Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4462/01

S16-4462-01

SCIENCE A/CHEMISTRY

CHEMISTRY 1
FOUNDATION TIER

A.M. FRIDAY, 17 June 2016

1 hour

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

4462 010001

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.
Do not use gel pen or correction fluid.

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. If you run out of space, use the additional page at the back of the booklet, taking care to number the question(s) correctly.

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 question **10**.

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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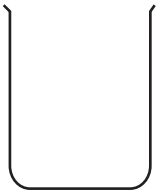
Answer **all** *questions.*

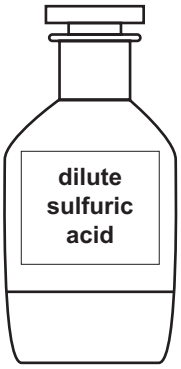
1. The chemicals and apparatus needed to prepare crystals of copper(II) sulfate are shown below.

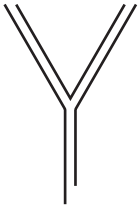
evaporating basin

stirring rod

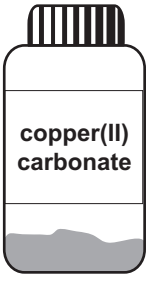


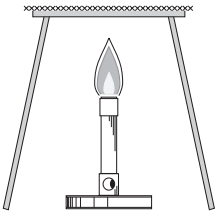
beaker





filter funnel
and paper





tripod, gauze and
Bunsen burner

Examiner only

There are three stages to the preparation of copper(II) sulfate crystals.

(a) Using the chemicals and apparatus shown on the opposite page, draw diagrams to show how each stage would be carried out. [3]

Stage **1**

Reacting copper(II) carbonate with dilute sulfuric acid until no more dissolves

Stage **2**

Removing unreacted copper(II) carbonate

Stage **3**

Obtaining crystals of copper(II) sulfate

4462 010003

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(b) Name the process described in Stage **2**. ..... [1]

(c) Choose substances from the box to complete the **word** equation for the reaction taking place. [1]

carbon dioxide	**hydrogen**	**copper(II) sulfate**
water	**copper(II) chloride**	

copper(II) carbonate + sulfuric acid ⟶ ..... + ... + ...

5

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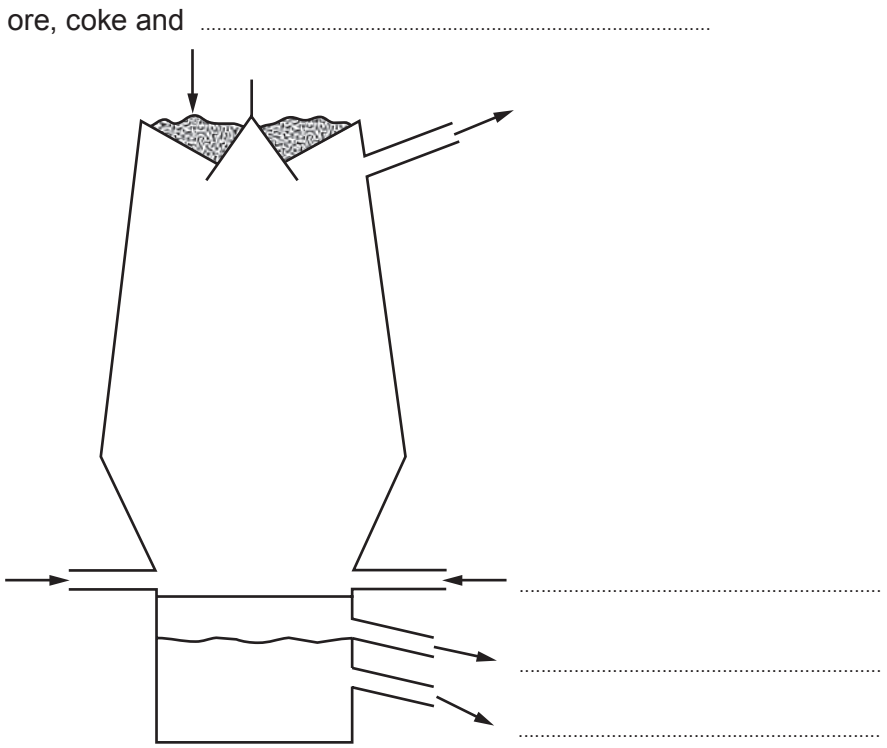
2. The diagram below shows where materials enter and leave the blast furnace. The labelling is incomplete.



hot air	**coke**	**iron**	**iron ore**
limestone	**slag**	**steel**	**waste gases**

Choose materials from the box to answer parts *(a)* and *(b)*.

(a) Fill in the blanks on the diagram. [4]

(b) Complete the sentences below.

(i) The furnace is heated by burning ..... in ..... . [1]

(ii) Impurities are removed by reacting them with .....

to form ..... . [1]

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(*c*) Balance the symbol equation that represents the main reaction occurring in the furnace. [1]

$$Fe_2O_3 + \square\,CO \longrightarrow 2Fe + 3CO_2$$

(*d*) 2000 tonnes of iron ore contains 1100 tonnes of iron. Calculate the percentage of iron in the ore. [2]

Percentage of iron = ... %

9

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3. *(a)* In 1912 Alfred Wegener suggested that all the continents must once have been joined together as one big mass.

Diagrams **A**-**D** show the position of the Earth's continents at different times during the last 225 million years.

A

B

C

D

Put the **letters** of the diagrams in the correct order on the timeline below. [1]

225 million years ago .....

150 million years ago .....

100 million years ago .....

today .....

(b) Describe **two** pieces of evidence that Wegener used to support his theory of continental drift. [2]

1. .....

2. .....

Examiner only

(c) Wegener's idea was finally accepted in 1960 and led to the modern theory of plate tectonics.

Which of the following events is likely to occur at a boundary where two plates **slide past** each other? [1]

earthquake	**tsunami**	**volcanic eruption**

.....

4

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4. *(a)* Crude oil is a mixture of compounds called hydrocarbons, which can be separated into fractions.

The table below shows some information about the main fractions obtained.

Fraction	Boiling point range (°C)	Number of carbon atoms in the hydrocarbon chains
refinery gases	−160 to 40	1-4
petrol	40 to 100	4-12
naphtha	100 to 150	7-14
paraffin	150 to 250	11-15
diesel oil	250 to 360	15-19

Use **only** the information in the table to answer parts (i)–(iii).

(i) Give the number of carbon atoms in the hydrocarbon chains found in both paraffin and diesel oil. [1]

.....

(ii) Name the fraction which contains the hydrocarbon with a boiling point of 69 °C. [1]

.....

(iii) Name the fraction which has the largest boiling point range. [1]

.....

(iv) Apart from carbon, name the other element present in all hydrocarbons. [1]

.....

Examiner only

(b) Plastics have replaced cast iron for making underground gas pipes.

Apart from cost, suggest **three** advantages of using plastics for underground gas pipes. [3]

.....

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7

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Turn over.

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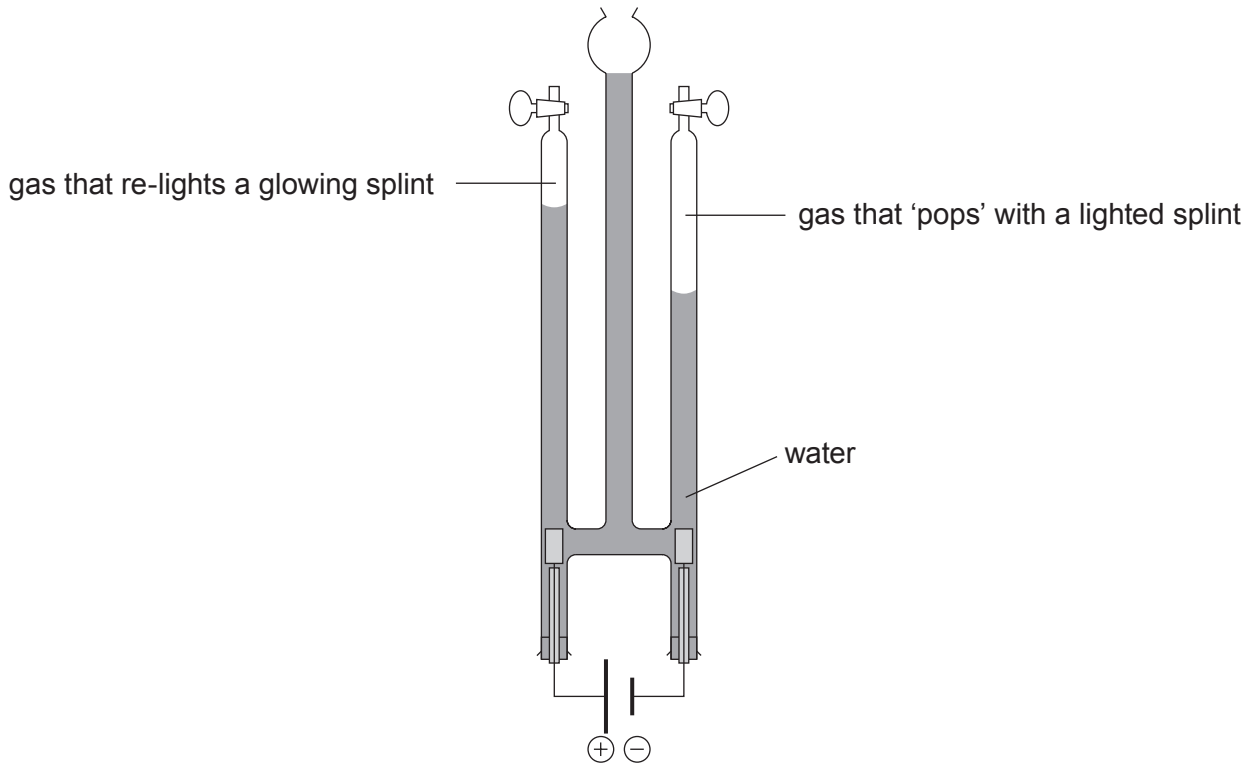
5. *(a)* The apparatus below was used to show the electrolysis of water.



Describe what the experiment tells you about water. [2]

.....

.....

.....

.....

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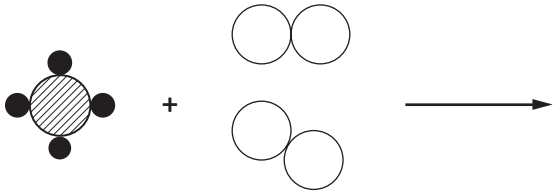
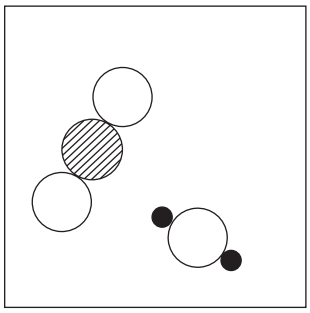
(b) Methane burns in air forming carbon dioxide and water. This reaction is represented by the symbol equation:

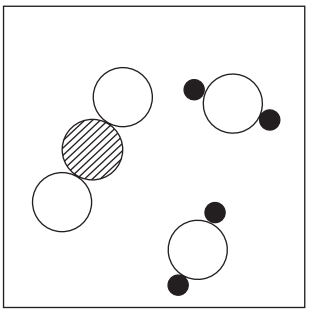
$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$



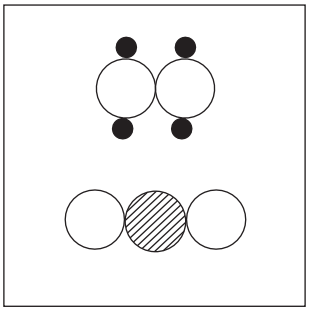
Choose the letter, **A**, **B**, **C** or **D**, which represents the products of this reaction. [1]



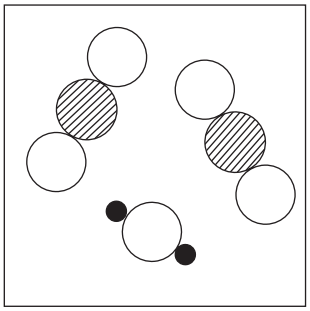
A



B



C



D

Letter .....

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3

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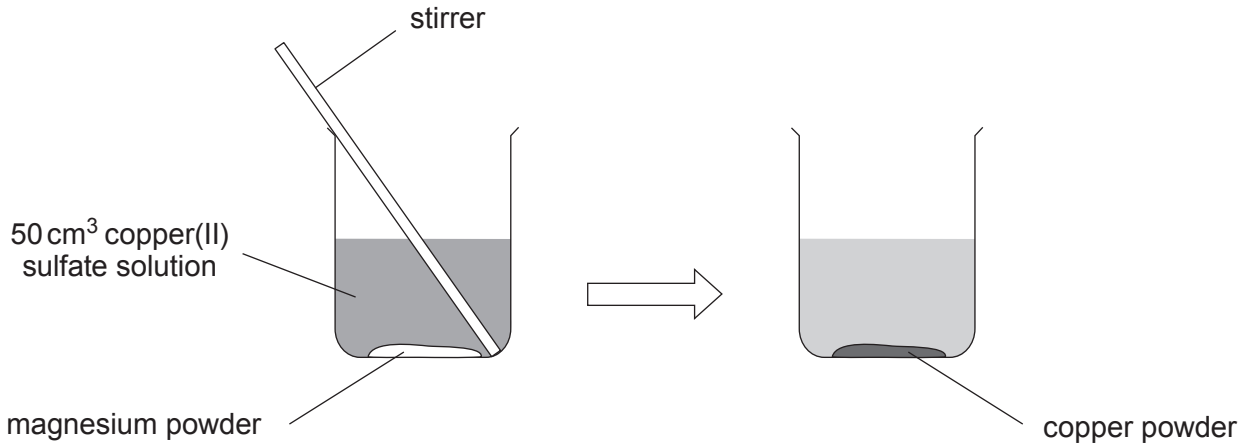
6. *(a)* A pupil investigated the mass of copper formed when magnesium powder was added to copper(II) sulfate solution.

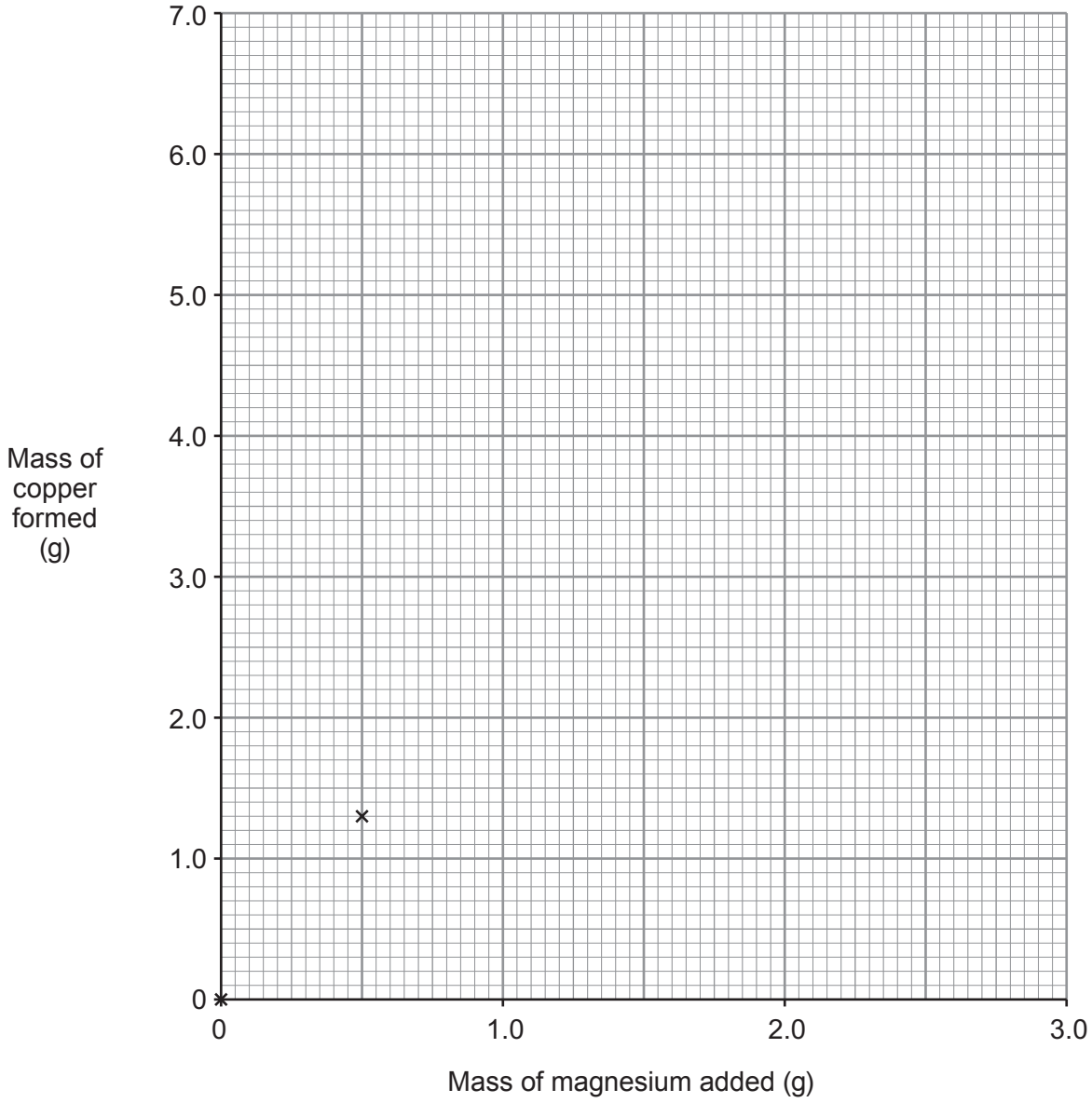


The results below show the mass of copper formed when different masses of magnesium powder were added to 50 cm^3 of copper(II) sulfate solution.

Mass of magnesium added (g)	Mass of copper formed (g)
0	0
0.5	1.3
1.0	2.6
1.5	4.0
2.0	5.3
2.5	6.7

(i) Plot the results from the table on the grid opposite and draw a suitable line. Two points have been plotted for you. [3]

Examiner only



(ii) Use the graph to find the mass of magnesium needed to form 5.0 g of copper. [1]

Mass of magnesium = ... g

(iii) Copper is obtained by filtering and then washing. State what else must be done to the copper before weighing. [1]

.....

(iv) Complete the equation for the reaction taking place by adding the symbols / formulae of the products. [1]

$Mg + CuSO_4 \longrightarrow$ ..... + ...

Examiner only

(b) When copper is added to a colourless silver nitrate solution a grey solid and a blue solution are formed.

Use this and the information in part *(a)* to place copper, magnesium and silver in order of reactivity.

Explain your reasoning. [2]

Most reactive .....

.....

Least reactive .....

Explanation .....

.....

.....

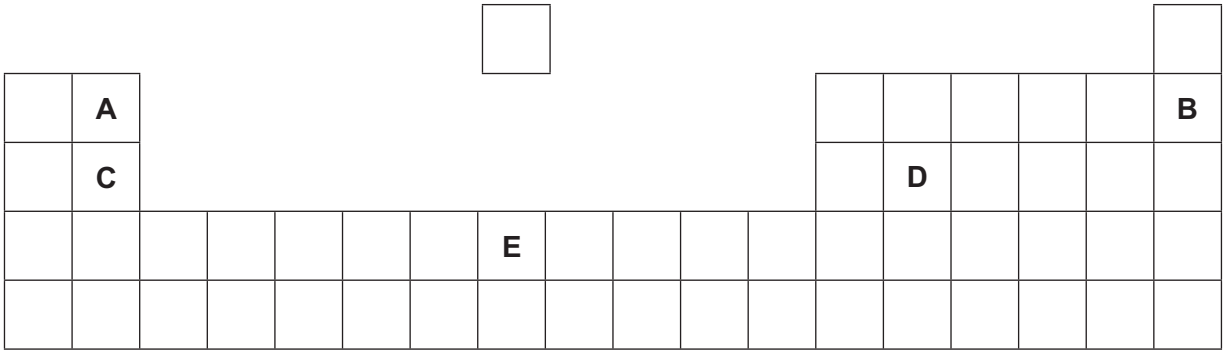
.....

8

Examiner only

7. *(a)* The following diagram shows an outline of the Periodic Table.

The letters shown are NOT the chemical symbols of the elements



(i) Give the group and period of the element labelled **C**. [2]

Group ..... Period .....

(ii) Give the **letter** of the element which has **both** metallic and non-metallic properties. Give the reason for your choice. [2]

Letter .....

Reason .....

.....

(b) (i) The chemical formula of aluminium nitrate is $Al(NO_3)_3$. Give the number of nitrogen atoms in the formula $Al(NO_3)_3$. [1]

.....

(ii) Give the chemical formula of lithium carbonate. [1]

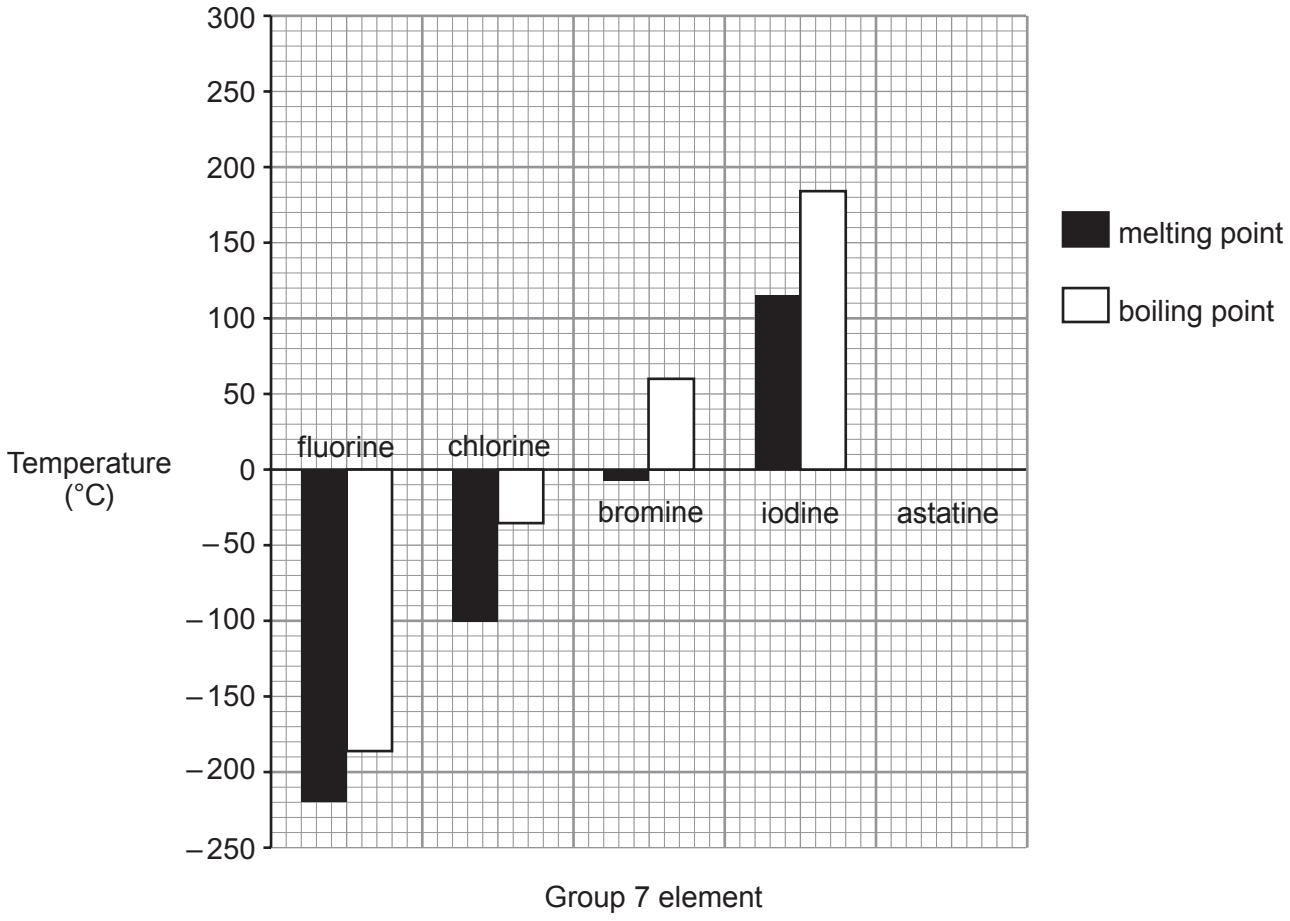
.....

6

Turn over.

Examiner only

8. The bar charts below show the melting points and boiling points of Group 7 elements.



Use the information in the bar charts to answer parts *(a)*-*(d)*.

(a) Describe the trend, if any, in the melting point going down the group. [1]

.....

(b) Name the element which has the **lowest** melting point. [1]

.....

(c) Using the same key, draw bars on the grid above to predict the approximate values for the melting point **and** boiling point of astatine. [2]

(d) Give the name of the element which is **liquid** at −70 °C. [1]

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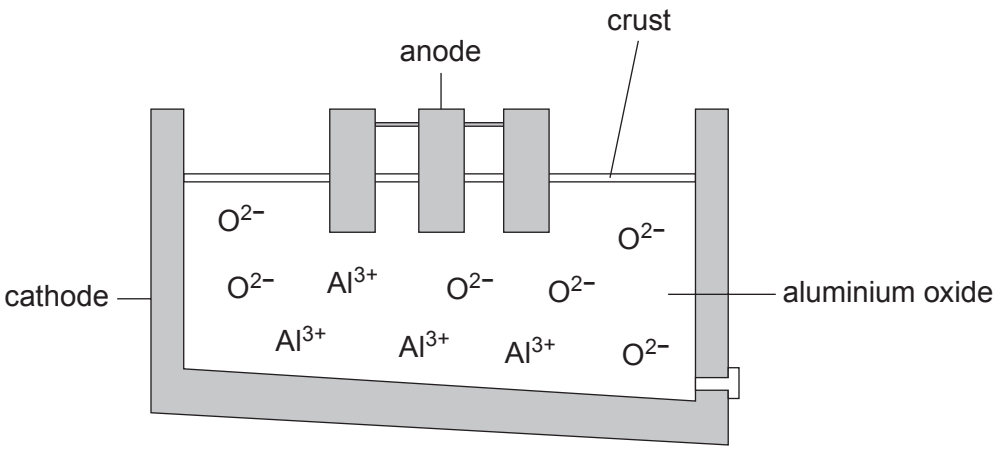
9. *(a)* The diagram below shows an electrolysis cell used in the extraction of aluminium.



(i) Give the state (solid, liquid or gas) of the aluminium oxide during this process. [1]

.....

(ii) Explain the movement of Al^{3+} and O^{2-} ions during the process. [3]

.....

.....

.....

.....

(b) State **one** property of aluminium that is **unusual** compared to most other metals. Give a use which relies on this property. [1]

Property .....

Use .....

Examiner only

(c) Scandium is added to aluminium alloys to increase their strength.

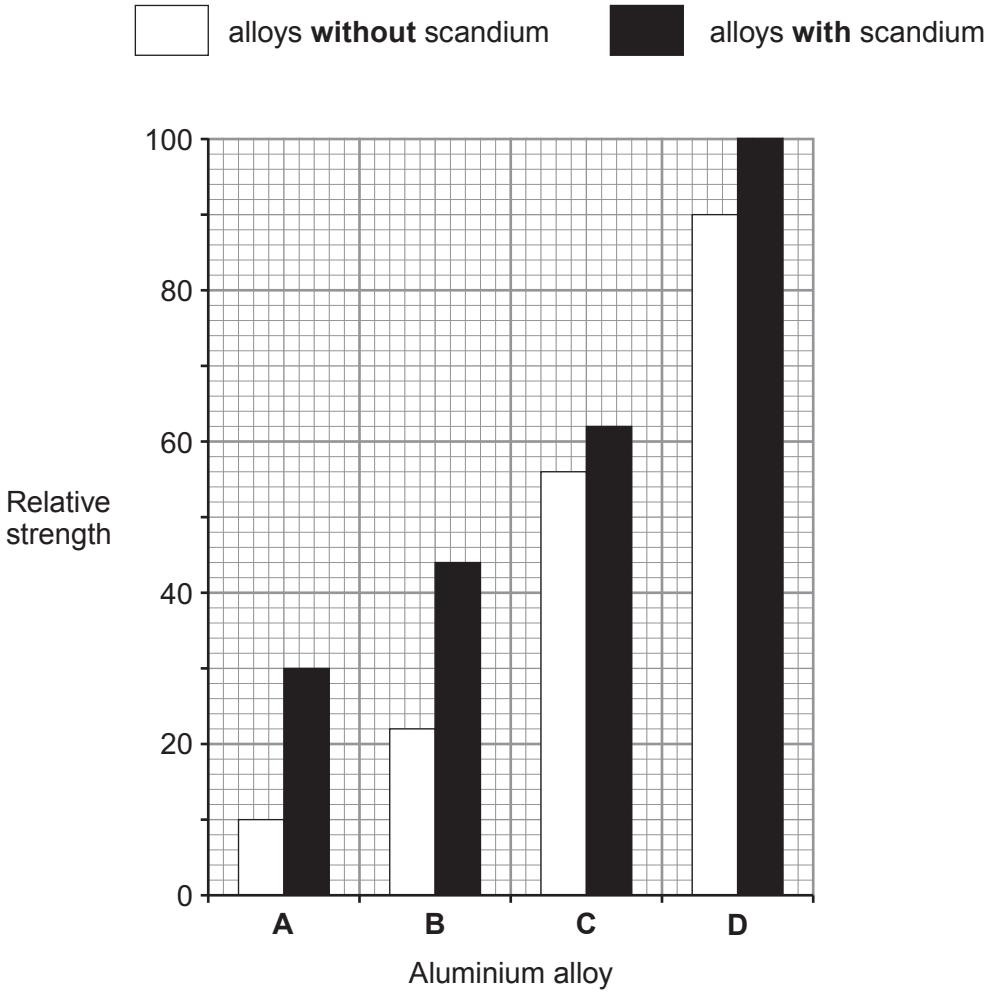
The graph below shows the relative strength of aluminium alloys, **A**-**D**, with and without added scandium.

Give the **letter** of the aluminium alloy where the relative strength is **increased** by 100 % when scandium is added. Use data from the graph to explain your choice. [2]

Letter .....

Reason .....

.....



7

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10. Describe the benefits and drawbacks associated with the **recycling** of plastic household waste. [6 QWC]

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6

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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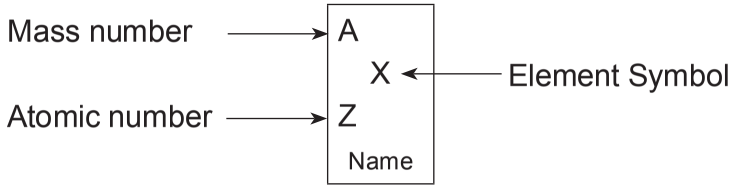
FORMULAE FOR SOME COMMON IONS

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
																	$^{4}_{2}$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:



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