Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4462/02

SCIENCE A
HIGHER TIER
CHEMISTRY 1

A.M. TUESDAY, 12 June 2012

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**8**	
4.	**6**	
5.	**6**	
6.	**8**	
7.	**5**	
8.	**4**	
9.	**4**	
10.	**3**	
11.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **11**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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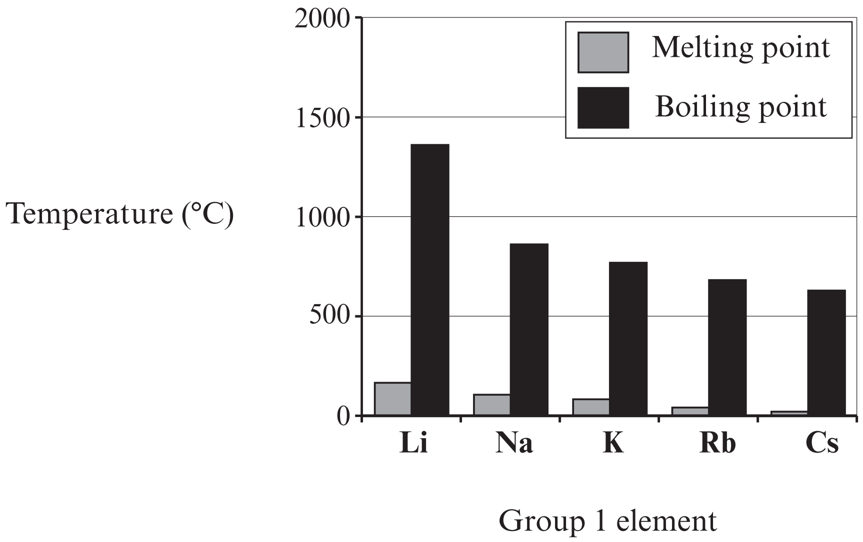
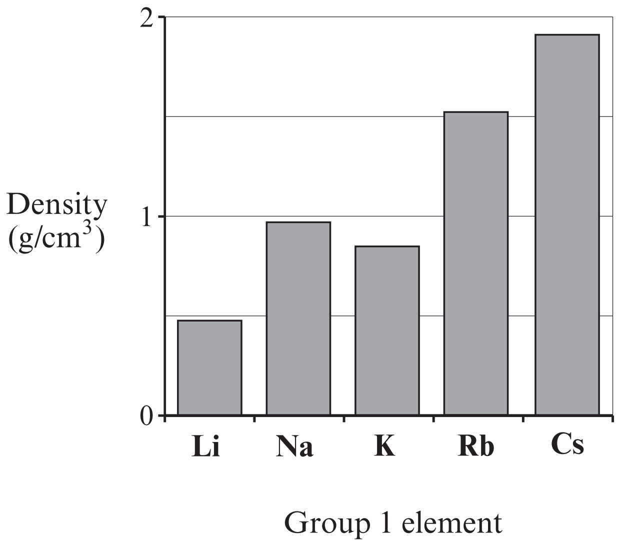
Answer **all** *questions.*

1. The graphs below show the trends in melting points, boiling points and densities of Group 1 elements.





Use the information in the graphs to answer the following questions.

(a) Describe the trends in the melting points and densities of the elements going **down** the group. [2]

....

....

(b) Give the name of the element which has a property which does not fit a trend. [1]

....

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(c) The table below shows the boiling points of Group 1 elements.

Group 1 element	Boiling point (°C)
lithium	1340
sodium	880
potassium	780
rubidium	690
caesium	670

Francium lies below caesium in Group 1.
Estimate, giving your reasoning, a value for the boiling point of francium. [2]

Value .... °C

Reason for value ....

....

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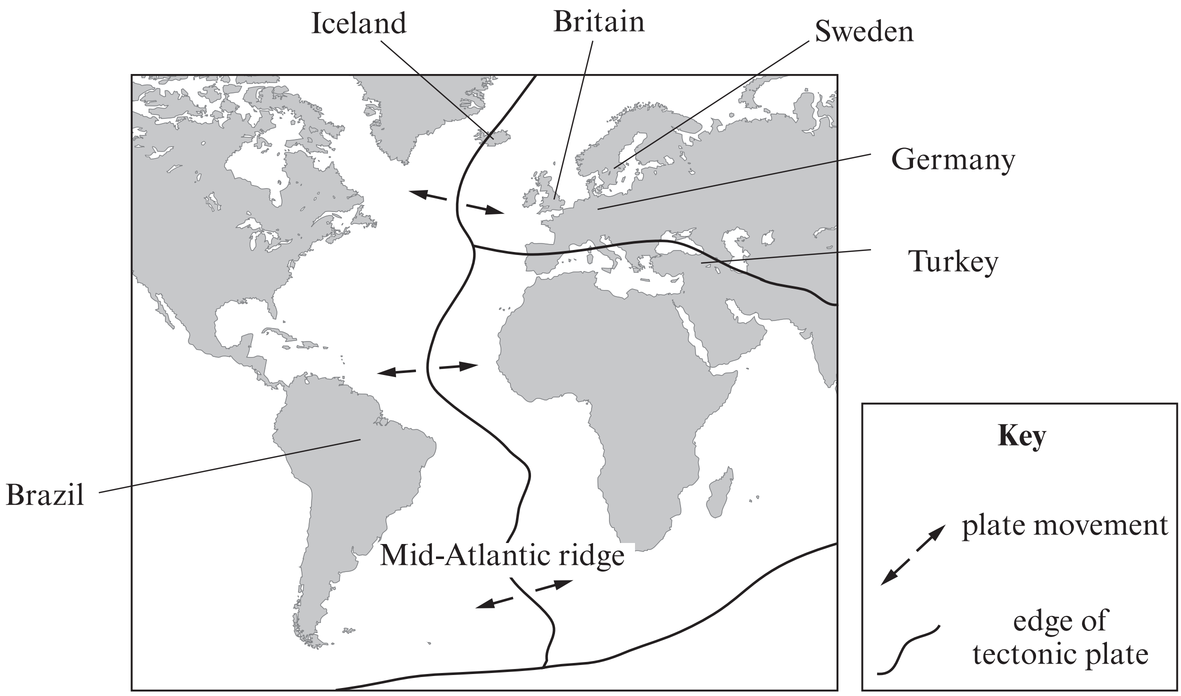
2. The map below shows some information about tectonic plates.



(a) Choose the country, labelled on the map above, in which you would expect to have the **most** volcanic eruptions. Give a reason for your choice of country. [2]

....

....

(b) Wegener's theory of continental drift was not accepted by other scientists until several years after his death in 1930. In 1960 parts of the ocean floor were surveyed, at various distances from a plate boundary. The data below shows the age of the rocks.

Distance from the plate boundary (km)	500	1000	1500	2000	2500
Age of rock (millions of years)	24	46	71	90	113

(i) Describe the pattern in the results. [1]

....

(ii) Using the data, state what conclusions can be drawn about what is happening at the plate boundary. [2]

....

....

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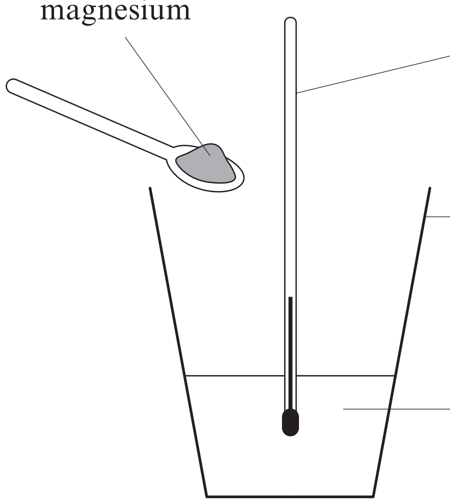
3. Four pupils investigated the temperature change which occurred when increasing amounts of powdered magnesium were added to 50 cm^3 of copper(II) sulfate solution in a polystyrene cup as shown in the diagram below.



- In the first experiment, each pupil weighed 0.2 g of magnesium.
- The pupils then measured out 50 cm^3 of copper(II) sulfate solution into a polystyrene cup and recorded the temperature of the solution.
- The pupils then added the magnesium to the solution, swirled the polystyrene cup and recorded the maximum temperature rise.
- They repeated the experiment using 0.4, 0.6, 0.8 and 1.0 g of magnesium powder, using a new 50 cm^3 of copper(II) sulfate solution each time.

The table below shows the results recorded.

Mass of magnesium powder (g)	Maximum temperature rise (°C)				
	Pupil **A**	Pupil **B**	Pupil **C**	Pupil **D**	Mean
0.2	3.5	3.5	3.7	3.7	3.6
0.4	6.0	5.9	6.1	6.0	6.0
0.6	7.8	8.2	8.0	8.0	8.0
0.8	9.1	9.0	3.0	8.9	9.0
1.0	8.8	9.2	8.9	9.1	9.0

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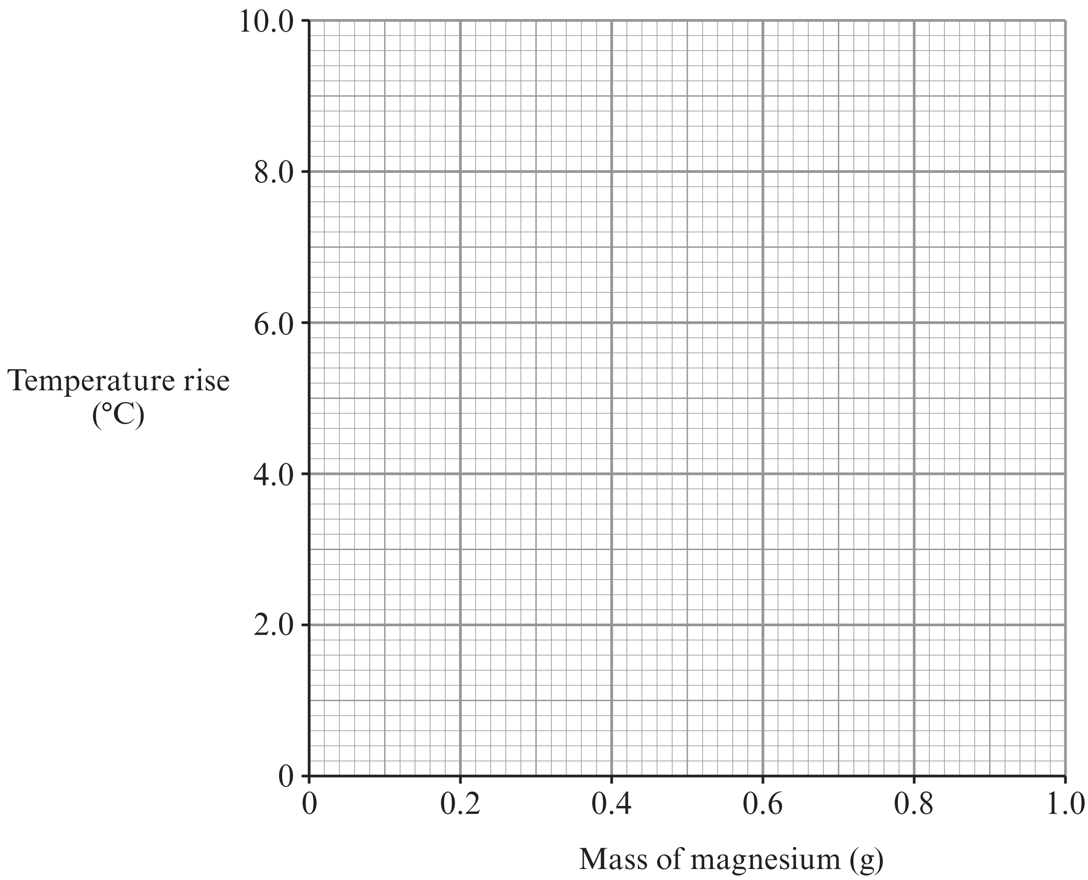
(a) (i) **Circle** the anomalous result **not** used in calculating one of the mean temperature rises. [1]

(ii) Suggest **one** possible cause for this anomalous result. [1]

....

(b) Using the grid provided, plot the mean temperature rise against the mass of magnesium added. Draw a line of best fit starting at the origin (0,0). [3]



(c) State why the line of best fit must be drawn to the origin (0,0). [1]

....

(d) Use your graph to find the smallest mass of magnesium needed to react with **all** the copper(II) sulfate. Give the reason for your answer. [2]

....

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4. Most scientists believe that the increase in the level of carbon dioxide in the atmosphere during the last 150 years has resulted in global warming.

Briefly describe and explain your understanding of the term 'global warming'. [6 QWC]

In your answer you should refer to

- its cause(s)
- its consequence(s)
- what can be done to reduce its impact

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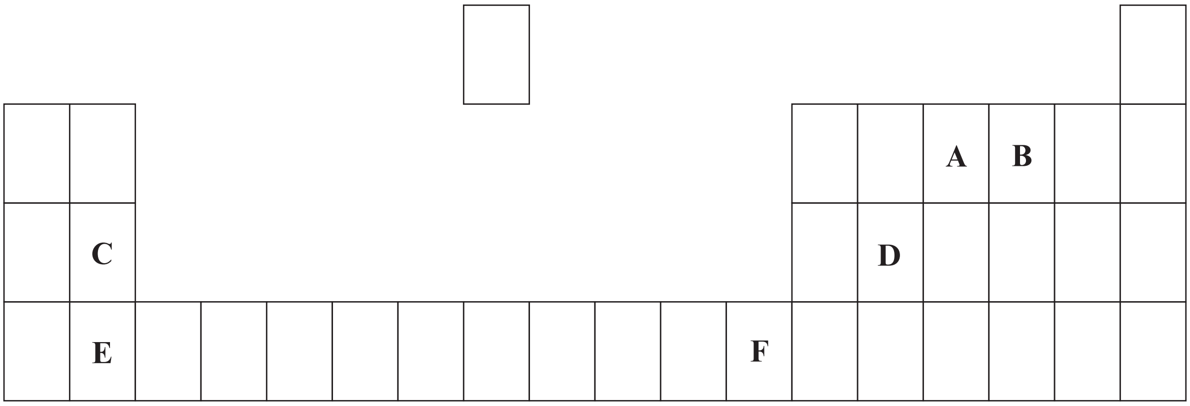
5. *(a)* The diagram below shows part of the Periodic Table of Elements. The letters **A-F** represent six elements. *Letters **A-F** are not the chemical symbols for the elements.*



(i) Give the **letter** of the element in Group 2 and Period 3. .... [1]

(ii) State **two** general physical properties that elements **C**, **E** and **F** have in common. [2]

....

....

(iii) The table below shows some properties of one of the six elements identified in the Periodic Table above.

Melting point (°C)	Boiling point (°C)	Appearance at 20 °C
1410	2355	shiny brittle solid

I. Give the **letter** of the element which you would expect to have these properties. [1]

....

II. Give a reason for your choice. [1]

....

(b) Mendeleev developed the modern Periodic Table of Elements at a time when not all the elements had been discovered.

State how Mendeleev overcame the problem of undiscovered elements. [1]

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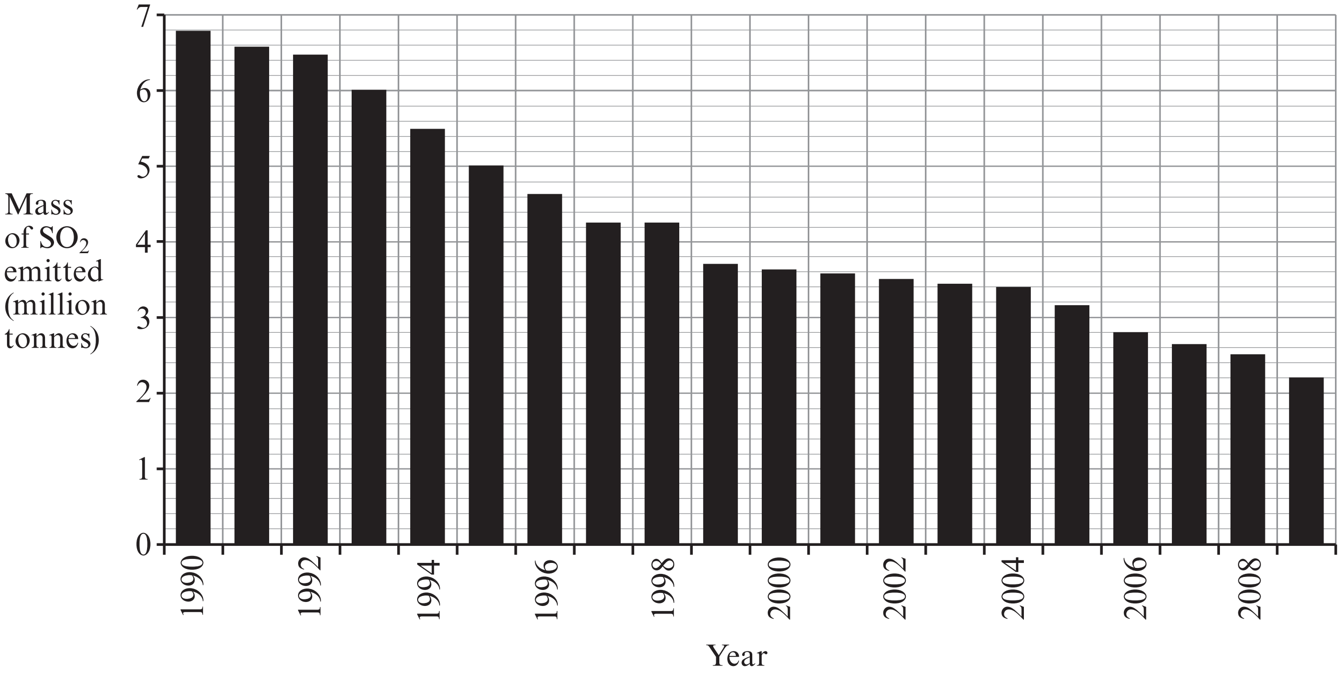
6. *(a)* The bar chart below shows the mass of sulfur dioxide emitted each year in the UK between 1990 and 2009.



(i) Describe the trend in sulfur dioxide emissions between 1990 and 2009. [1]

....

(ii) Calculate the % decrease in sulfur dioxide emissions between 2008 and 2009. Show your workings. [3]

....

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(b) (i) One significant source of acid rain is coal-burning power stations. Explain how burning coal results in the formation of acid rain. [3]

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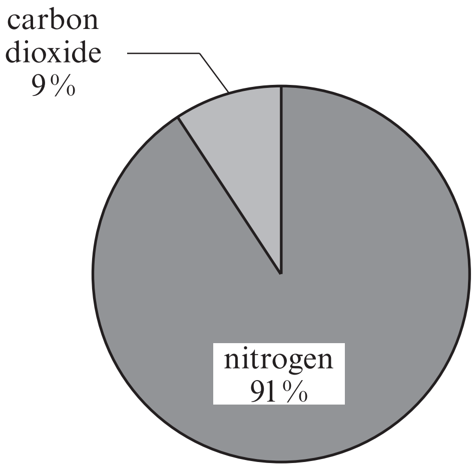
(ii) State **one** method of reducing sulfur dioxide emissions from coal-burning power stations. [1]

....

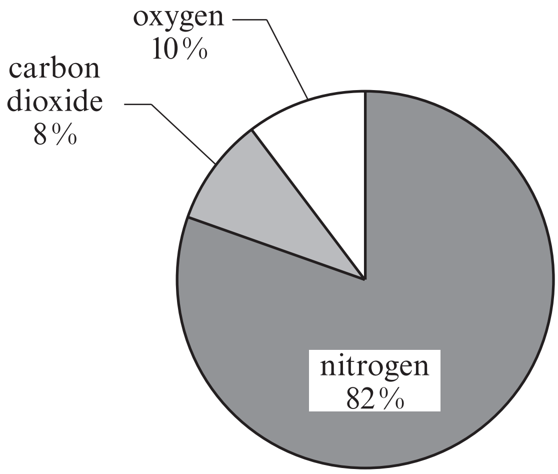
8

Examiner only

7. *(a)* The pie charts below show the composition of the Earth's atmosphere at 3000 million and 2000 million years ago.



Composition of the Earth's atmosphere 3000 million years ago



Composition of the Earth's atmosphere 2000 million years ago

Describe how the percentages of carbon dioxide and oxygen have changed between 3000 million and 2000 million years ago. State and explain the reasons for these changes. [3]

....

....

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....

(b) State the percentages of nitrogen, oxygen and carbon dioxide present in the atmosphere today. [2]

nitrogen .... %

oxygen .... %

carbon dioxide .... %

5

Examiner only

8. *(a)* Aqueous solutions of sodium carbonate, sodium chloride and sodium hydroxide are stored in three bottles labelled **A**, **B** and **C**, but not necessarily in that order.

A class of pupils was instructed to carry out the following procedures on each solution.

Procedure 1: Add three drops of universal indicator solution. Record the colour and pH.

Procedure 2: Add dilute hydrochloric acid. Record observations including any temperature change.

The results of one pupil are shown below.

Sodium solution	Procedure 1	Procedure 2
A	navy blue / pH 10	bubbles formed, temperature increase of 9 °C
B	purple / pH 14	no bubbles formed, temperature increase of 6 °C
C	green / pH 7	no bubbles formed, no temperature change

(i) Use the information above to identify solutions **A**, **B** and **C**. [2]

A is ....

B is ....

C is ....

(ii) Fill in the boxes to balance the symbol equation below. [1]

$$Na_2CO_3 \quad + \quad \square \; HCl \longrightarrow \square \; NaCl \quad + \quad H_2O \quad + \quad CO_2$$

(b) Use the table of formulae of common ions on the inside of the back cover of this examination paper to write the formula of copper(II) nitrate. [1]

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4

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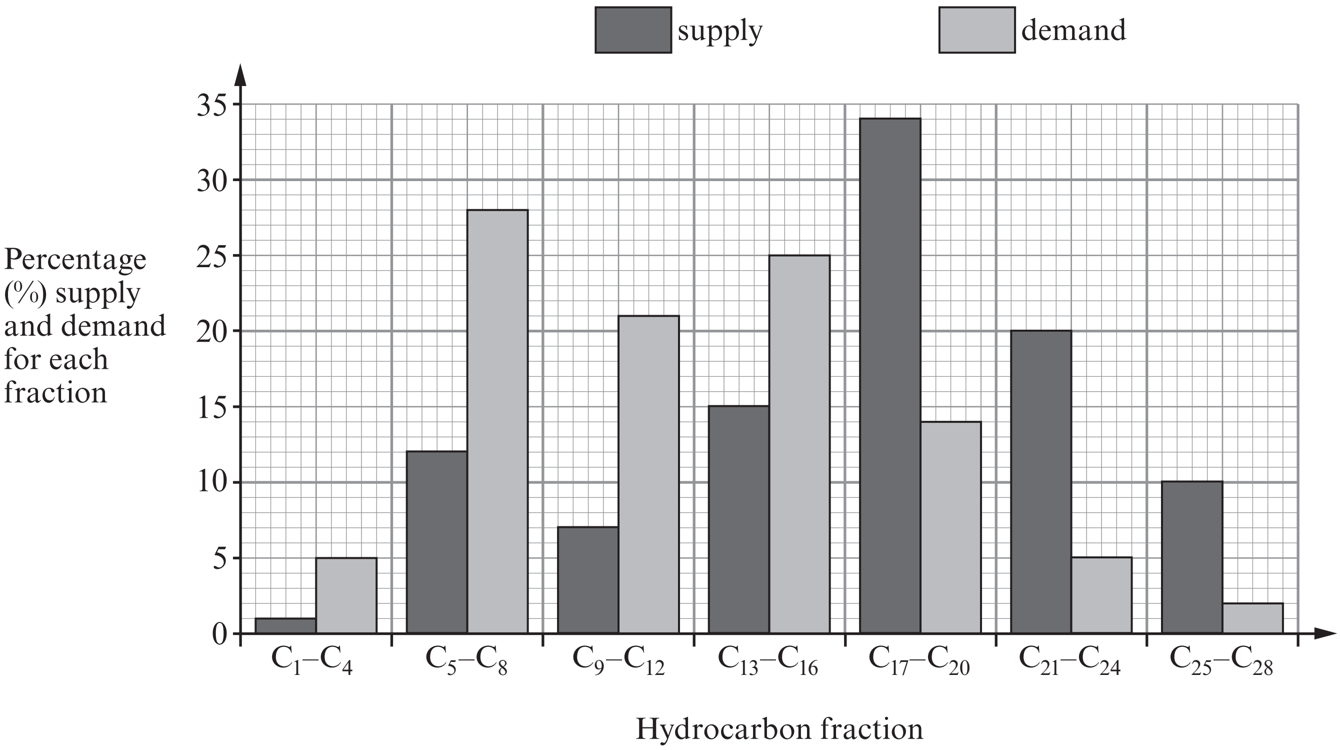
9. Crude oil is a mixture of hydrocarbon compounds. Crude oil can be separated into simpler mixtures called fractions. Each fraction contains hydrocarbons of similar chain lengths.

The bar chart below shows the relative ‘supply’ and ‘demand’ for some fractions.



Use the bar chart to help you answer parts *(a)* and *(b)*.

(a) Describe how the **difference** between *supply* and *demand* for each fraction changes as chain length increases. [2]

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(b) Oil companies have developed a process called cracking.
State the meaning of the term *cracking* and give the reason why it is an important process. [2]

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4

Examiner only

10. During the electrolysis of molten aluminium oxide, aluminium ions travel to the cathode and oxide ions travel to the anode.

(a) The melting point of aluminium oxide is 2000 °C. Cryolite is added to lower this value to 950 °C. State why reducing the melting point of the electrolyte reduces the cost of the process. [1]

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(b) Give the reason why the ions move to the electrodes during electrolysis. [1]

....

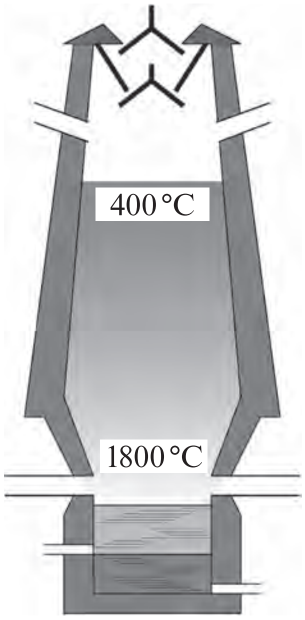
(c) Fill in the boxes to balance the anode equation. [1]

$$\square\ O^{2-} \quad - \quad \square\ e^{-} \longrightarrow O_2$$

3

Examiner only

11. The diagram below shows the blast furnace used to extract iron from its ore.



Outline the industrial extraction of iron from its ore. [6 QWC]

In your answer you should refer to the

- raw materials
- main reactions taking place
- products formed

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:

Mass number → A

X ← Element Symbol

Atomic number → Z

Name