen. Level 3 was only achieved by the best candidates.</p>
			Total	7	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
10	a	i	Germany (1) 2320 tonnes (is the greatest) (1)	2	<p>allow when all added together Germany is the most (1) allow Germany has the largest population / Germany is the most industrialised (1)</p> <p><u>Examiner's Comments</u></p> <p>Most candidates correctly identified Germany with many calculating the mass as 2320 tonnes or suggesting that Germany had the largest population.</p>
		ii	<p>No any two from:</p> <p>In Germany NH₃ bigger than SO₂ (1)</p> <p>In Sweden NH₃ bigger than SO₂ (1)</p> <p>In Estonia SO₂ is the highest value / SO₂ is higher than NO_x (1)</p> <p>In Poland SO₂ bigger than NO_x (1)</p>	2	<p>No marks for no on its own. Marks are for the explanations</p> <p>allow only Slovakia and UK show this pattern (1)</p> <p><u>Examiner's Comments</u></p> <p>Part (ii) was less well answered. Better candidates usually scored both marks because they detailed those countries that did not match the trend and explained why, often quoting amounts from the table. Weaker candidates lacked the precision required in their answers.</p>
		iii	$\frac{52}{3600} \times 100$ <p>(1)</p> <p>1.44 (%) (1)</p>	2	<p>FIRST LOOK AT ANSWER IF ANSWER = 1.44 or 1.4 AWARD 2 MARKS</p> <p>do not allow 1 / 1.45</p> <p><u>Examiner's Comments</u></p> <p>In part (iii) only about a third of candidates performed the calculation correctly. Often incorrect values were selected from the table. Part (iii) was common with the higher tier. The comparison between the two percentages was often vague or candidates stated that the percentage of the population and the percentage of ammonia were similar which was insufficient to score.</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iv	Other countries make more than their share (of ammonia) / Sweden makes less (ammonia) than expected / Sweden makes less (ammonia) per million of population (1)	1	<p>allow Sweden has better anti-pollution laws</p> <p>ignore values are roughly the same</p> <p>allow Sweden makes less than average</p> <p>allow ecf from percentage above 1.9% in (i)</p> <p><u>Examiner's Comments</u></p> <p>Most candidates found part (iv) difficult. Part (iv) was common with the higher tier.</p>
	b	i	2000 (1)	1	<p><u>Examiner's Comments??</u></p> <p>This was the best answered question on the paper with very many candidates correctly interpreting the graph to state 2000.</p>
		ii	<p>decreases / gets smaller / gets less (1)</p> <p>better pollution controls / introduction of limits to amount of pollution (1)</p>	2	<p>allow use of catalytic converters on cars / less cars (on the road) (1)</p> <p>allow new machinery producing less pollution (1)</p> <p>allow less industrial output / reduction in population / change in fuels used (1)</p> <p>allow more renewable energy sources used (1)</p> <p>allow factories have moved elsewhere</p> <p>allow greater public awareness (1)</p> <p>allow government initiatives (1)</p> <p><u>Examiner's Comments</u></p> <p>Most candidates correctly identified the trend but fewer could suggest an acceptable reason. The most common suggestions revolved around increased public awareness.</p>
			Total	10	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
11		<p>takes a long time to form (1)</p> <p>are used up faster than they are formed or cannot be made again or finite (1)</p>	2	<p>allow takes (many) years to form or thousands or millions of years to form (1)</p> <p>ignore takes hundreds of years to form</p> <p>allow once it's gone, its gone / can't be replaced (1)</p> <p>ignore cannot be used again</p> <p>allow runs out eventually / will run out of fossil fuels or named fossil fuel e.g.coal (1)</p> <p>Examiner's Comments</p> <p>Most candidates scored 1 mark, usually for the idea that non-renewable fuels are finite. Fewer gained the second mark for taking a long time to form. The main error was candidates who stated 'it can't be used again'.</p>
		Total	2	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
12	a	<p>NO_x (1)</p> <p>greatest (negative) gradient (1)</p>	2	<p>The second marking point is dependent on the correct pollutant</p> <p>allow greatest (negative) slope / steepest graph</p> <p>allow correct comparison of mass change shown by quoting values e.g. 190, 80 and 20 (within ±1 square)</p> <p>has greatest change in mass is not sufficient unless supported by data – one piece of data is sufficient</p> <p><u>?Examiner's Comments??</u></p> <p>Many candidates recognised that the oxides of nitrogen showed the greatest change in mass between 1990 and 2000. To get full marks candidates had to support this answer with data taken from the graph. Many candidates stated that the graph was steeper here or gave the actual value of the decrease (190 tonnes). Some candidates used data from the whole of the graph from 1990 to 2015 rather than from the period asked for in the question.</p>
	b	i	2	<p>FIRST LOOK AT ANSWER IF ANSWER = 1.44 or 1.4 AWARD 2 MARKS</p> <p>do not allow 1 / 1.45</p> <p><u>Examiner's Comments</u></p> <p>Many candidates could calculate the percentage as 1.44% but were not always able to explain its significance.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	ii	Other countries make more than their share (of ammonia) / Sweden makes less (ammonia) than expected / Sweden makes less (ammonia) per million of population (1)	1	<p>allow Sweden has better anti-pollution laws</p> <p>ignore values are roughly the same</p> <p>allow Sweden makes less than average</p> <p>allow ecf from percentage above 1.9% in (b)(i)</p> <p><u>Examiner's Comments</u></p> <p>Many candidates could calculate the percentage as 1.44% but were not always able to explain its significance. Candidates were expected to state that Sweden makes less ammonia that would have been expected from the EU average.</p>
	iii	<p>FIRST LOOK AT ANSWER IF ANSWER = 25 AWARD 2 MARKS</p> <p style="font-size: 1.5em; margin-left: 20px;">974</p> <hr style="width: 50px; margin-left: 20px;"/> <p style="font-size: 1.5em; margin-left: 20px;">39 (1)</p> <p>25 (1)</p>	2	<p>allow 24.974 correctly rounded up for the first mark</p> <p><u>Examiner's Comments</u></p> <p>Many candidates could calculate the mass of sulfur dioxide per million of population made in Poland as 25 tonnes. Some candidates ignored the comment in the stem about quoting the answer to 2 significant figures. Candidates in.</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iv	Poland makes more (sulfur dioxide) than expected / Poland makes more (sulfur dioxide) than the average / Poland makes more (sulfur dioxide) per million of population (1)	1	<p>allow Poland uses a fuel that makes lots of sulfur dioxide allow fewer pollution control laws in Poland / Poland cannot afford (modern) pollution controls allow some countries produce less than the average</p> <p>allow pollution instead of sulfur dioxide</p> <p>allow ecf from (b)(iii) if below 9.1</p> <p><u>Examiner's Comments</u></p> <p>Many candidates were not always able to explain the significance of this answer in terms of Poland making more sulfur dioxide than expected from the EU average. Candidates often just mentioned that Poland made lots of pollution.</p>
		v	<p>Quotes some evidence that indicates a higher population gives more pollutants / ora e.g. Germany has a higher population than Estonia and makes more pollutants (1)</p> <p>Quotes some evidence that indicates a higher population gives less pollutants / ora e.g. UK has a higher population than Poland and makes less pollutants (1)</p>	2	<p>The data quoted must be able to be checked to see if it is correct and not ambiguous</p> <p>allow the higher populated countries like Germany Poland and the UK produces a lot more pollution</p> <p><u>Examiner's Comments</u></p> <p>Many candidates made general comments in (v) without quoting any data from the table to support each of the two statements. The best answers chose countries and compared population and amount of pollutants for example Estonia has a smaller population than Sweden but makes more sulfur dioxide.</p>
			Total	10	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
13		large energy requirement (1) expensive (1)	2	allow heat for energy allow high cost of equipment allow issues related to scaling up / needs lots of water (1) ignore takes a long time <u>?Examiner's Comments??</u> Candidates often mentioned the idea that distillation requires lots of energy and as a result that the purification of sea water would be expensive. Candidates often repeated the information in the stem of the question in terms of using a large amount of water.
		Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
14	a	i	<p>any one from</p> <p>less used for in electricity generation (1)</p> <p>less used for other uses (1)</p> <p>less used for farming (1)</p>	1	<p>allow new ways to generate electricity that do not use water</p> <p>allow less demand for rather than less used for</p> <p>fewer farmers or less farming is not sufficient</p> <p>Examiner's Comments</p> <p>Most candidates appreciated from the bar chart that less water was being used for electricity generation. Some candidates mentioned the increase in use of methods to generate electricity that did not use water such as solar power or wind turbine.</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
ii	$\text{percentage} = \frac{\text{volume for public water supply}}{\text{total volume}} \times 100$ <p>(1)</p> <p>but</p> $\frac{13000}{42000} \times 100(2)$	2	$\frac{13000}{42000} = 0.3095(1)$ <p>allow</p> <p>0.3095 x 100 (1)</p> <p>No mark for 30.95%</p> <p>allow ecf from wrong interpretation of bar charts for the first mark</p> <p>allow alternative approaches for example showing that 30.95% of 42000 is 13000 i.e. 30.95 divided by 100 (1) and then 0.3095 x 42000 (1)</p> <p>Examiner's Comments</p> <p>Candidates often showed clearly the working out of the required calculation. Almost all candidates could interpret the bar chart to appreciate that the total daily volume of water was 42000 megalitres. Most candidates showed that 13000 was 30.95% of 42000, however some candidates showed that 30.95% of 42000 was 12999 (13000) instead. Centres must advise candidates that in calculations such as these the marks are awarded for the working out, and so all the working out has to be fully shown.</p>
iii	increase (1)	1	<p>allow went to 37.14 (%)</p> <p>Examiner's Comments</p> <p>Some candidates did a second calculation to work out the percentage of water used for public water supply and therefore show that it had increased. Other candidates used a more qualitative approach in terms of the volume of water used for public water supply being constant but the total decreasing.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b	<p>prediction made</p> <p>water meters increases (so less water used) (1)</p> <p>population increases so more water used (1)</p> <p>water leakage has not changed so no effect (1)</p>	3	<p>no marks for the prediction but without a prediction maximum two marks</p> <p>Examiner's Comments</p> <p>Candidates were often able to use the data provided to make a comment about the volume of water needed for public water supply in terms of the population increase, number of water meters and the amount of water loss. Candidates found the data about water loss the most difficult to interpret because it did not really change. The question asked for a prediction and many candidates did not make an overall prediction and so were not awarded full marks.</p>
	c	i	1	<p>Examiner's Comments</p> <p>Many candidates chose Albania.</p>
		ii	2	<p>Allow high population but very little water</p> <p>A population of 15 million is not sufficient Has the most population to share the water is not sufficient</p> <p>Examiner's Comments</p> <p>Candidates chose a variety of different countries including the United States, China and Bangladesh even though the data only supported one country namely Niger. The best explanations compared the amount of water available with the population and found that Niger had the smallest amount of water available per person.</p>
		Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15	a		<p>water meters increases (so less water used) (1)</p> <p>population increases (so more water used) (1)</p> <p>idea of a balance between more and less water being used (1)</p>	3	<p>Examiner's Comments</p> <p>This question required candidates to process information from two graphs and use it to support a prediction. Most candidates identified that the number of homes with water meters was increasing and that the population was rising. Only a few candidates could make the final step to say that these two changes would balance each other out for the third mark.</p>
	b	i	<p>electricity generation (1)</p>	1	<p>Examiner's Comments</p> <p>Most candidates could correctly identify electricity generation in part (i).</p>
		ii	<p>any three from:</p> <p>decrease in total water usage (1)</p> <p>decrease in use for electricity generation (1)</p> <p>decrease in amount used for farming (1)</p> <p>other uses decreases (1)</p>	3	<p>allow (virtually) no change in use for farming (1)</p> <p>Examiner's Comments</p> <p>They also correctly interpreted the data to recognise three other patterns.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	iii	$\frac{13000}{42000} \times 100 \text{ (2)}$ <p>but if incorrect then</p> $\text{percentage} = \frac{\text{volume for public water supply}}{\text{total volume}} \times 100$	2	<p>allow $\frac{13000}{42000} = 0.3095 \text{ (1)}$</p> <p>allow $\frac{13}{42} \times 100 \text{ (1)}$</p> <p>0.3095 x 100 (1)</p> <p>No mark for 30.95%</p> <p>Examiner's Comments</p> <p>This part was more challenging, but was well answered by better candidates. Occasionally the number of zeroes involved proved a stumbling block for some candidates who often then attempted to manipulate the answer to 30.95%.</p>
	iv	increase (1)	1	<p>allow went to 37.14 (%)</p> <p>Examiner's Comments</p> <p>About a third of candidates correctly identified an increase. Many stated that the percentage did not change, presumably because the question states that the volume does not change, failing to recognise that the total volume used had fallen.</p>
		Total	10	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance								
16		<p>(sea water because) any two from: removes more of the pollutant / removes 9% more of nitrogen dioxide / 99% of nitrogen dioxide removed (1) does not form a waste product (1) cheap(er) (1) readily available (near the coast) (1)</p> <p>OR</p> <p>(limestone because) idea of does not have to be pumped (a long way) from the sea (1) need less mass of material (1)</p>	2	<p>No marks for sea water or for limestone - the marks are for the explanation</p> <p>allow does not produce waste (1)</p> <p>allow only a small amount needed (1)</p> <p>Examiner's Comments</p> <p>Good responses to this question displayed an ability to interpret the data about limestone and sea water and decide, with reasons, which method would be more suitable for removing nitrogen dioxide from the waste gases of the power station. The mark scheme allowed candidates to choose either limestone or sea water, provided their choice was clearly justified.</p>								
		Total	2									
17		<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">gas</td> <td style="width: 50%;">percentage</td> </tr> <tr> <td>nitrogen</td> <td>(78%)</td> </tr> <tr> <td>oxygen</td> <td>(21%)</td> </tr> <tr> <td>(carbon dioxide)</td> <td>0.035%</td> </tr> </table> <p>all three correct (2) but one or two correct (1)</p>	gas	percentage	nitrogen	(78%)	oxygen	(21%)	(carbon dioxide)	0.035%	2	<p>allow carbon dioxide between 0.03 and 0.04%</p> <p>Examiner's Comments</p> <p>Most candidates correctly identified nitrogen and oxygen as the missing gases in the table. When candidates did not gain full marks it was usually because they failed to correctly recall the percentage of carbon dioxide in the air. 1%, being the difference between the percentages quoted and 100%, was a common error.</p>
gas	percentage											
nitrogen	(78%)											
oxygen	(21%)											
(carbon dioxide)	0.035%											
		Total	2									

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance	
18	a	<p>as (the concentration of) smoke increased, the number of deaths increased / ora (1)</p> <p>as (the concentration of) sulfur dioxide increased, the number of deaths increased / ora (1)</p>	2	<p>allow as concentration increases deaths increase (1)</p> <p>allow idea that graphs have the same shape (1)</p> <p>allow the higher the (concentrations of) smoke and sulfur dioxide, the more deaths (per day) (2)</p> <p>Examiner's Comments</p> <p>Very well answered although some candidates only scored one mark as they forgot to mention both smoke and sulfur dioxide.</p>	
	b	<p>(carbon monoxide is formed by) incomplete combustion (of petrol or diesel in car engines) (1)</p> <p>(carbon monoxide is a problem because) it is poisonous (1)</p>	2	<p>allow it is toxic</p> <p>ignore it is harmful</p> <p>ignore it will kill you</p> <p>Examiner's Comments</p> <p>Candidates knew that carbon monoxide was poisonous but few knew that it is made during incomplete combustion. The most prevalent answer referred to cars as being the source of carbon monoxide.</p>	
	c	i	oxygen carbon dioxide (1)	1	<p>both required for the mark</p> <p>Examiner's Comments</p> <p>Was well answered.</p>
		ii	increases decreases (1)	1	<p>both required for the mark</p> <p>Examiner's Comments</p> <p>Was well answered.</p>
Total			6		

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
19		<p>as (the concentration of) smoke increased, the number of deaths increased / ora (1)</p> <p>as (the concentration of) sulfur dioxide increased, the number of deaths increased / ora (1)</p>	2	<p>allow as concentration increases deaths increase (1)</p> <p>allow idea that graphs have the same shape (1)</p> <p>allow the higher the (concentrations of) smoke and sulfur dioxide, the more deaths (per day) (2)</p> <p>Examiner's Comments</p> <p>This question was well answered with candidates able to correctly interpret the graph and describe the relationship between the number of deaths and the concentrations of smoke and sulfur dioxide.</p>
		Total	2	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
20		<p>any two from:</p> <p>corrodes metals / rusts iron / rusts (ferrous) metals (1)</p> <p>reacts with marble or limestone (statues) (1)</p> <p>damages statues / damages buildings / erodes stonework / AW (1)</p> <p>kills plants / damages trees / can damage crops (1)</p> <p>kills (aquatic) animals / destroys animal habitats (1)</p> <p>increases amount of heavy metal ions in water / increases concentration of aluminium in water (1)</p>	2	<p>not rusts aluminium or other non-ferrous metals</p> <p>allow erodes or dissolves rocks such as limestone and chalk</p> <p>allow dissolves buildings allow corrodes buildings</p> <p>allow deforestation allow harms plants</p> <p>allow harms animals pollutes the environment or habitats is not sufficient</p> <p>allow causes or triggers asthma</p> <p>not damages the ozone layer</p> <p>not greenhouse gas / global warming</p> <p>Examiner's Comments</p> <p>The environmental effects of acid rain were well known by the candidates. The most common correct answers involved the killing of plants or aquatic animals or the erosion of rocks, buildings and statues.</p>
		Total	2	
21		D ✓	1(AO 1.1)	<p><u>Examiner's Comments</u></p> <p>While most of the higher ability candidates knew that the early atmosphere was formed by volcanic activity, many lower ability candidates were also quite familiar with this.</p>
		Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
22			C ✓	1(AO 1.1)	<u>Examiner's Comments</u> Many candidates knew that 'potable water' means safe to drink and chose tap water as the best of the alternatives given.
			Total	1	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
23	a	<p>CO₂ emissions (in the UK) have decreased (from 1993 to 2013 / from 2006) ✓</p> <p>Global sea levels have risen (from 1993 to 2013) ✓</p> <p>(Therefore) data suggests that CO₂ emissions are not the (only) cause of rising sea levels / Idea that factors other than CO₂ emissions contribute to rising sea levels / data does not support a link (between human activity and climate change) ✓</p>	3(AO 3.1b)	<p>ALLOW idea that there is a negative correlation between CO₂ emissions and global sea levels / CO₂ emissions and global sea levels are inversely proportional for 2 marks</p> <p>ALLOW idea that sea levels were still rising when CO₂ emissions were decreasing for 2 marks</p> <p>ALLOW idea that the data does not completely support a link ALLOW idea that there is a mismatch between the data, ie one is UK but one is global</p> <p><u>Examiner's Comments</u></p> <p>The whole of this question was common with the Higher Tier paper.</p> <p>Many candidates successfully described the trends of the two lines. However, some assumed that the graph illustrated what they were expecting and made statements such as 'this shows that humans have a massive impact on global warming'. Some lower ability candidates clearly did not understand that the two lines on the chart referred to different Y axes, so discussed sea level and CO₂ emissions being equal in 2008 or 2010.</p>


Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
b	<p>Any two from:</p> <p>Idea that CO₂ emissions (from burning fossil fuels) are only from the UK and not a global figure ✓</p> <p>Global CO₂ emissions could be increasing ✓</p> <p>Idea that CO₂ emissions from other sources (not just burning fossil fuels) should be considered ✓</p> <p>Idea that there is a lag between CO₂ emissions impacting on global sea levels ✓</p>	2(AO 3.2a)	<p>ALLOW idea that different countries produce different CO₂ emissions</p> <p>ALLOW idea that emissions from one country will not have a large impact on global CO₂ levels</p> <p>IGNORE idea that other factors may affect global sea levels</p> <p>IGNORE idea that there are other greenhouse gases</p> <p>Examiner's Comments</p> <p>Some candidates gained credit for realising that there were other sources of CO₂ but the majority discussed factors other than CO₂ such as methane emissions. These answers could not be given credit because the question was specifically about the link between CO₂ emissions and global sea levels. A significant minority of candidates mentioned difficulty of acquiring data on CO₂.</p>

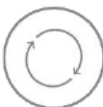
Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	c i	<p>Any one from:</p> <p>Idea of melting ice caps / melting glaciers / melting sea ice ✓</p> <p>Altered weather patterns ✓</p>	1(AO 1.1)	<p>IGNORE 'melting ice'</p> <p>ALLOW specific examples or effects of altered weather patterns eg drought in some places or flooding in others</p> <p>ALLOW specific effects of rising sea levels eg coastal erosion / flooding of low lying land</p> <p>IGNORE rising temperatures</p> <p>Examiner's Comments Many candidates went no further than the stem, stating that temperatures would rise. Examiners were looking for a little more detail than this. There were many references to the ozone layer, the greenhouse effect, acid rain and global warming, which were not creditworthy.</p>
	ii	<p>Any one from:</p> <p>Reduce consumption of fossil fuels ✓</p> <p>Use biofuels ✓</p> <p>Use renewable energy sources ✓</p> <p>Stop carbon dioxide escaping when fuels are used ✓</p> <p>Plant more trees / reduce deforestation / AW ✓</p>	1(AO 1.1)	<p>ALLOW specific examples eg car share / cycle to work / use public transport / use electric cars / don't leave appliances on standby</p> <p>ALLOW specific renewable energy sources eg wind / solar energy / tidal</p> <p>IGNORE use carbon neutral energy sources</p> <p>ALLOW use carbon capture (and storage)</p> <p>Examiner's Comments This question was very well answered, with suggestions ranging from tree planting to increased use of public transport. This was clearly an issue that candidates have discussed.</p>
		Total	7	

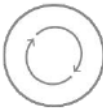
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24			D ✓	1(AO 2.1)	
			Total	1	
25			C ✓	1(AO 1.1)	<p>Examiner's Comments</p> <p> Misconception</p> <p>Some candidates do not recognise water vapour as a greenhouse gas. Candidates also confuse nitrogen with nitrous oxides so think nitrogen itself is a greenhouse gas.</p>
			Total	1	
26			B ✓	1(AO 1.1)	
			Total	1	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
27	a	<p>CO₂ emissions (in the UK) have decreased (from 1993 to 2013 / from 2006) ✓</p> <p>Global sea levels have risen (from 1993 to 2013) ✓</p> <p>(Therefore) data suggests that CO₂ emissions are not the (only) cause of rising sea levels / Idea that factors other than CO₂ emissions contribute to rising sea levels / data does not support a link (between human activity and climate change) ✓</p>	3(AO 3.1b)	<p>ALLOW idea that there is a negative correlation between CO₂ emissions and global sea levels / CO₂ emissions and global sea levels are inversely proportional for 2 marks</p> <p>ALLOW idea that sea levels were still rising when CO₂ emissions were decreasing for 2 marks</p> <p>ALLOW idea that the data does not completely support a link ALLOW idea that there is a mismatch between the data, ie one is UK but one is global</p> <p><u>Examiner's Comments</u></p> <p>Good responses to this question evaluated the information in the graph to describe that despite carbon dioxide emissions declining from (approximately) 2006, global sea levels have continued to rise; therefore, the data does not support a link between human activity and climate change. Many candidates also appreciated the mismatch between the data, ie one is UK but one is global. Lower ability candidates thought that they should be finding a link and contrived one from the period 1995 – 2005.</p> <p align="center">  AfL </p> <p>Candidates should be encouraged to write their answers clearly and concisely. Many candidates wrote more than was necessary in their answer to this question and often contradicted themselves as a result.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
				<p>Exemplar 1</p> <p><i>The graph does not show a link between human activity and global warming. Firstly, the graph shows that the sea levels increase as the relative CO₂ emissions decrease. Therefore, the use of fossil fuels has not had an impact on the rise of global sea levels.</i> [3]</p> <p>This response illustrates a clear, concise answer to this question, which was given all 3 marks.</p>
	b	<p>Any two from:</p> <p>Idea that CO₂ emissions (from burning fossil fuels) are only from the UK and not a global figure ✓</p> <p>Global CO₂ emissions could be increasing ✓</p> <p>Idea that CO₂ emissions from other sources (not just burning fossil fuels) should be considered ✓</p> <p>Idea that there is a lag between CO₂ emissions impacting on global sea levels ✓</p>	2(AO 3.2a)	<p>ALLOW idea that different countries produce different CO₂ emissions</p> <p>ALLOW idea that emissions from one country will not have a large impact on global CO₂ levels</p> <p>IGNORE idea that other factors may affect global sea levels</p> <p>IGNORE idea that there are other greenhouse gases</p> <p><u>Examiner's Comments</u></p> <p>Many candidates correctly stated that CO₂ emissions can come from sources other than the burning of fossil fuels or that the CO₂ emissions (in the data) are only from the UK and are not a global figure.</p> <div style="text-align: center;">  AFL </div> <p>Examiners use bold type to draw the candidates' attention to key aspects of a question.</p> <p>Despite the emboldening of 'CO₂ emissions by fossil fuels' in this question, many candidates described other factors, or other greenhouse gases, which may affect global sea levels and did not gain marks.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	c i	<p>Any one from:</p> <p>Idea of melting ice caps / melting glaciers / melting sea ice ✓</p> <p>Altered weather patterns ✓</p>	1(AO 1.1)	<p>IGNORE 'melting ice'</p> <p>ALLOW specific examples or effects of altered weather patterns eg drought in some places or flooding in others</p> <p>ALLOW specific effects of rising sea levels eg coastal erosion / flooding of low lying land</p> <p>IGNORE rising temperatures</p> <p>Examiner's Comments Good responses to this question described melting ice caps or altered weather patterns. A significant number of candidates did not relate their answer to climate, but to the effect on animals or ecosystems, and therefore did not gain the mark. The most common response was 'increased temperatures; this also did not gain the mark as 'rise in global temperatures' and 'global warming' were both mentioned in the stem of the question.</p>
	ii	<p>Any one from:</p> <p>Reduce consumption of fossil fuels ✓</p> <p>Use biofuels ✓</p> <p>Use renewable energy sources ✓</p> <p>Stop carbon dioxide escaping when fuels are used ✓</p> <p>Plant more trees / reduce deforestation / AW ✓</p> <p>Recycle plastics etc (rather than burning) ✓</p>	1(AO 1.1)	<p>ALLOW specific examples eg car share / cycle to work / use public transport / use electric cars / don't leave appliances on standby</p> <p>ALLOW specific renewable energy sources eg wind / solar energy / tidal</p> <p>IGNORE use carbon neutral energy sources</p> <p>ALLOW use carbon capture (and storage)</p> <p>Examiner's Comments Most candidates were able to suggest a method to lower carbon dioxide levels.</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
			Total
7			