Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4462/02

SCIENCE A/CHEMISTRY

CHEMISTRY 1
HIGHER TIER

A.M. THURSDAY, 12 June 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**4**	
3.	**7**	
4.	**6**	
5.	**6**	
6.	**5**	
7.	**11**	
8.	**4**	
9.	**4**	
10.	**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.
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(s) 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 questions **4** and **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. *(a)* The table below shows some properties of three elements in the Periodic Table.

Element	Melting point (°C)	Boiling point (°C)	Appearance	Malleable or brittle?	Electrical conductivity
aluminium	660	2519	shiny solid	malleable	good
silicon	1414	3265	shiny solid	brittle	semiconductor
phosphorus	44	280	white solid	brittle	poor

Describe how the information in the table shows that silicon is difficult to classify as a metal or a non-metal. [2]

.....

.....

.....

(b) Give the **symbol** of the element which is found in Group 2 and Period 3 of the Periodic Table. [1]

.....

(c) (i) The chemical formula of copper(II) nitrate is $Cu(NO_3)_2$. Give the number of nitrogen atoms in the formula $Cu(NO_3)_2$. [1]

.....

(ii) Give the chemical formula of silver oxide. [1]

.....

(d) Nano-scale silver particles are added to socks to reduce the effects of smelly feet. Recent research has found that these particles can easily leak into waste water during washing.

(i) State the property of nano-scale silver particles that makes them useful in socks.

..... [1]

(ii) Suggest a reason why some scientists are concerned about nano-scale silver particles entering waste water. [1]

.....

.....

7

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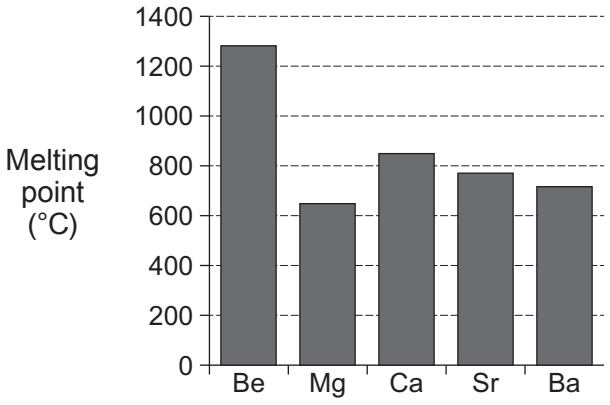
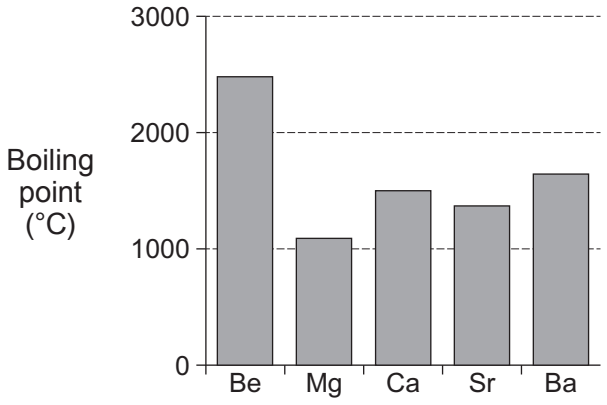
2. *(a)* The graphs below show the melting points and boiling points of Group 2 elements.





Use the information in the graphs to describe the trends, if any, in the melting point and boiling point of Group 2 elements. [2]

Melting point .....

.....

Boiling point .....

.....

(b) The table below describes the reactions of Group 2 elements when added to cold water.

Group 2 Element	Reaction when added to cold water
beryllium	no reaction
magnesium	very slow reaction
calcium	fairly vigorous reaction
strontium	very fast reaction

Barium lies below strontium in Group 2. State, giving a reason, how you would expect barium to react with cold water. [2]

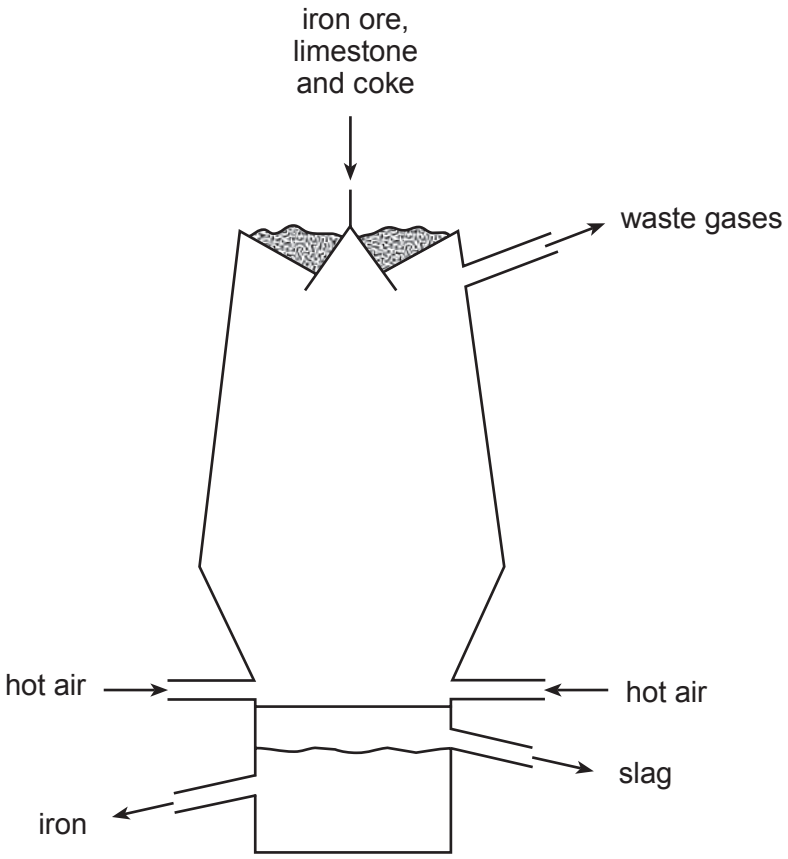
.....

.....

4

Examiner only

3. *(a)* Iron is extracted in the blast furnace. Iron ore, limestone, coke and hot air are the raw materials.



(i) Give the reason for adding each of the following to the furnace:

I coke; [1]

.....

II limestone. [1]

.....

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

Fe_2O_3 + ☐ CO ⟶ ☐ Fe + ☐ CO_2

II Give the chemical name of the substance which is reduced in the furnace. [1]

.....

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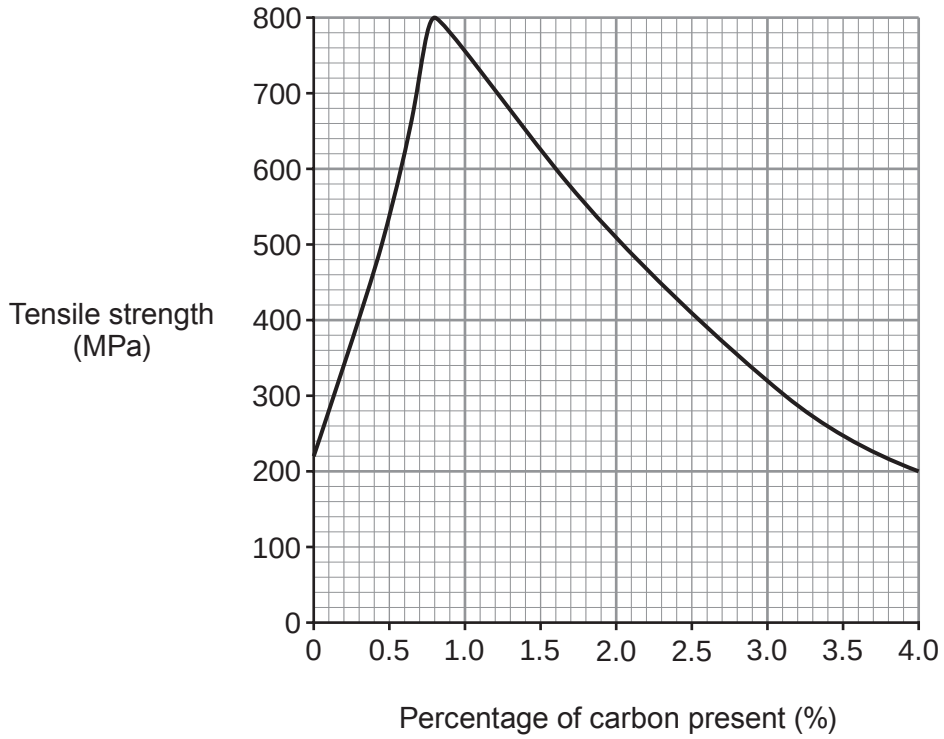
(b) The graph below shows how the tensile strength of iron alloys changes with the percentage of carbon present.



(i) Describe how the tensile strength changes as the percentage of carbon present increases. [2]

.....

.....

(ii) The table below shows the percentage of carbon present in some iron alloys.

Alloy of iron	Percentage of carbon present in the alloy (%)
wrought iron	0.1
mild steel	0.3
high-carbon steel	0.9
cast iron	3.6

Use the information in the table and the graph to name the alloy which has the **lowest** tensile strength. [1]

.....

7

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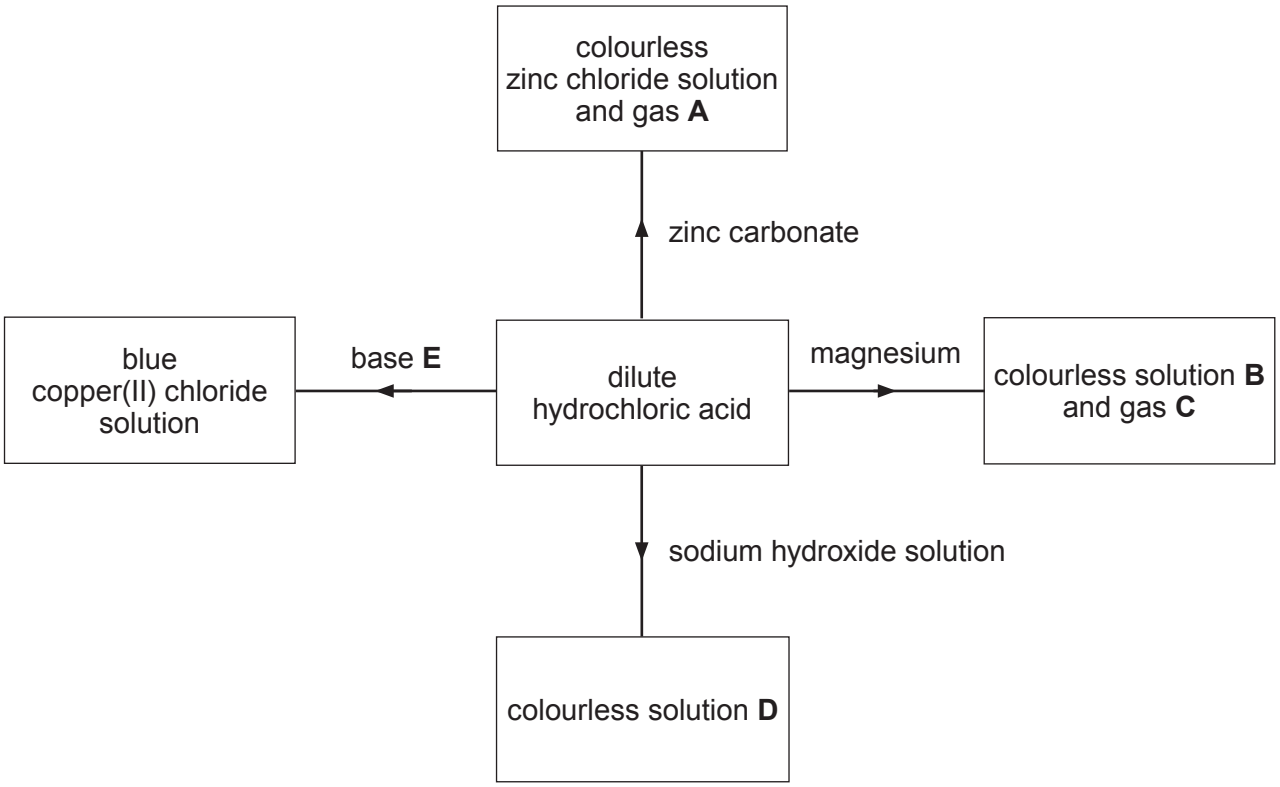
4. Explain, giving examples, why plastics have replaced traditional materials such as iron, glass and wood for making many everyday things. [6 QWC]

6

Examiner only

5. The diagram below shows some reactions of dilute hydrochloric acid.



(a) Give the names of each of the substances **A** to **E**. [5]

A .....

B .....

C .....

D .....

E .....

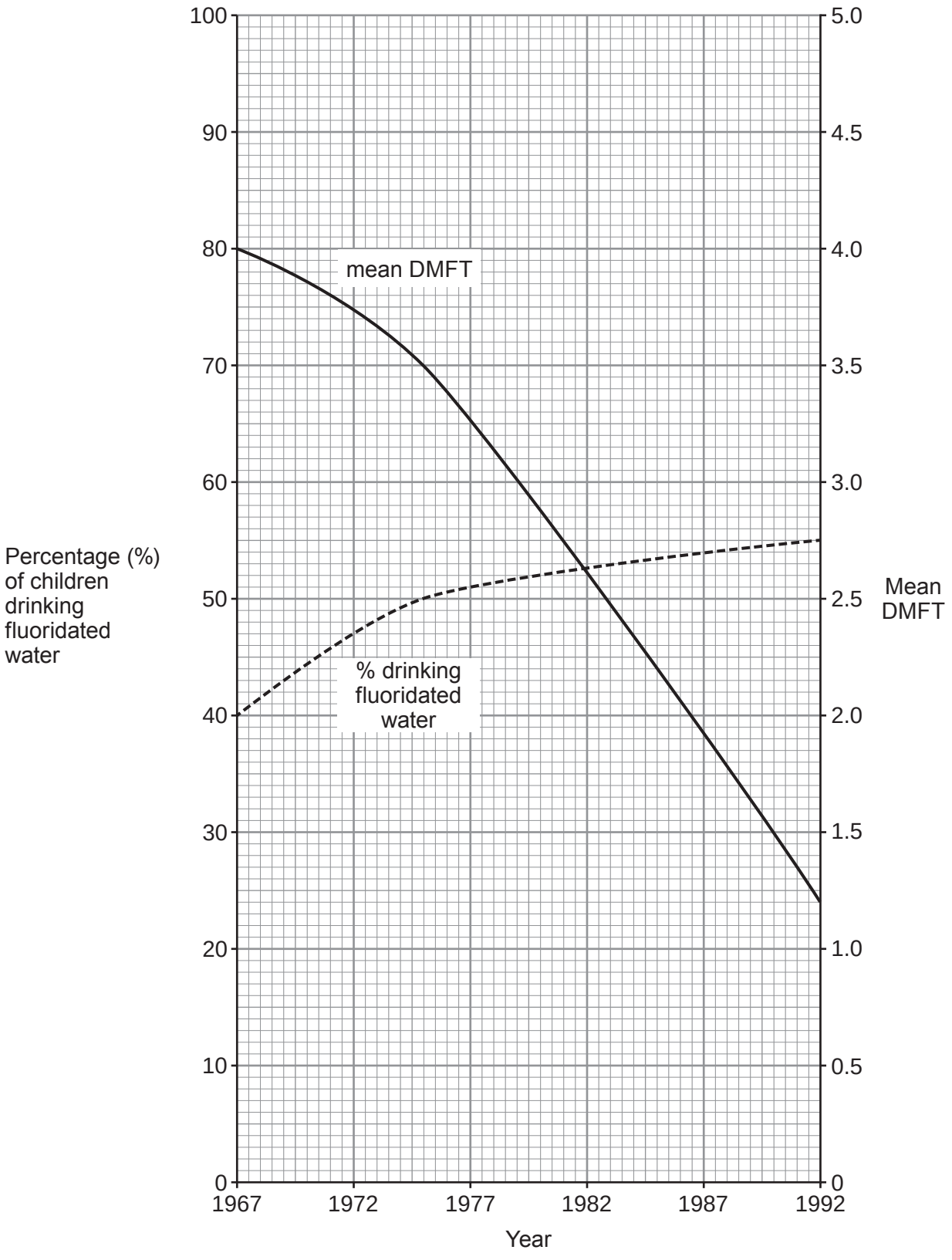
(b) Give the chemical formula of zinc chloride. [1]

.....

6

6. The graphs below show the results of research on the effect of water fluoridation on the teeth of children aged 12 years in the United States.

(DMFT = number of decayed, missing or filled teeth)



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(a) Calculate the percentage decrease in the mean DMFT between 1967 and 1992. [2]

Percentage decrease in the mean DMFT = ... %

(b) Apart from drinking water, give **one** *other* source of fluoride which could reduce tooth decay. [1]

.....

(c) In your opinion, do the advantages of the fluoridation of drinking water outweigh the disadvantages? Explain your reasoning. [2]

Opinion (**Yes** or **No**) .....

Explanation

.....

.....

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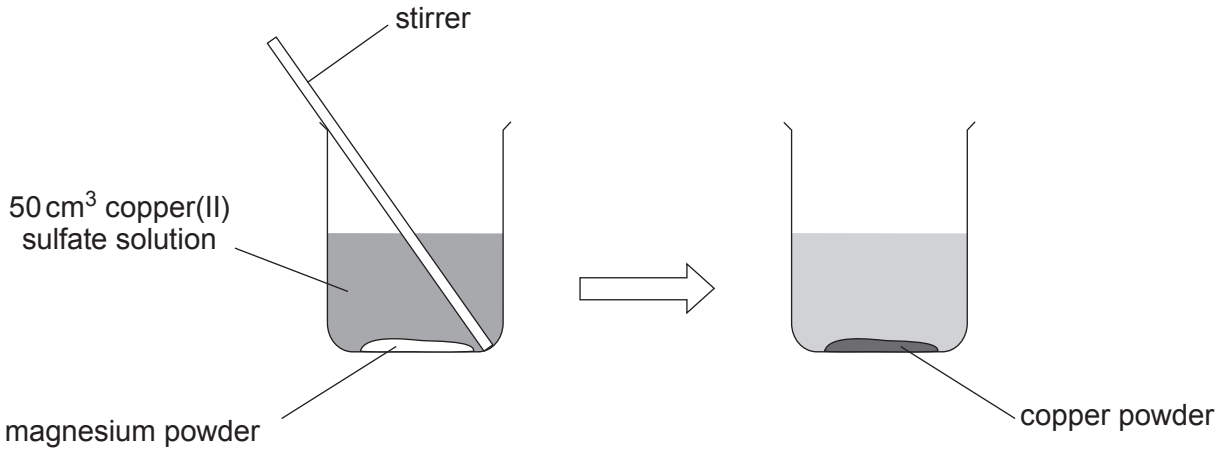
7. Three students individually investigated the mass of copper formed when increasing amounts of magnesium powder were added to 50 cm^3 of copper(II) sulfate solution.



- Each pupil added 0.10 g of magnesium to 50 cm^3 of copper(II) sulfate solution and stirred the mixture until no more magnesium remained.
- They filtered, dried and weighed the copper formed.
- They repeated the experiment using 0.15, 0.20 and 0.25 g of magnesium powder and a new 50 cm^3 of copper(II) sulfate solution each time.
- The results are shown below.

Mass of magnesium added (g)	Mass of copper formed (g)			
	Student **A**	Student **B**	Student **C**	Mean
0.10	0.15	0.10	0.17	0.14
0.15	0.25	0.21	0.23	0.23
0.20	0.37	0.36	0.32	0.35
0.25	0.37	0.42	0.38	0.39

The graph opposite shows the masses of copper that **should** be formed.

(a) On the same grid plot the mean mass of copper formed against the mass of magnesium added. Draw a suitable line. [3]

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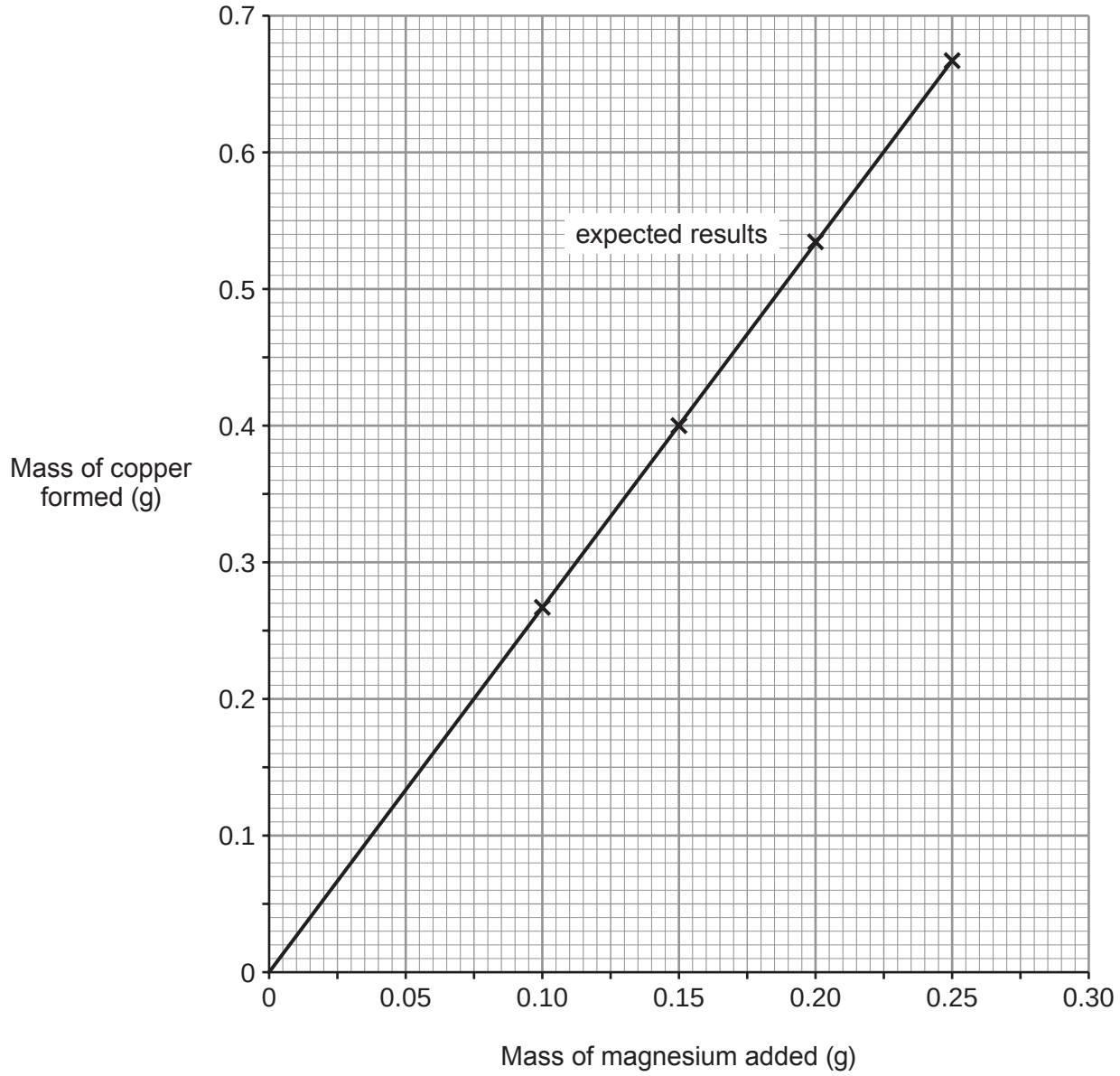


(b) Describe the **main** difference between the expected graph and the one plotted using the experimental results. [1]

.....

(c) Suggest **two** possible reasons for the difference in the graphs. [2]

.....

.....

.....

.....

Examiner only

(d) On Anglesey there is a large copper mine called Parys Mountain. Unwanted rock from the mining process has been dumped forming waste tips. As rainwater passes through the waste tips it dissolves copper salts. One of the salts is copper(II) sulfate.

During the 18th century large shallow pits were dug all over the mountain. These filled with rainwater. Scrap iron was placed into the water and after a few months the pits were drained and a copper-rich solid sludge was collected.

Explain the reaction taking place in the pits. [3]

.....

.....

.....

.....

(e) Copper is a good electrical conductor and is therefore used to make electrical wiring. Give a **different** property of copper and **one** use which relies on this property. [2]

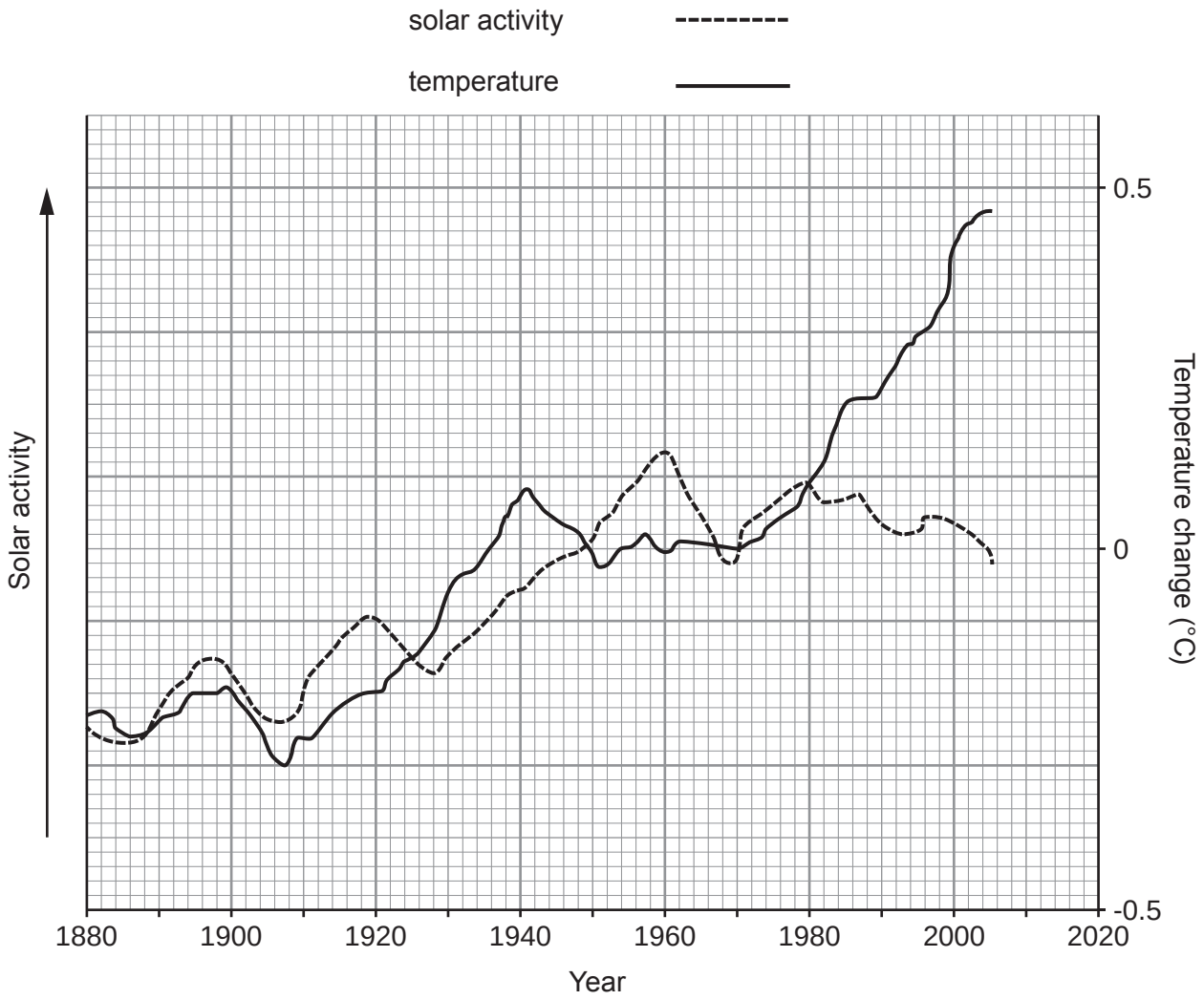
Property .....

Use .....

11

Examiner only

8. *(a)* A small minority of scientists believe that it is changes in solar activity (i.e. changes in the brightness and warmth of the sun) that causes global warming. The graphs below show the changes in solar activity and atmospheric temperature since 1880.



Using the information from the graphs, state how well the evidence supports the argument that solar activity is the cause of global warming. [2]

.....

.....

(b) Most scientists believe the main cause of global warming is the increase in carbon dioxide levels in the atmosphere.

(i) State the **main** cause of this increase in carbon dioxide levels. [1]

.....

(ii) Describe **one** method of reducing current atmospheric carbon dioxide levels. [1]

.....

4

Examiner only

9. The table below shows the relative *'supply of'* and *'demand for'* some fractions obtained from a sample of crude oil from the North Sea.

Fraction	% mass of fraction	
	In crude oil *(supply of)*	Market demand *(demand for)*
C_1-C_4	2	5
C_5-C_8	12	28
C_9-C_{12}	7	20
C_{13}-C_{16}	15	25
C_{17}-C_{20}	35	15
C_{21}-C_{24}	19	5
C_{25}+	10	2

(a) Give a reason why market demand for the C_5-C_8 fraction is high. [1]

.....

(b) The supply of the C_5-C_8 fraction is less than the market demand. Explain how oil companies overcome this problem. [2]

.....

.....

.....

(c) One hydrocarbon found in the C_1-C_4 fraction is propane. Propane burns in air forming carbon dioxide and water.

Balance the symbol equation that represents this reaction. [1]

C_3H_8 + ☐ O_2 ⟶ ☐ CO_2 + ☐ H_2O

4

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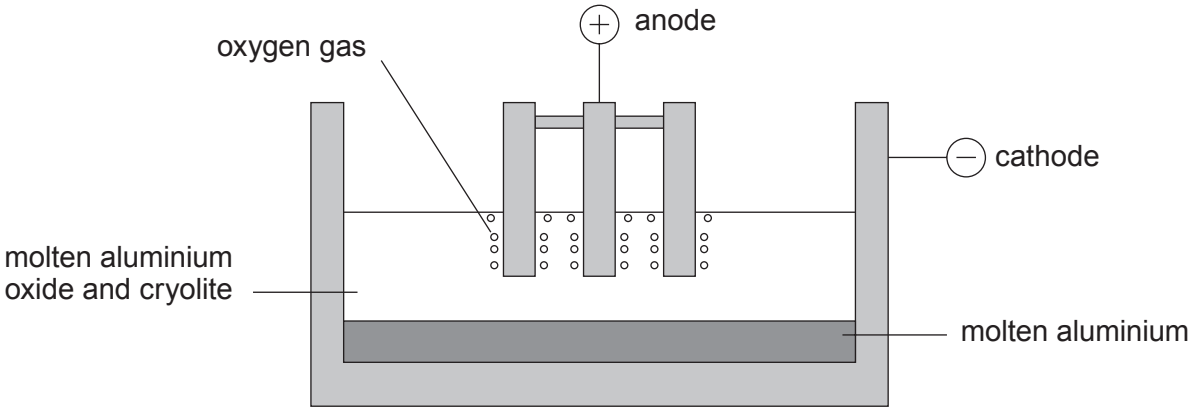
10. The diagram below shows an electrolysis cell used in the extraction of aluminium.



Outline the industrial extraction of aluminium. [6 QWC]

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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
								$^{1}_{1}$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: