GCSE

4462/02

SCIENCE A/CHEMISTRY

CHEMISTRY 1
HIGHER TIER

A.M. THURSDAY, 12 June 2014

1 hour

Suitable for Modified
Language Candidates

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	

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.

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

How does the information in the table show that silicon is difficult to classify as a metal or a non-metal? [2]

....

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....

(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) Why are some scientists concerned about nano-scale silver particles entering waste water? [1]

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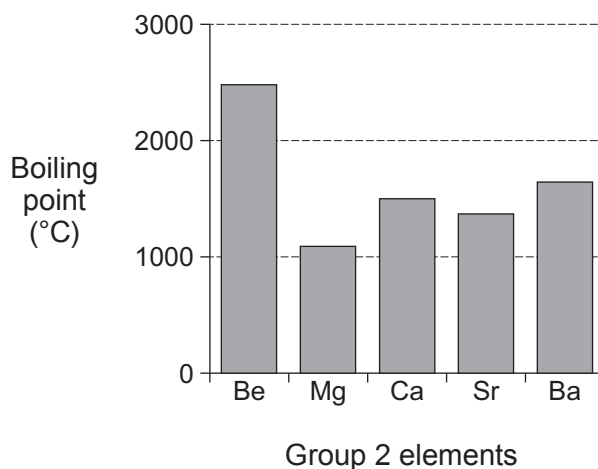
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2. *(a)* The graphs below show the melting points and boiling points of Group 2 elements.
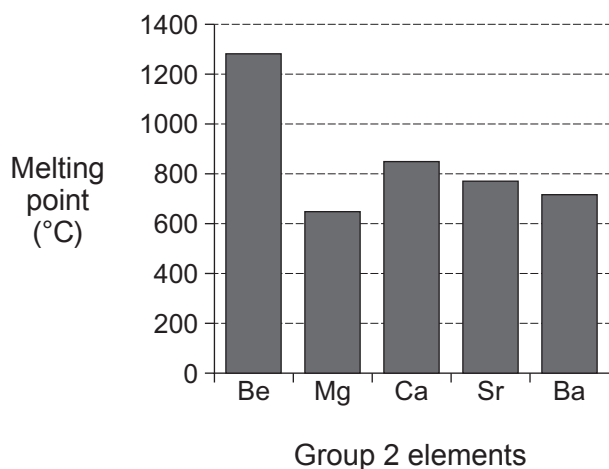
Use the information in the graphs. Describe the trends, if any, in the melting point and boiling point of Group 2 elements. [2]

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. How would you expect barium to react with cold water? Give a reason for your answer. [2]

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4

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

iron ore,
limestone
and coke

waste gases

hot air →

← hot air

slag

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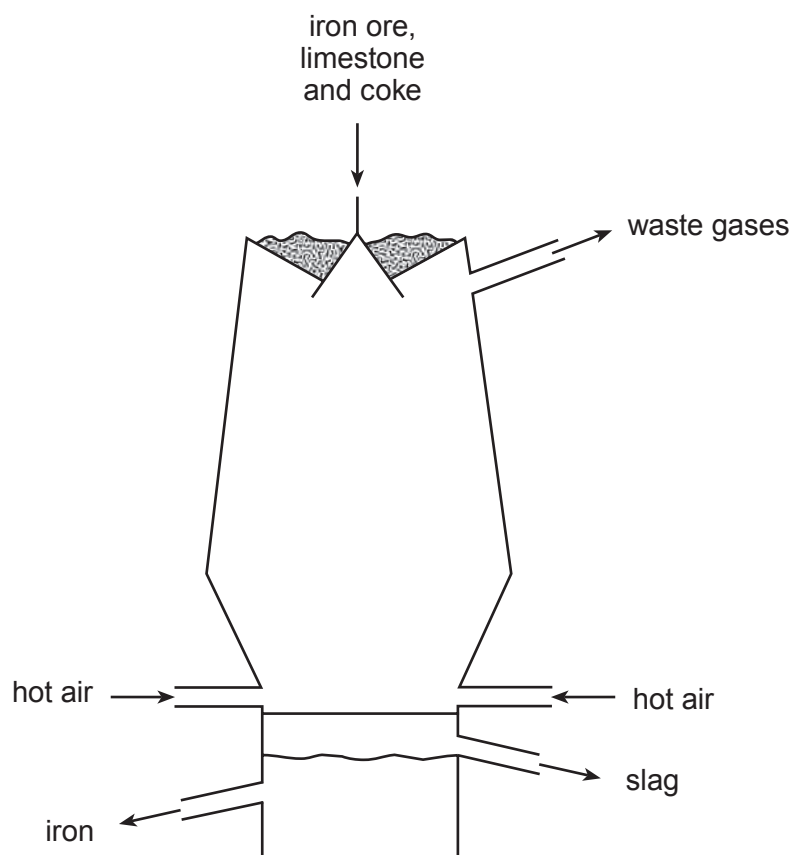
(i) Give the reason for adding each of the following to the furnace:

 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]

....

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

Percentage of carbon present (%)
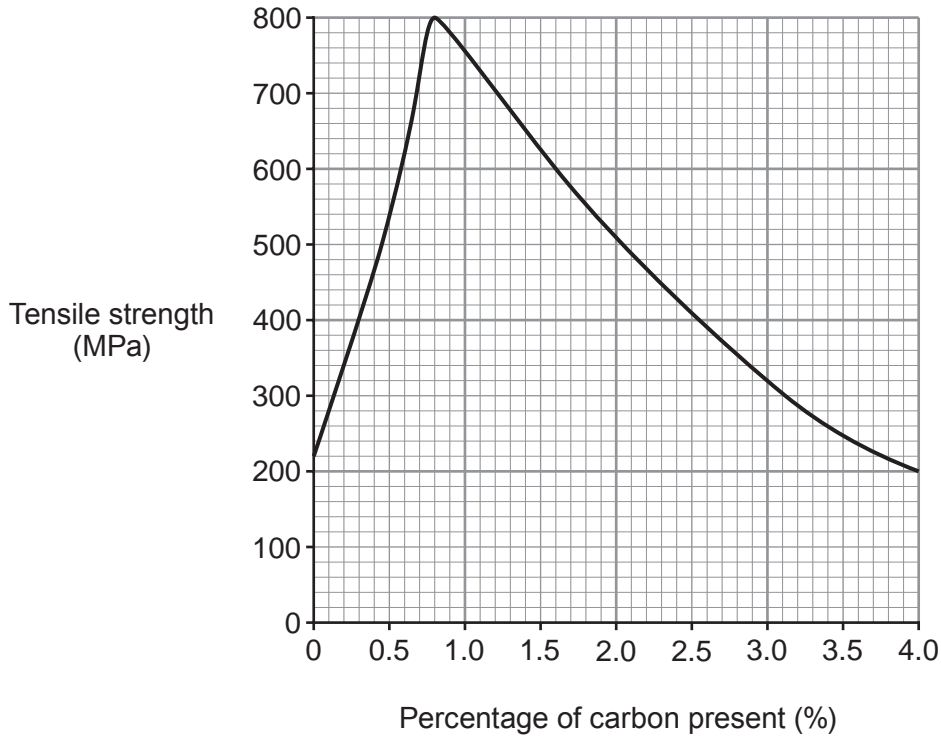
(i) How does the tensile strength change as the percentage of carbon present increases? [2]

....

....

(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. Name the alloy which has the **lowest** tensile strength. [1]

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7

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

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6

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

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                    ┌─────────────────────┐
                    │     colourless      │
                    │ zinc chloride solution │
                    │     and gas A       │
                    └─────────────────────┘
                              ↑
                         zinc carbonate

┌──────────────┐   base E   ┌──────────────┐   magnesium   ┌──────────────────┐
│     blue     │ ←───────── │    dilute    │ ──────────→   │ colourless solution B │
│ copper(II) chloride │     │ hydrochloric acid │          │     and gas C     │
│   solution   │           │              │               └──────────────────┘
└──────────────┘           └──────────────┘
                              │
                     sodium hydroxide solution
                              ↓
                    ┌─────────────────────┐
                    │ colourless solution D │
                    └─────────────────────┘
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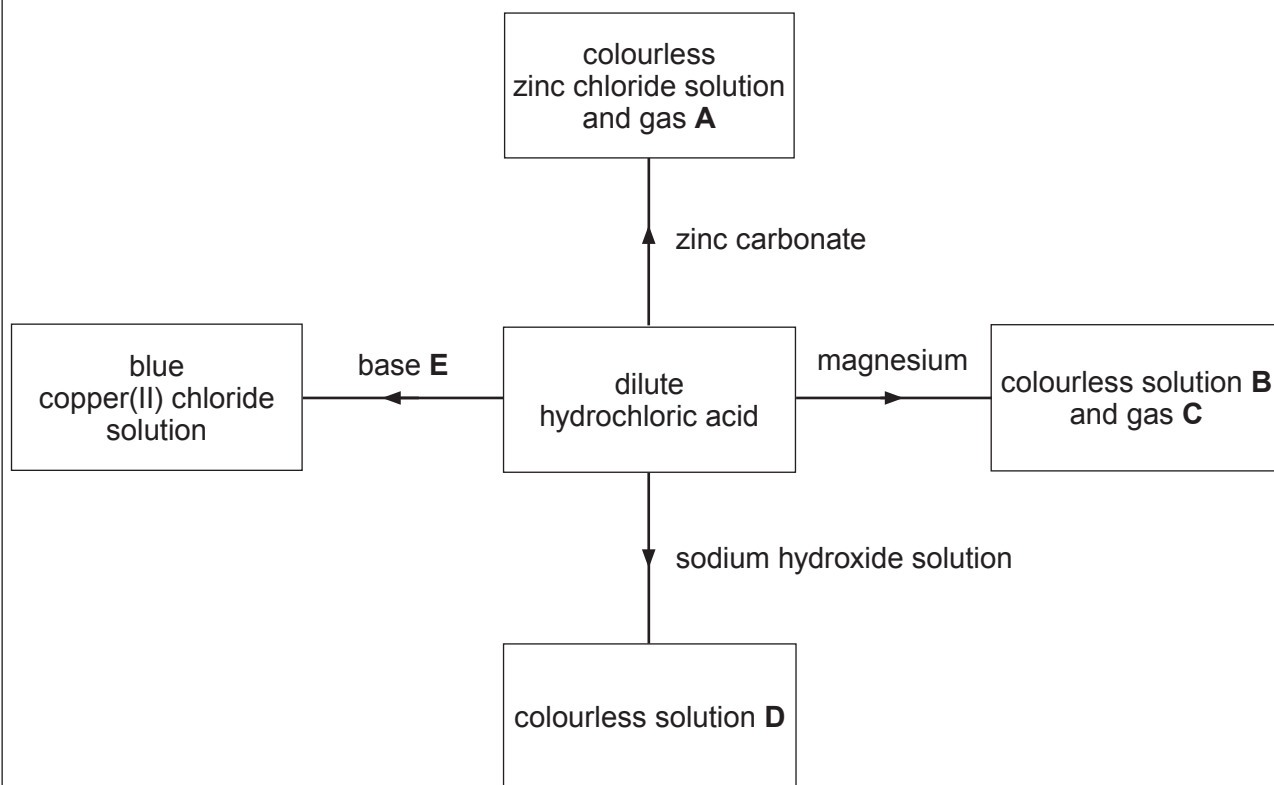
(a) Give the names of each of the substances **A** to **E**. [5]

A ....

B ....

C ....

D ....

E ....

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

....

Turn over.

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)

Percentage (%) of children drinking fluoridated water

Mean DMFT

Year

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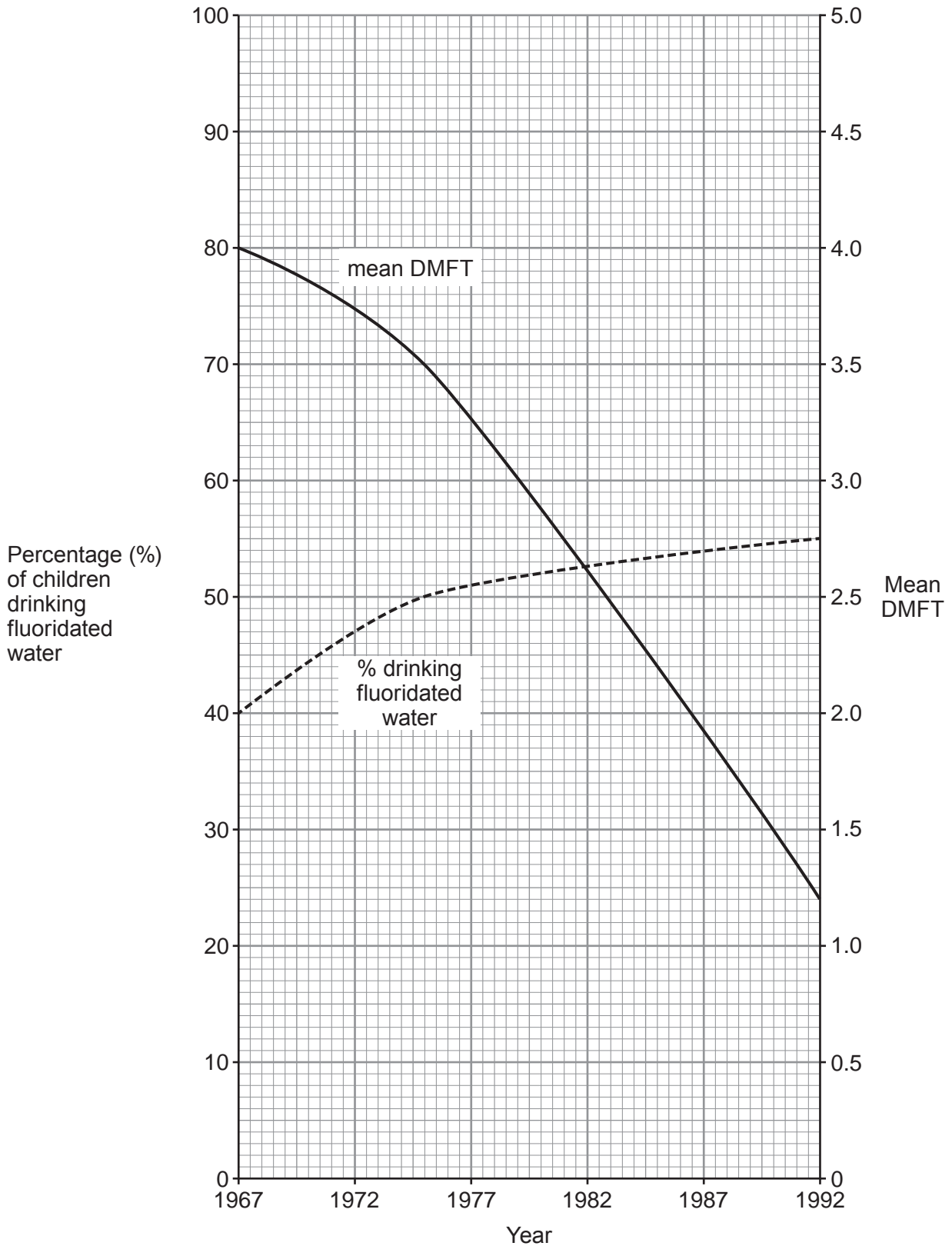
(a)   Calculate the percentage decrease in the mean DMFT between 1967 and 1992.   [2]

Percentage decrease in the mean DMFT = ... %

(b)   Give **one** *other* source of fluoride which could reduce tooth decay. Do not use drinking water as your answer.   [1]

....

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

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

Explanation

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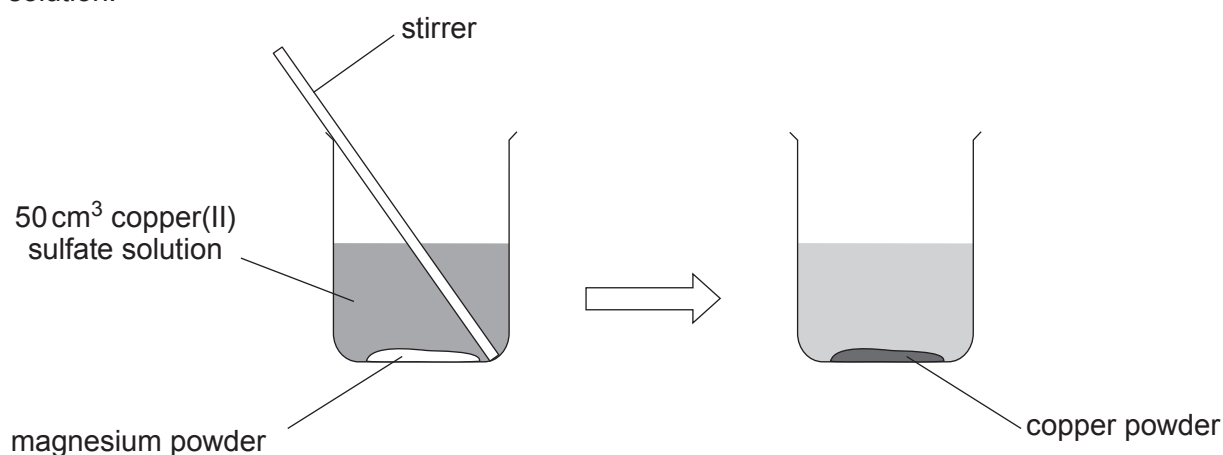
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7. Three students **A**, **B** and **C** did an experiment. They investigated the mass of copper formed when increasing amounts of magnesium powder were added to $50\,cm^3$ of copper(II) sulfate solution.


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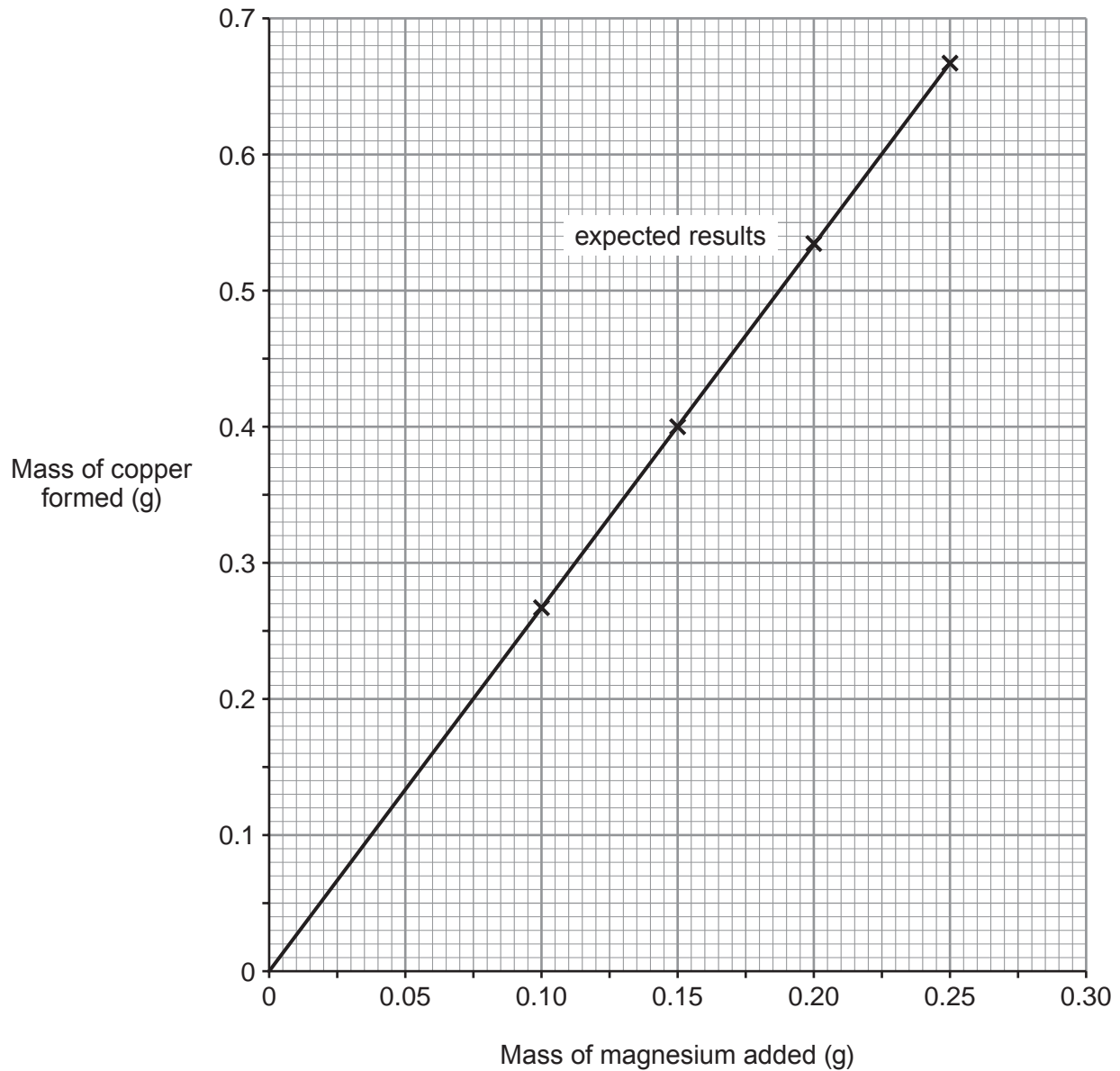
(b) Describe the **main** difference between the expected graph and the one plotted using the experimental results. [1]

....

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

....

....

....

....

(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.

In the past large shallow pits were dug all over the mountain. These filled with rainwater. Scrap iron was placed into the water. 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]

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....

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

Property ....

Use ....

11

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.

solar activity   - - - - - - - - -

temperature   —————
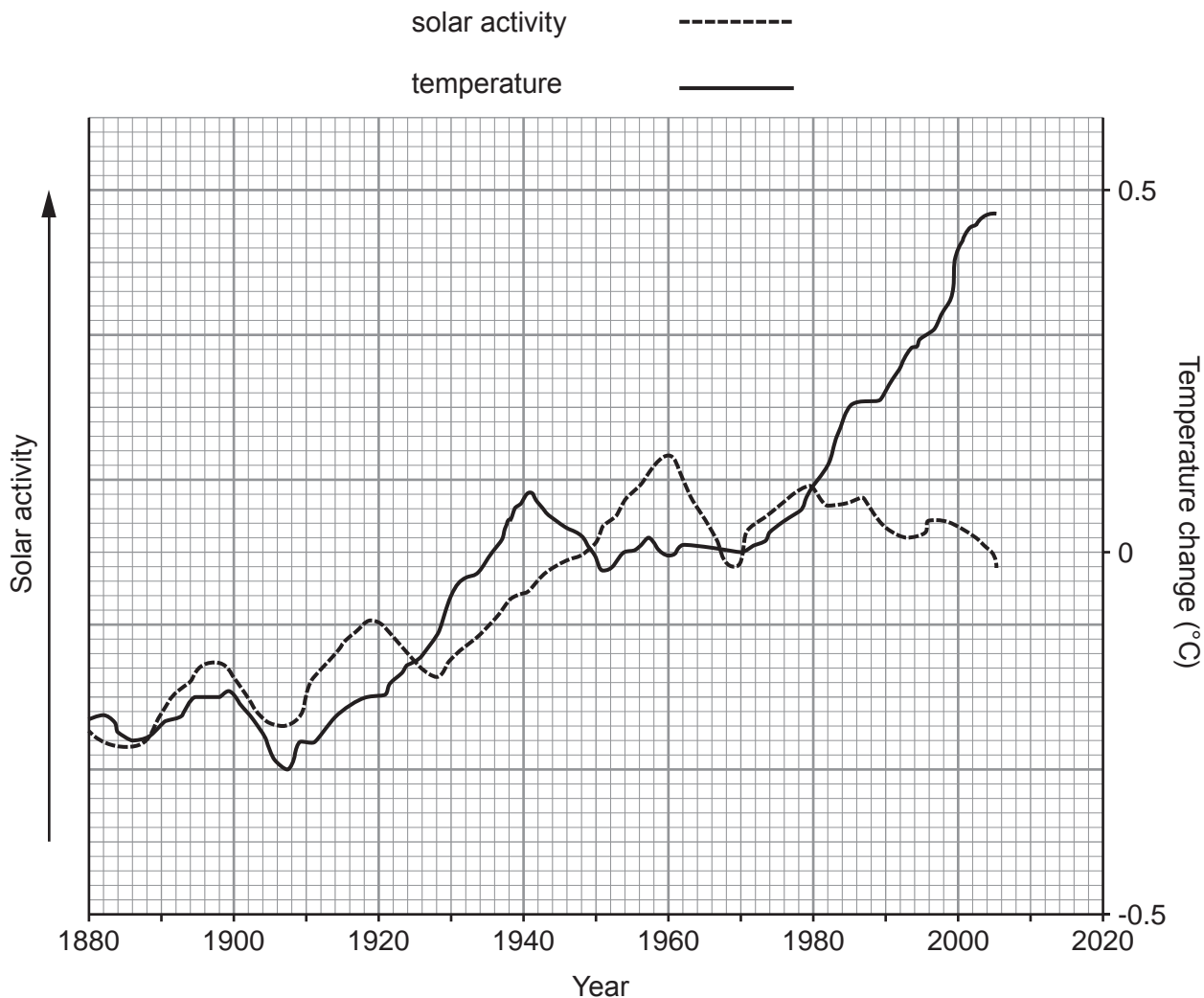
Use the information from the graphs. How well does the evidence support the argument that solar activity is the cause of global warming? [2]

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....

(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

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) Why is market demand for the C_5-C_8 fraction high? [1]

....

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

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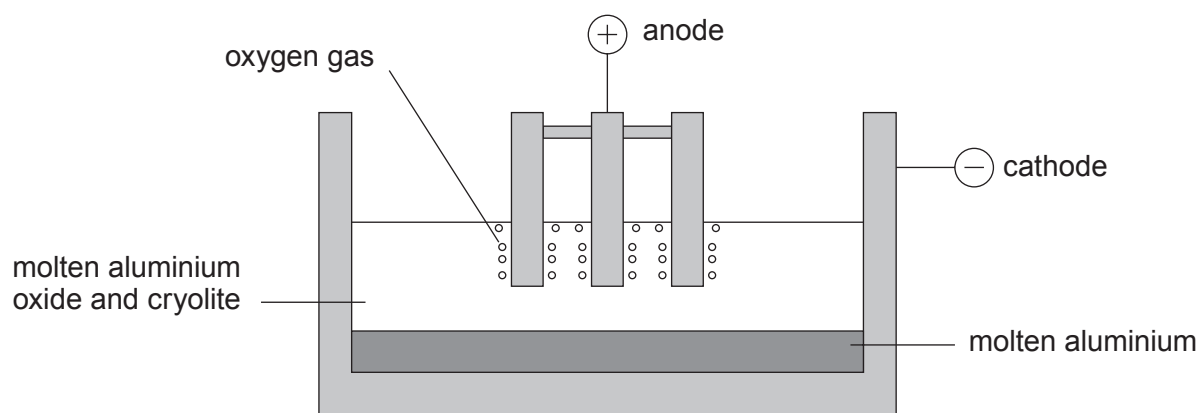
(c) One hydrocarbon found in the C_1-C_4 fraction is propane. Propane burns in air forming carbon dioxide and water.

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

C_3H_8 + ☐ O_2 ⟶ ☐ CO_2 + ☐ H_2O

4

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

oxygen gas

$+$ anode

$-$ cathode

molten aluminium
oxide and cryolite

molten aluminium

Outline the industrial extraction of aluminium. [6 QWC]

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END OF PAPER

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

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+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

Group

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

Key:

Mass number → A

Atomic number → Z

$^{A}_{Z}X$ ← Element Symbol

Name