1(a). Scientists think that the composition of the early atmosphere changed slowly over many billions of years.

Scientists estimated the composition of the earliest atmosphere on Earth.

Earth's earliest atmosphere

Gas	Percentage composition (%)
carbon dioxide	1.9
water vapour	95.8
other gases	2.3

Estimated surface temperature = 700 – 1100 °C

Scientists also estimated the composition of the atmosphere shortly before the first plant life existed.

Atmosphere just before the first plant life

Gas	Percentage composition (%)
carbon dioxide	89.8
water vapour	2.1
other gases	

Explain the change in the amount of water vapour shown in the tables.

---

[2]

(b). Plants caused further changes to the composition of gases in the atmosphere.

Predict the effect that plants had on the percentage of carbon dioxide in the atmosphere.

Explain your reasoning.

---

[2]

2. The surface of the planet Neptune is covered with clouds.
The clouds contain methane and hydrogen.

(i) The table shows the boiling point and melting point of methane.

melting point (°C)	−182.5
boiling point (°C)	−161.5

Put one tick (✓) in each row to show the correct state symbol for methane on Earth.

	(s)	(l)	(g)	(aq)
State of methane on Earth (✓)				

[1]

(ii) The clouds also contain hydrogen.

Use the information in the box to predict the boiling point of hydrogen.

Put a (ring) around the correct answer.

-161 °C **-253 °C** **-120 °C** **+52 °C**

[1]

3. Fertilisers are used to help to grow food.

The first stage of making fertilisers uses hydrogen to make ammonia. Very large amounts of hydrogen are needed.

The table shows some information about one large scale process for making hydrogen.

Raw materials	• methane gas from refining crude oil • steam
Temperature of process (°C)	700 – 1100
Waste gases	• carbon dioxide, • carbon monoxide, • unreacted methane
Atom economy (%)	< 20

The waste gases are collected to make sure that they do not harm the workers.

Which waste gas is directly harmful to people? What are its effects?

Gas_____

Effect on people_____

_____ **[2]**

4. Matt finds out about the bonding in some compounds.
He dissolves them in water and uses a pH meter to find out if each compound is an acid or an alkali.

The table shows his results.

Compound	Bonding in compound	Acid or alkali?
sodium hydroxide	ionic	alkali
ammonia	covalent	alkali
hydrogen chloride	covalent	acid
ethanoic acid	covalent	acid
calcium hydroxide	ionic	alkali

The pure compounds in the table have different states at room temperature and pressure.

They all dissolve in water to form a solution.

Draw straight lines to connect each **substance** to the correct **state symbol**.

substance	state symbol
solid sodium hydroxide	(g)
hydrogen chloride gas	(l)
liquid ethanoic acid	(s)
a solution dissolved in water	(aq)

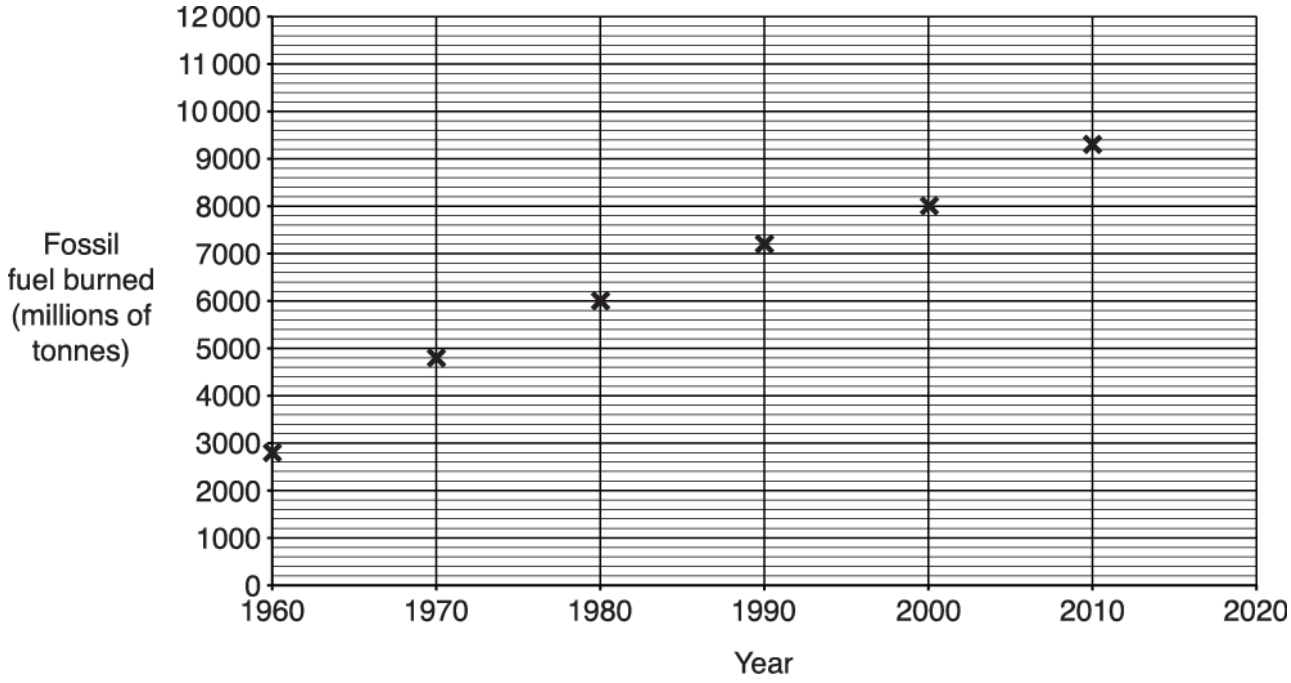
[2]

5. Complete the table to show the missing **formulae** and **elements** in each substance.

Substance	Formula	Elements in substance
graphite		carbon only
oxygen		oxygen only
potassium chloride	KC*l*	

[2]

6(a). John looks at a graph that shows the amount of fossil fuels burned in the world between 1960 and 2010.



(i) John says that the amount of fossil fuels burned has increased by the same amount every ten years.

Is he correct?
Use data from the graph to justify your answer.

---

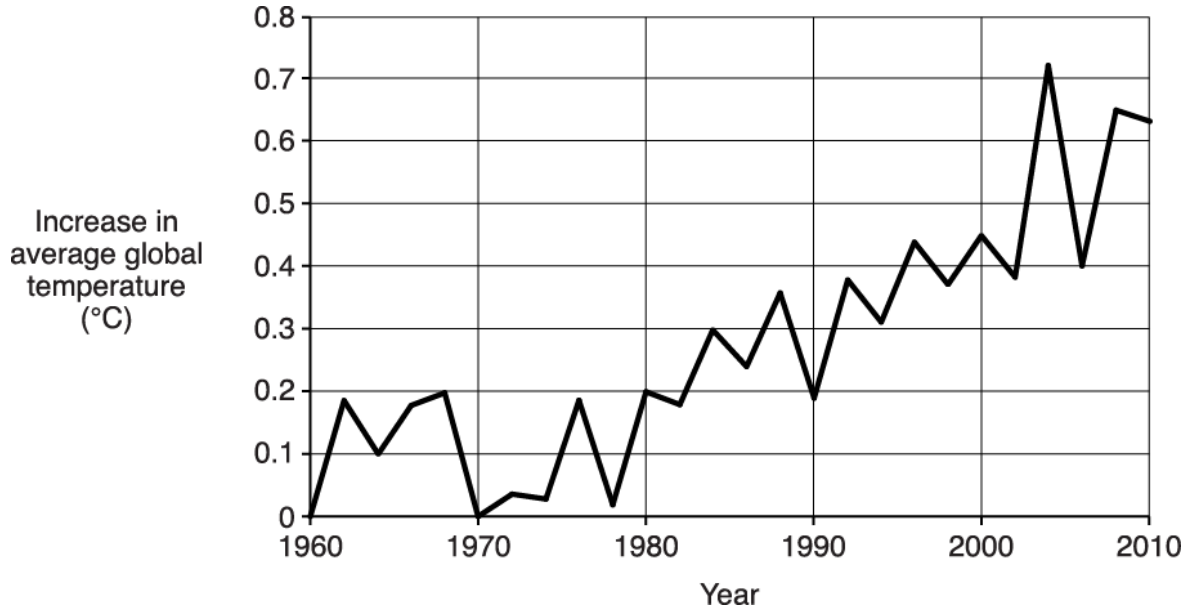
[2]

(ii) Estimate the amount of fossil fuels that will be burned in 2020.

_____ millions of tonnes

[1]

(b). John also looks at the changes in average global temperature over the same time.



(i) What does the graph show about changes in average global temperature?

_____

_____

_____

_____

_____ [2]

(ii) Complete these sentences about the **two** graphs.
Choose from the words in the list. You may use each word once, more than once or not at all.

cause	**correlation**	**decreased**
increased	**reaction**	**stayed the same**

From 1960–2010, the amount of fossil fuels burned has _____ and the average global temperature has _____.

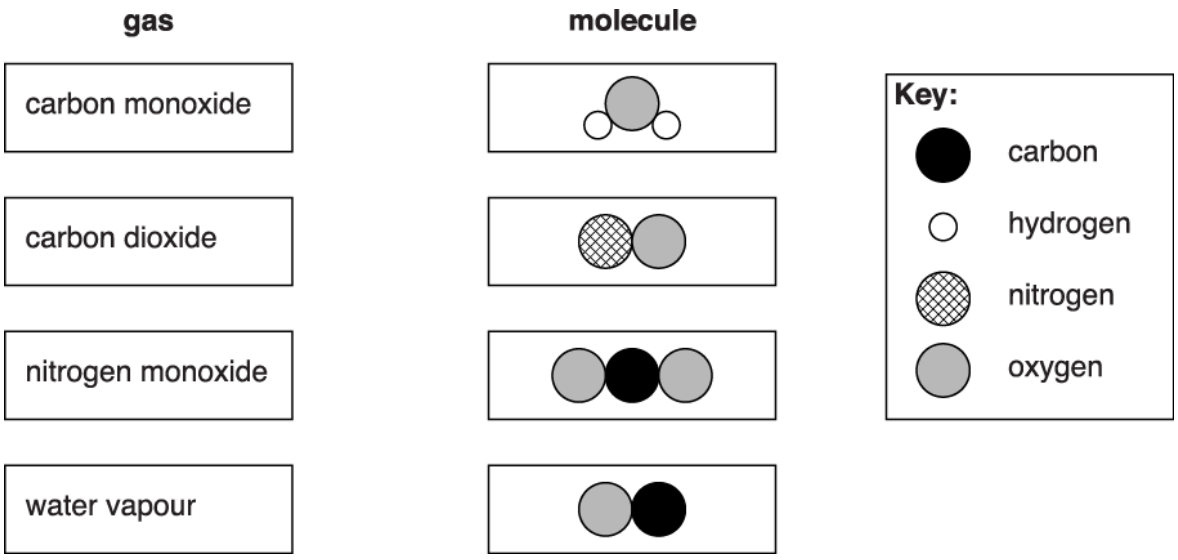
This means there is a _____ between the amount of fossil fuels burned and the average global temperature.

[3]

7(a). The air contains some gases that are emitted by cars.

Some gases in the air are listed below.
Diagrams of their molecules are also shown.

Draw a straight line from each **gas** to its correct **molecule**.



[3]

(b). Scientists measure the pollutants in the exhaust gases from 2 cars.

The cars are the same except for the fuel they use (petrol or diesel).

	Pollutant (grams per km travelled)	
	Nitrogen dioxide	Carbon particulates
Petrol car	6.0	none
Diesel car	9.0	0.5

Pollutants from cars build up in towns and can be harmful to human health.

Explain why each pollutant in the table is harmful and decide which car is better for use in towns.

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

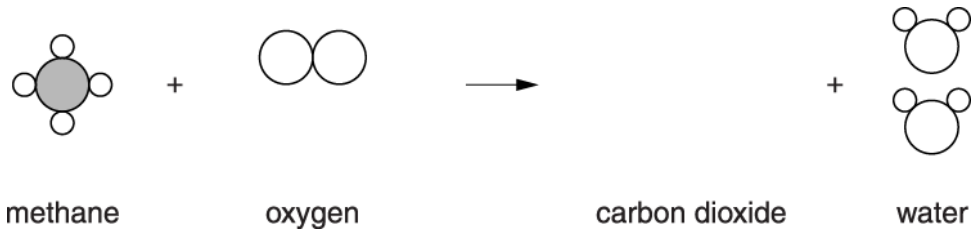
[6]

8. Methane, CH_4, is a chemical in natural gas.

When methane burns in a plentiful supply of air, **complete combustion** takes place.

The products are carbon dioxide and water.

(i) Finish this diagram to show the complete combustion of one molecule of methane.



[2]

(ii) When methane, CH_4, burns in a limited supply of oxygen, **incomplete combustion** takes place.

Which of these statements about this incomplete combustion are true?

Put ticks (✓) in the boxes next to the **two** correct statements.

Not all of the carbon reacts with oxygen. ☐

None of the hydrogen reacts with oxygen. ☐

Water is not one of the products. ☐

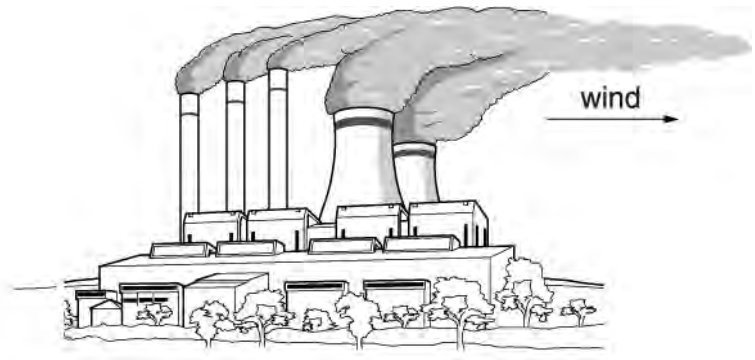
Carbon monoxide is one of the products. ☐

Carbon is the only product. ☐

[2]

9(a). Sulfur dioxide is released from a coal-burning power station.

Scientists study this air pollution.



They take measurements along a line from the power station in the direction the wind is blowing.

They measure the sulfur dioxide concentration in the air at different distances.

Their results are shown in the table.

Distance from the power station in km	1	2	3	4	5	6	7
Sulfur dioxide concentration in $\mu g/m^3$	134	86	65	52	42	38	36

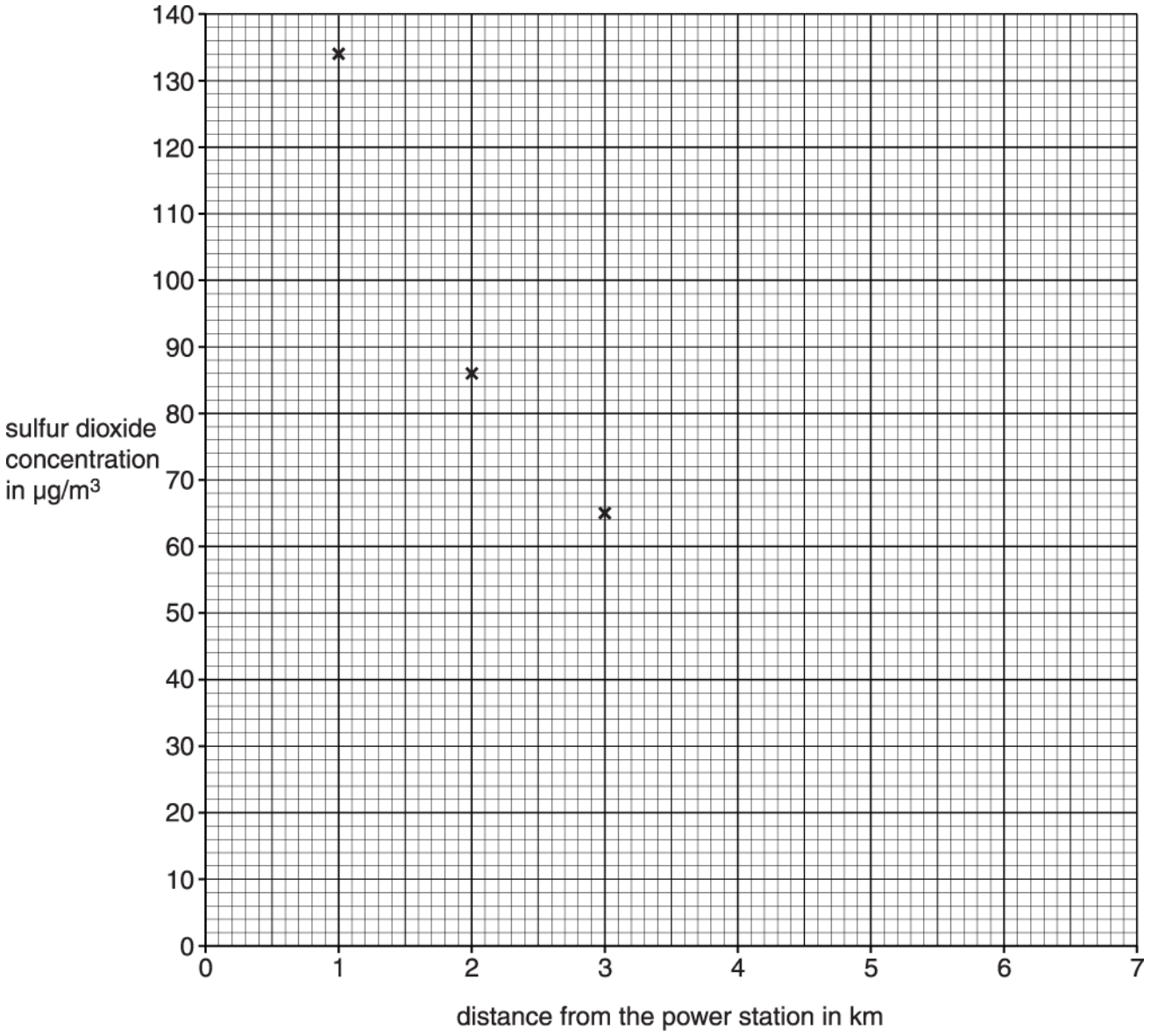
(i) Three of these results have been plotted on the graph opposite.

Plot the other results.

[2]

(ii) Draw a curve of best fit.

[1]



(b). Finish this sentence to describe the correlation shown by the graph.

As the distance from the power station _____ the concentration of sulfur dioxide in the air _____ .

[1]

(c).

(i) Sulfur dioxide reacts with two substances in the air to make acid rain.

Name these two substances.

1

2

---

[2]

(ii) Nitrogen dioxide also makes acid rain.

Give the formula of this gas, and write down where it comes from.

formula _____

where it comes from _____

[2]

10(a) Mars is a planet in our solar system.

.

The table shows the percentage of each gas in the atmosphere on Mars.

Name of gas	Percentage in atmosphere on Mars
carbon dioxide	95.3%
nitrogen	2.7%
argon	1.6%
oxygen	0.13%

Which of the statements about the gases on Mars are true?

Put a tick (?) in the boxes next to the **two** correct answers.

Most of the atmosphere on Mars is nitrogen. ☐

The gases on Mars are all found on Earth. ☐

All of the gases are elements. ☐

There is more argon than oxygen on Mars. ☐

The percentage of oxygen on Mars is the same as on Earth. ☐

[2]

(b). Draw straight lines to connect each **gas in the atmosphere** with its correct **formula**.

gas in the atmosphere	formula
nitrogen	NO_2
argon	N_2
oxygen	Ar
	ArO_2
	O
	O_2

[2]

11. Scientists measure the nitrogen dioxide concentration in the air next to a motorway.

They sample the air at nine different times.

At each time the scientists measure six samples of air.

They work out the mean value of these measurements.

The table shows the results from one set of six samples.

Sample number	1	2	3	4	5	6	mean
Nitrogen dioxide concentration in ?g/m^3	123	122	120	121	124	122	122

(i) Why is it an advantage to take six samples rather than one?

---

[6]

(ii) The true value for the nitrogen dioxide concentration lies within a range of values.

According to the results in the table, what is this range?

range = from _____ to _____ ?g/m^3 **[1]**

12(a) Lee looks up some data about some molecular substances.

.

Substance	Formula	Relative formula mass	State at room temperature
nitrogen	N_2	28	.....
oxygen	.....	32	gas
carbon dioxide	CO_2	44	gas
water	H_2O	18	liquid

Complete the table by filling in the blank spaces.

[2]

(b). All of the substances in the table are **molecular**.

What does molecular mean?

Put a tick (✓) in the box next to the correct answer.

many ions bonded together ☐

a large structure of identical atoms ☐

a small number of atoms bonded together ☐

a structure of protons and electrons ☐

[1]

(c). Lee looks at the data and has this idea.

> I think that if a molecular substance has a relative formula mass of less than 100 it is always a gas.

Does the data in the table support Lee's idea?

Explain your reasoning.

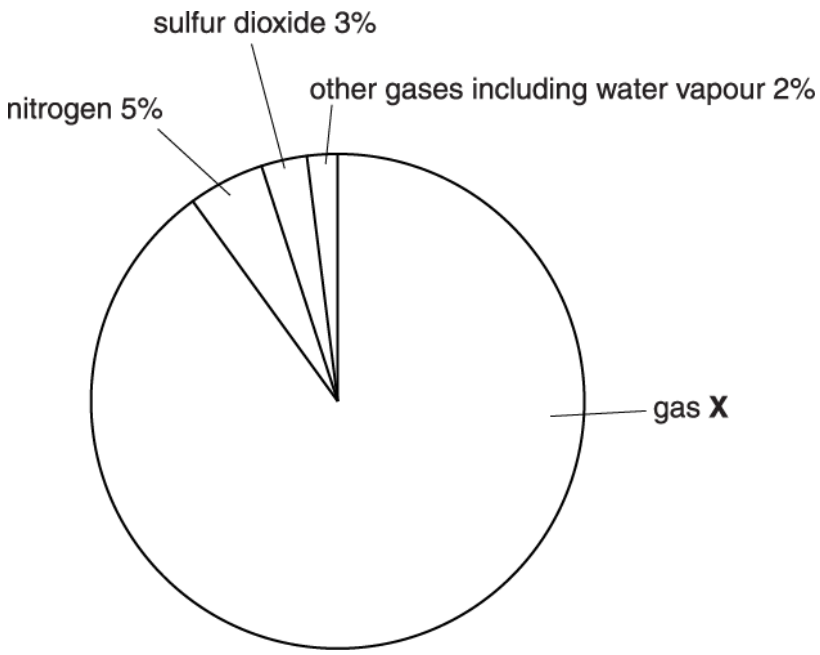
---

[3]

13(a) Scientists have estimated the percentage of different gases in the atmosphere before plant life on Earth began.

.

The pie chart shows this estimation.



What is the gas **X** that made up most of the atmosphere before there was life on Earth?

Put a (ring) around the correct answer.

argon **carbon dioxide** **nitrogen oxide** **oxygen**

[1]

(b). Explain why the composition of the Earth's atmosphere changed after plant life on Earth began.

---

[2]

14(a) The table shows the percentage of the three main gases in air.

.

Complete the table.

Name of gas	Percentage in air
_ _ _ _ _ _ _ _ _ _ _ _	78%
oxygen	21%
argon	_ _ _ %

[2]

(b). The **early atmospheres** on Earth and on Mars contained **carbon dioxide** and **water vapour**.

	Early atmospheres of Earth and Mars	Atmosphere of the Earth today	Atmosphere of Mars today
Carbon dioxide	75%	0.04%	95%
Water vapour	20%	very little	very little

How have the atmospheres of Earth and Mars changed over time?
Give reasons for the changes to the Earth's atmosphere.

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

---

[6]

15. Here is a model of a molecule of carbon dioxide.

Draw lines to link parts of this model to the correct labels.

Some of the labels are incorrect.

Carbon dioxide

Carbon atom

Double bond

Hydrogen atom

Ionic bond

Oxygen atom

[3]

16. **Table 5.1** shows some data for four elements **Q, R, T** and **X**.

Element	Melting point (°C)	Boiling point (°C)	Electrical conductivity when solid	Reactivity
Q	−189	−186	none	unreactive
R	98	883	good	very reactive
T	−101	−35	none	very reactive
X	119	445	none	fairly reactive

Table 5.1

Which element in **Table 5.1** is a liquid at 500 °C? ---------- **[1]**

17. Diesel is a fossil fuel.

Name **two** pollutants caused by the incomplete combustion of fossil fuels.

1 ----------

2 ----------

[2]

18. **Table 1.1** shows some information about diamond, graphite and carbon dioxide.

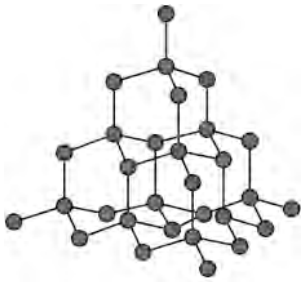
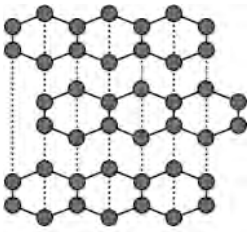
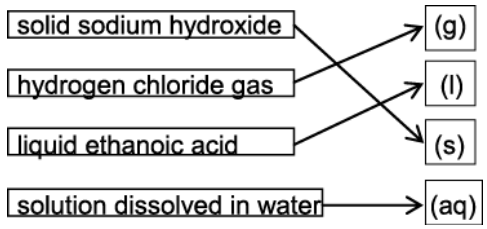
	Diamond	Graphite	Carbon dioxide
Diagram of structure			
Formula	C(s)	C(s)	$CO_2(g)$
Element or compound?	element	element	compound
State at room temperature and pressure	solid		
Structure and bonding	giant covalent	giant covalent	simple covalent

Table 1.1

Explain why diamond and graphite are elements, but carbon dioxide is a compound.

--- [2]

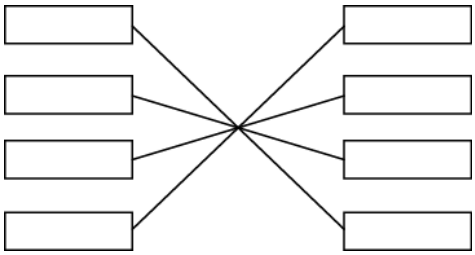
END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		water vapour condensed / turned into a liquid / became oceans ✓ because the Earth cooled / surface temperature fell ✓	2	
	b		carbon dioxide percentage decreases ✓ plants use carbon dioxide for photosynthesis / to make glucose ✓	2	
			Total	**4**	
2		i	(g) ✓	1	
		ii	-253° C ✓	1	
			Total	**2**	
3			carbon monoxide ✓ toxic / reduces oxygen content of blood ✓	2	
			Total	**2**	
4				2	All correct (2) 2 or 3 correct (1) **Examiner's Comments** Most were able to link at least two substances with the correct state symbol with solid and gas most frequently linked successfully. Some seemed to think that (s) meant solution.
			Total	**2**	
5			C **and** O_2 (1) potassium **and** chlorine (1)	2	**Reject** O, 2O, O2, O^2 **Reject** potassium chloride **Examiner's Comments** The symbol for graphite was seldom seen and usually incorrect e.g. G/Gr and oxygen was often O. Potassium and chlorine were more commonly correct although there were quite a few references to chloride.

Question			Answer/Indicative content	Marks	Guidance
			Total	2	

Question			Answer/Indicative content	Marks	Guidance
6	a	i	'No' uses one 10 year period of correct data or identifies fluctuation in the size of increase in data (1) **and** uses a different 10 year period of correct data to compare and justify the answer (1)	2	'No' on its own is insufficient Correct data from graph that could be used: 1960-70 increase of 2000 (millions of) tons/bigger increase 1970-80 increase of 1200 (millions of) tons 1980-90 increase of 1200 (millions of) tons 1990-2000 increase of 800 (millions of) tons/smaller increase 2000-10 increase of 1300 (millions of) tons If 'yes' is given then check graph and **allow** maximum 1 mark if straight LOBF and 'yes' is justified **Examiner's Comments** This question required the calculation of the changes in 'fossil fuels burned' (millions of tonnes) for at least 2 of the sections of a 10 year period. The command words 'use the data' required such a calculation to enable both marks to be scored. A significant number of candidates didn't attempt the calculation, or incorrectly calculated these values over 2 ten year periods. The final evaluation of the data was generally well done, even when the values were incorrect.
		ii	Value between 10000 and 11000	1	**Examiner's Comments** Generally well answered from an extrapolation of the graph.
	b	i	Any two from: General trend is upward; Fluctuation occurs (line goes up and down); Reaches a maximum of (just over) 0.7 / reaches a maximum between 2000 and 2010	2	**Allow** positive correlation **Allow** calculation of increase in temperature for first marking point **Examiner's Comments** Most candidates could identify the general upward trend in the data. A significant number could also identify either the fluctuations in the data or the maximum point of the graph.

Question			Answer/Indicative content	Marks	Guidance
		ii	increased;(1) increased;(1) correlation;(1)	3	Examiner's Comments Generally well answered, with 'increased' being identified for the first space and 'correlation' identified for the last space. The only issue was the middle statement. 'Reaction' was a common incorrect response here.
			Total	8	

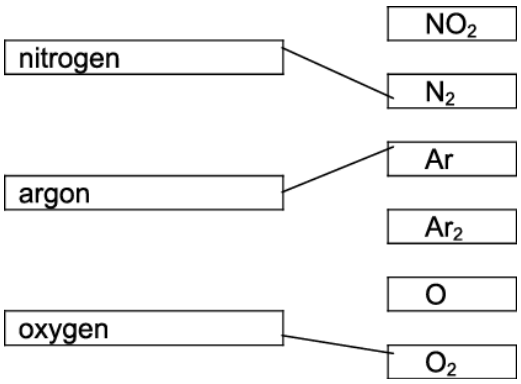
Question			Answer/Indicative content	Marks	Guidance
7	a			3	All 4 lines correct = 3 3 or 2 lines correct = 2 1 line correct = 1 **Examiner's Comments** Generally well answered, and done so neatly.

Question			Answer/Indicative content	Marks	Guidance
	b		[Level 3] Chooses petrol car **AND** Give a reason why **both** pollutants are harmful **AND** Compares data for **both** of the pollutants Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Chooses petrol car **AND** Give a reason why **both** pollutants are harmful **OR** Compares data for **both** of the pollutants **OR** Gives a reason why **one** pollutant is harmful **AND** compares data for **one** of the pollutants Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Give a reason why one pollutant is harmful **OR** compares data for **one** of the pollutants. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to D** **Indicative scientific points may include:** Reasons for harm – nitrogen dioxide • Causes breathing problems • Possible links to asthma • Forms acid rain • Acid rain harms plants and animals Reasons for harm – carbon particulates • Causes breathing problems • Possible links to asthma • Makes things dirty Reasons for choosing petrol • diesel cars emit (3.0g/km) more nitrogen dioxide • diesel cars emit (0.5g/km) more carbon particulates • diesel emits more (of both) pollutants **Use the L1, L2, L3 annotations; do not use ticks.** **Examiner's Comments** Many candidates were able to correctly select the relevant data and explain why the petrol car was better. Quoting the data was not enough to score the full marks here and this was the area where candidates appeared to lack the skills needed to access the highest level on a frequent basis. The release of gases into the atmosphere was often confused with burning of the gases. Fewer candidates could articulate the effects of the pollutant gases on the atmosphere. Greenhouse gases and the ozone layer were often confused when used to attempt this question.
			Total	9	

Question			Answer/Indicative content	Marks	Guidance
8		i	one additional oxygen molecule on left / 2 in front of the one oxygen molecule on left (1) one carbon dioxide molecule on right (1)	2	**do not allow** if there is a visible gap between the oxygens **allow** slightly overlapping circles Any shape but no gaps between carbon and oxygens and the two oxygens must not touch **allow** circle with C for carbon / O for oxygen **do not allow** oxygen circles same size as hydrogen unless labelled with O **Examiner's Comments** The majority of candidates failed to score either of the 2 marks here. Where they did score, it was only 1 mark for most candidates. The mark scored was for correctly drawing a molecule of carbon dioxide using one black circle, with 2 white circles, one on either side, which touched the back circle but not each other (linear shape). Other common mistakes included using small circles that were representative of hydrogen atoms and a lack of shading. Only the stronger candidates realised they needed to add an oxygen molecule to the left hand side of the diagram to balance the equation.
		ii	tick in box 1 (1) tick in box 4 (1)	2	**Examiner's Comments** This was answered well with most candidates scoring at least 1 mark. Candidates were more able to demonstrate they understood that carbon monoxide was a product of incomplete combustion.
			Total	**4**	

Question			Answer/Indicative content	Marks	Guidance
9	a	i	all points plotted to within +/? ½ small square	2	two or three points plotted to within +/? ½ small square = **1 mark** **Examiner's Comments** This question involved plotting accurate points and most candidates could plot the points with reasonable facility.
		ii	smooth curve within 1 small square of all points	1	**allow** curve through the given points only if no points are plotted for 1a(i) **allow** smooth curve for wrongly plotted points (ECF) **do not allow** more than one line. **Examiner's Comments** This questions involved drawing a line of best fit, which in this case was a smooth curve. Surprisingly few candidates could produce an acceptably drawn smooth curve. The lines drawn were often doubled in sections or 'dot to dot' style multiple lines had been drawn with or without a ruler.
	b		increases decreases	1	**allow** alternative wording with same meaning **allow** reverse answer – decreases … increases **Examiner's Comments** This was generally well answered, with candidates expressing the correlation shown by the graph. Most candidates used increases/decreases as expected but many others used acceptable alternatives.

Question			Answer/Indicative content	Marks	Guidance
	c	i	oxygen (1) water (1)	2	either order **allow** correct formula **allow** 'water vapour' **Examiner's Comments** Candidates could identify 'oxygen' as an element within the atmosphere but few candidates identified 'water'. Common incorrect responses were carbon dioxide and nitrogen. These responses show a very poor understanding of the elements within a formula of a compound when given its name.
		ii	NO_2 (1) car engine / exhaust / power station / combustion of fuels (1)	2	**allow** N_2O_4 **Examiner's Comments** Very few candidates scored both marks here. The formula of nitrogen dioxide was poorly recalled and poorly expressed with numbers often superscript rather than subscript. Where candidates offered the formula, it was often accompanied by an incorrect attempt to write an equation. This was another example of where candidates didn't respond to the requirements of the question.
			Total	8	

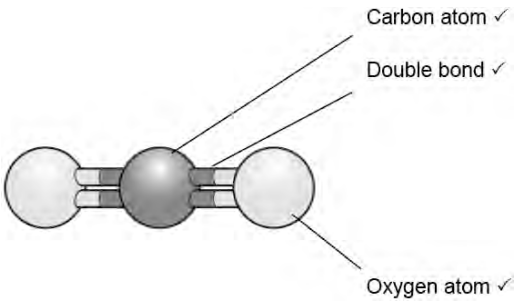
Question			Answer/Indicative content	Marks	Guidance
10	a		Most of the atmosphere on mars in nitrogen. ☐ The gases on Mars are all found on Earth. ✓ All of the gases are elements ☐ There is more argon than oxygen on Mars. ✓ The percentage of oxygen on mars is the same as on earth. ☐	2	**Examiner's Comments** Generally 1 or 2 marks awarded – there were no observable patterns if incorrect responses were offered.
	b			2	all correct = 2 marks 2 / 1 correct = 1 mark **Examiner's Comments** Many candidates failed to achieve both marks. Most chose alternatives for N_2 (often NO_2) and Ar, although the more obvious error would have been O for O_2.
			Total	**4**	
11		i	there is always some variation in measurements (1) can work out a mean / average as a best estimate of the true value (1)	2	**allow** can identify outliers / taking only one sample could be faulty (1) **Examiner's Comments** Surprisingly few candidates mentioned anything about calculating an average/mean. A popular answer would involve something about outliers. Most candidates incorrectly used 'reliable' and accurate'. Most marks were gained by the use of 'mean', 'average' and 'outlier'.
		ii	120 to 124	1	**allow** 124 to 120 **Examiner's Comments** A significant number of candidates could identify the range correctly.
			Total	**3**	

Question			Answer/Indicative content	Marks	Guidance
12	a		gas; (1) O_2; (1)	2	**Reject** O / O^2 / O2 Examiner's Comments The state of nitrogen at room temperature and the formula for oxygen were well known. Some candidates thought that nitrogen was a liquid and others gave the formula of oxygen as O or O^2.
	b		box 3	1	Examiner's Comments When answering this question most candidates correctly identify a molecule as being a small number of atoms bonded together. The most common misconception was that it is many ions bonded together.
	c		Does not support and identifies water as the anomaly; Water is below 100 / water has RFM of 18; Water is a liquid;	3	If no other mark awarded: **allow** some support and some don't for 1 mark Examiner's Comments Most candidates correctly identified water as the anomaly in the data given and they gave clear reasoning to explain their choice. Some responses were too vague, merely referring to parts of the data such as 'all are under 100'.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
13	a		carbon dioxide	1	**Examiner's Comments** Generally well answered with most candidates identifying carbon dioxide as the correct response.
	b		**any two from:** (Plants / trees) photosynthesised; carbon dioxide decreased; oxygen increased;	2	**Ignore** respiration **Accept** 'plants change carbon dioxide into oxygen' for 2 marks (See guidance of list principle for this question) **Ignore** respiration **Accept** 'plants change carbon dioxide into oxygen' for 2 marks (See guidance of list principle for this question) **Examiner's Comments** Many candidates scored both marks here. There were surprisingly few answers that referred to the role of plants. Commonly scored points were reduction in carbon dioxide and increase in oxygen, but misconceptions included the processes of respiration to provide oxygen or plants breathing.
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
14	a		<table><tr><td>Nitrogen (1)</td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td>1% (1)</td></tr></table>	2	Examiner's Comments This was generally answered well, but the common misconception was that 'carbon dioxide' had the largest percentage abundance with 78%. This could be attributed to the fact that the consequences of pollution by carbon dioxide is considered in detail. Perhaps the actual percentage abundance of carbon dioxide can be emphasised in centres for future exam sessions. The percentage abundance of Argon in the air varied and included values that added up to more than 100% in total.
	b		**[Level 3]** Comments on data for CO_2 and water vapour on both planets **and** gives reasons for changes in CO_2 and water vapour on Earth. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Comments on data for one gas on both planets and gives a reason for change on Earth **OR** comments on data for CO_2 and water vapour on one planet and gives a reason for change on Earth **OR** comments on data for CO_2 and water vapour on both planets Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Comments on data for one gas on both planets **OR** comments on data for CO_2 and water vapour on one planet **OR** gives a reason for the change of one gas on Earth. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer	6	This question is targeted at grades up to D **Indicative scientific points may include:** **Comments on data** • percentage carbon dioxide in atmosphere on Earth has decreased • percentage water vapour in atmosphere on Earth has decreased • percentage carbon dioxide in atmosphere on Mars has increased • percentage water vapour in atmosphere on Mars has decreased **Reasons for changes to Earth's atmosphere** • Earth cooled and water vapour condensed to form oceans • Carbon dioxide dissolved in the oceans. • Carbon dioxide was locked in the formation of sedimentary rocks • Carbon dioxide locked in the formation of fossil fuels • Evolution of (photosynthesising) plants lowered percentage of carbon dioxide. **Ignore** reasons for change on Mars **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer/Indicative content	Marks	Guidance
			not worthy of credit. (0 marks)		Examiner's Comments A significant number of candidates struggled with this question. The description of the changes to the atmospheres that were given in the table were not forthcoming in many responses. Candidates were able to use the information provided to comment on the changes in gases, particularly on Earth. Of those who were unsuccessful with this question, it was often because they discussed issues such as global warming, climate change and the effects of human activity on a modern Earth, but made no reference to the data provided. Photosynthesis and dissolving in the oceans were often identified as reasons for the decrease in carbon dioxide levels on Earth. The cooling of the Earth to form the oceans, removing water vapour, was discussed to a lesser extent. The quality of written communication was poor in some areas, particularly organisation of ideas. For example, it was often unclear through either poor grammar or a complete omission of a word, which planet the candidates were referring to. 'The atmosphere has decreased on Earth and increased on Mars' or 'the carbon dioxide went up' were typical responses that failed to score as candidates missed crucial marks to show they understood the data in the table.
			Total	**8**	

Question			Answer/Indicative content	Marks	Guidance
15				3 (AO 1.1 × 3)	**ALLOW** the double bond line to either (or both) double bond(s) **ALLOW** oxygen link to either (or both) oxygen atoms **DO NOT ALLOW** a link to 'ionic bond' as this a CON to the double bond mark. Examiner's Comments Most candidates correctly identified the carbon atom, double bonds and the oxygen atoms. The most frequent errors were to substitute hydrogen for oxygen and, less often, to connect the same part of the model to more than one box.
			Total	3	
16			R ✓	1 (AO 2.1)	If more than one option given, **CON** Examiner's Comments The higher ability candidates correctly identified the liquid. Others showed the usual problems with interpreting melting points and boiling points, and gave 'X' as their answer.
			Total	1	
17			**Any two from:** Carbon monoxide / CO ✓ (carbon) particulates ✓ unburnt fuel / AW ✓	2 (AO 1.1 × 2)	**IGNORE** carbon dioxide Examiner's Comments The main problem was to miss the words 'incomplete combustion' in the command line, giving carbon dioxide as one of their answers. 'Methane' was the most common other answer.
			Total	2	

Question			Answer/Indicative content	Marks	Guidance
18			diamond and graphite contain only carbon (atoms)✓ carbon dioxide contains carbon and oxygen (atoms) / also contains oxygen (atoms)✓	2 (AO 2× 1.1)	ALLOW only one <u>type</u> of atom / all same atom ALLOW two <u>types</u> of atom / different IGNORE mixtures / elements <u>Examiner's Comments</u> Candidates should be aware that an element contains only one type of atom and a compound has more than one type of atom joined together in a fixed ratio. In this case it was sufficient to identify that the elements contained <u>only</u> carbon atoms but that carbon dioxide had carbon and oxygen.
			Total	2	