| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4462/01

## SCIENCE A/CHEMISTRY

## CHEMISTRY 1
## FOUNDATION TIER

A.M. THURSDAY, 12 June 2014

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **5** | |
| **2.** | **6** | |
| **3.** | **6** | |
| **4.** | **3** | |
| **5.** | **5** | |
| **6.** | **4** | |
| **7.** | **7** | |
| **8.** | **7** | |
| **9.** | **4** | |
| **10.** | **7** | |
| **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.
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 question **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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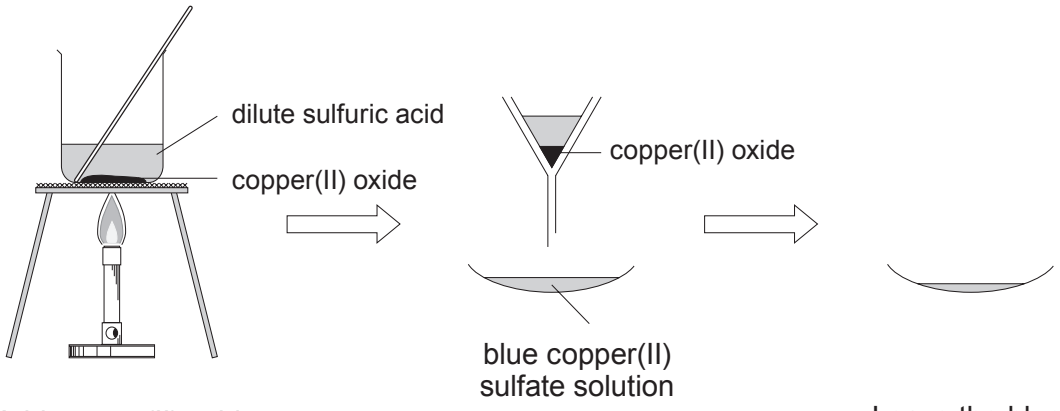
*Answer* **all** *questions.*

**1.** One method of preparing a salt is by reacting a base with a dilute acid. The information below shows the stages a pupil follows to make a salt.




Add copper(II) oxide to warm dilute sulfuric acid until **all** the acid has been used up, stirring continuously.

Stage **1**

Stage **2**

Leave the blue solution at room temperature for a few days.

Stage **3**

**Use the information in the diagrams to answer the following questions.**

*(a)* State what the pupil can see when **all** the acid has been used up. [1]

.....

*(b)* (i) Name the process used in stage **2**. [1]

.....

(ii) Name the substance removed during stage **3**. [1]

.....

*(c)* (i) Give the name of the **base** used in this experiment. [1]

.....

(ii) Give the name of the **salt** formed in this experiment. [1]

.....

5

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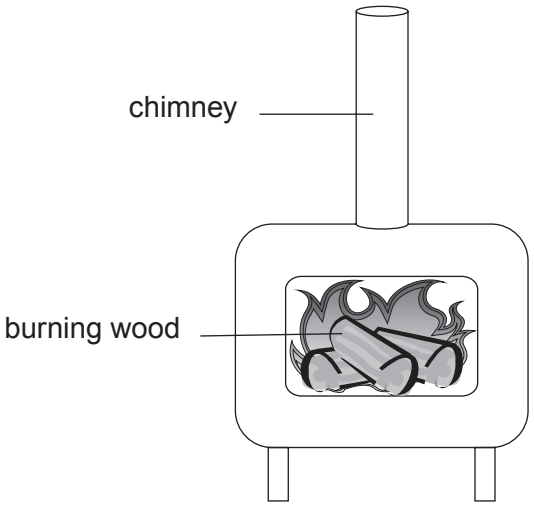
**2.** Wood burning stoves are a popular alternative to using oil or natural gas to heat homes. The diagram below shows the main products formed when wood burns.




**Main products**

**carbon, carbon dioxide, sulfur dioxide and water vapour**

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*(a)* Name the gas in the air that is needed for wood to burn. [1]

.....

*(b)* Choose from the list of the main products formed when wood burns

- the substance which causes acid rain, .....
- an element. ..... [2]

*(c)* Most scientists believe that increasing carbon dioxide levels in the atmosphere causes global warming. Explain why using wood as a fuel is said to be carbon-neutral. [3]

.....

.....

.....

.....

.....

6

Examiner only

**3.** *(a)* The box below contains some properties of aluminium.

| | |
|---|---|
| **low density** | **resists corrosion** |
| **good electrical conductor** | **good thermal conductor** |

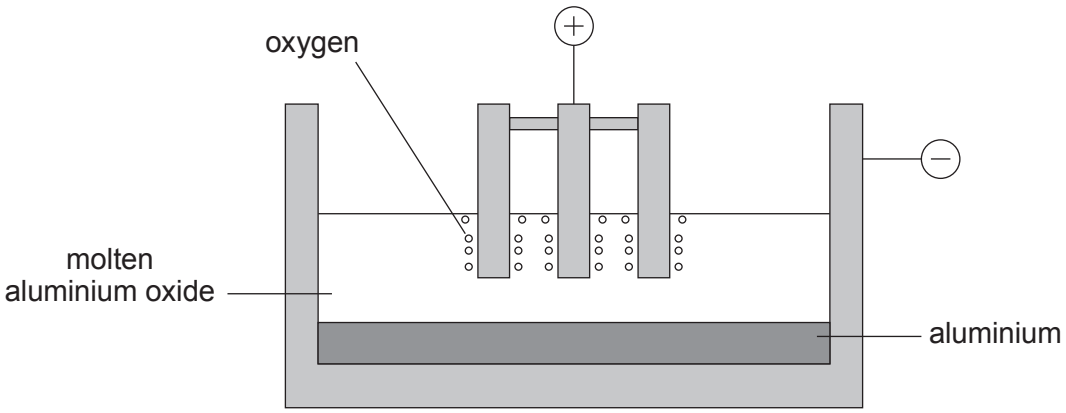
Window frames can be made from several materials including aluminium and iron. Choose **one** property from the box which makes aluminium a **better** material than iron for making window frames. Give a reason for your answer. [2]

*Property* .....

*Reason* .....

.....

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




(i) Which **negative ion** is attracted to the positive electrode? ..... [1]

(ii) Write a **word** equation for the overall reaction occurring. [1]

..... ⟶ ..... + .....

(iii) The temperature of the electrolysis cell is about 1000 °C. The melting point of aluminium is 660 °C.

Give the state (*solid*, *liquid* or *gas*) of the aluminium in the cell. [1]

.....

(iv) Give the **main** reason why this process is expensive. [1]

.....

6

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**4.** Seawater is an important raw material from which many different substances can be obtained. The table below shows the concentration (measured in g / kg of seawater) of the most abundant ions found in seawater.

| Ion | Concentration (g / kg of seawater) |
|---|---|
| lithium | 0.000174 |
| fluoride | 0.0013 |
| sodium | 10.77 |
| magnesium | 1.29 |
| chloride | 19.35 |
| potassium | 0.399 |
| calcium | 0.412 |
| bromide | 0.000067 |
| iodide | 0.0000005 |

**Use the information in the table to answer the following questions.**

*(a)* (i) Name the two **most** abundant ions in seawater. [1]

..... and .....

(ii) Give the **chemical formula** of the compound formed from these ions. [1]

.....

*(b)* Both chlorine and iodine were once obtained from seawater. Suggest why it is too expensive to use seawater as a source of iodine. [1]

.....

3

Examiner only

**5.** *(a)* The table below shows information about some of the fractions obtained from crude oil.

| Fraction | Boiling point range (°C) | Number of carbon atoms in the hydrocarbons |
|---|---|---|
| petrol | 40-100 | $C_4$-$C_{12}$ |
| naphtha | 100-150 | $C_7$-$C_{14}$ |
| paraffin (kerosene) | 150-250 | $C_{11}$-$C_{15}$ |
| diesel oil (gas oil) | 250-350 | $C_{15}$-$C_{19}$ |

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

(i) Pentane is a hydrocarbon found in crude oil and has the formula $C_5H_{12}$. Suggest a value for the boiling point of pentane. [1]

..... °C

(ii) Give the number of carbon atoms in the hydrocarbons found in both the paraffin and diesel oil fractions. [1]

.....

(iii) Give **one** piece of information from the table which shows that each fraction is a mixture. [1]

.....

*(b)* Propane, $C_3H_8$, is a hydrocarbon that burns in air forming carbon dioxide and water.

One more step is needed to balance the symbol equation that represents this reaction.

$$C_3H_8 + \boxed{?}\ O_2 \longrightarrow 3CO_2 + 4H_2O$$

Begin the last step by calculating the total number of oxygen atoms shown on the **right hand side** of the equation. [1]

*Number of oxygen atoms =* .....

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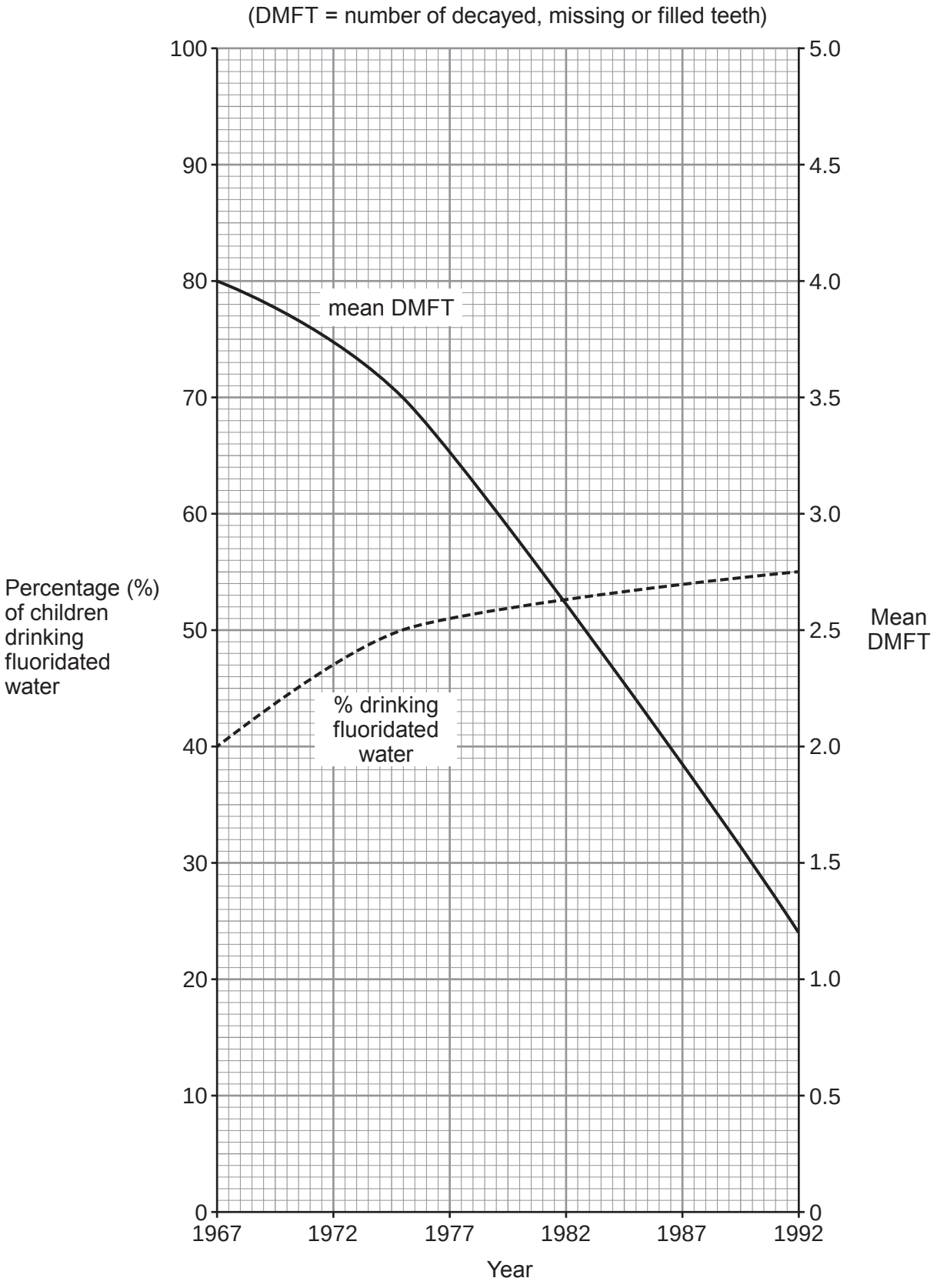
*(c)* Choose from the box below the term used for the process of breaking down long-chain hydrocarbons into smaller more useful ones. [1]

| **cracking** | **polymerisation** | **reduction** | **neutralisation** |
|---|---|---|---|

.....

5

**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.



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*(a)* Use the graph to find the decrease in the mean DMFT between 1967 and 1992. [1]

*Decrease in the mean DMFT =* .....

*(b)* Does the evidence from the graph support the following statement? Give a reason for your answer.

"Fluoridation of drinking water is responsible for the decrease in tooth decay among 12 year-olds." [1]

.....

.....

.....

*(c)* Give **two** reasons why some people oppose the fluoridation of drinking water. [2]

*Reason 1* .....

*Reason 2* .....

4

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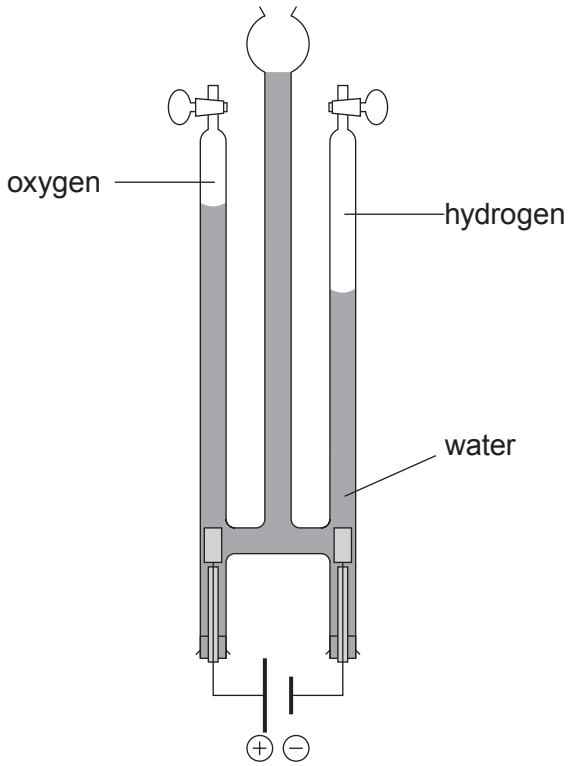
**7.** *(a)* The apparatus below is used to break down water into hydrogen and oxygen using an electric current.




(i) Name this process. ..... [1]

(ii) The table below shows the total volume of hydrogen formed over 10 minutes.

| Time (minutes) | 0 | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|
| Volume of hydrogen ($cm^3$) | 0 | 4 | 8 | 12 | 16 | 20 |

I Plot the results from the table on the grid opposite and draw a suitable line. **Label this line 'hydrogen'.** [2]

II Draw a second line on the grid to show the volume of oxygen that would be collected during the same 10 minutes. [2] **Label this line 'oxygen'.**

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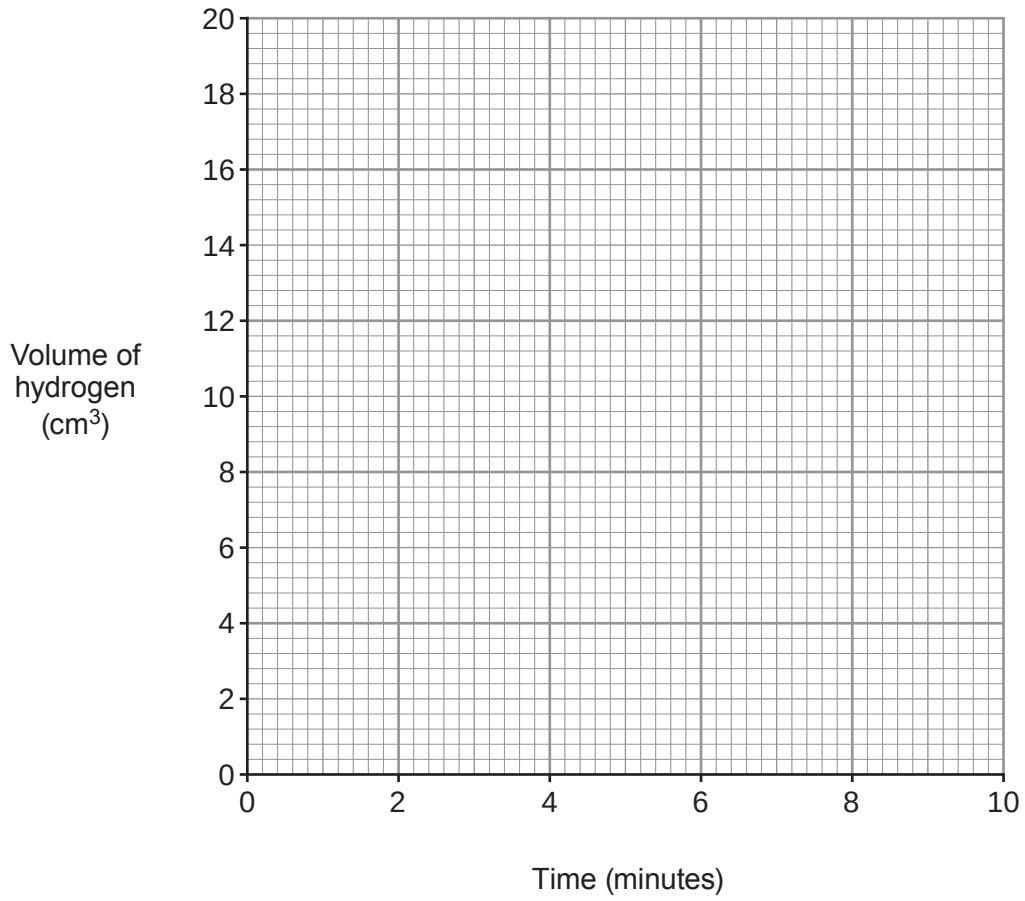
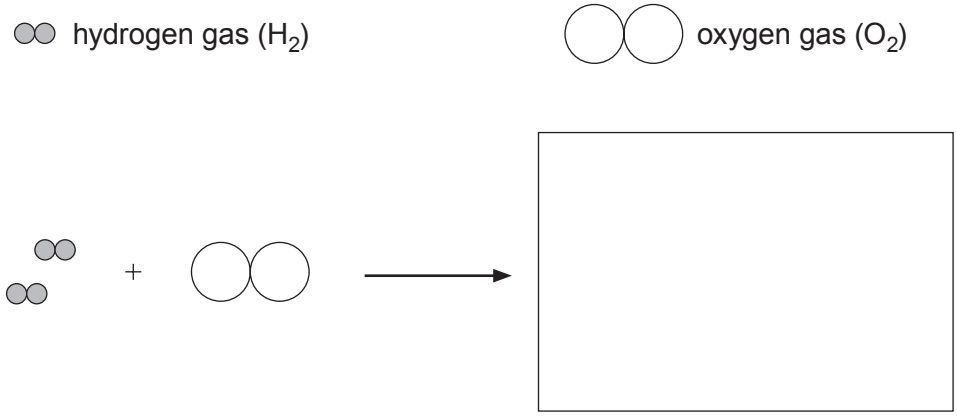



*(b)* Hydrogen burns in air forming water. This reaction is represented by the following symbol equation.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

Use this and the key below to complete the equation in the form of a diagram.

[2]




7

Examiner only

**8.** *(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]

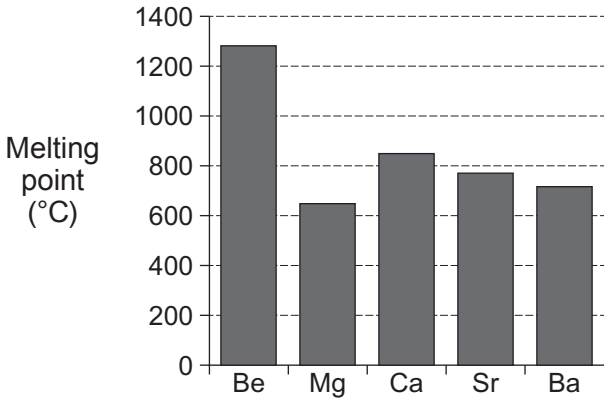
.....

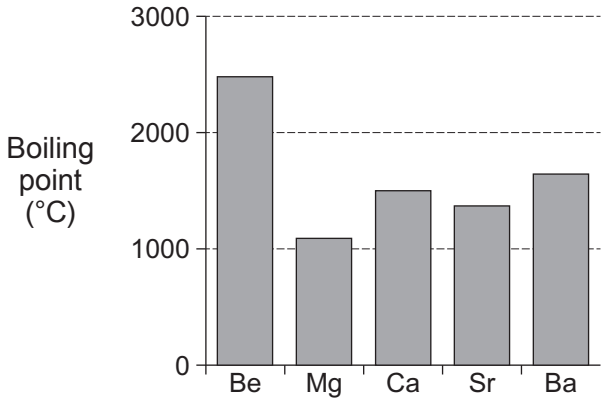
.....

7

Examiner only

**9.** *(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]

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4

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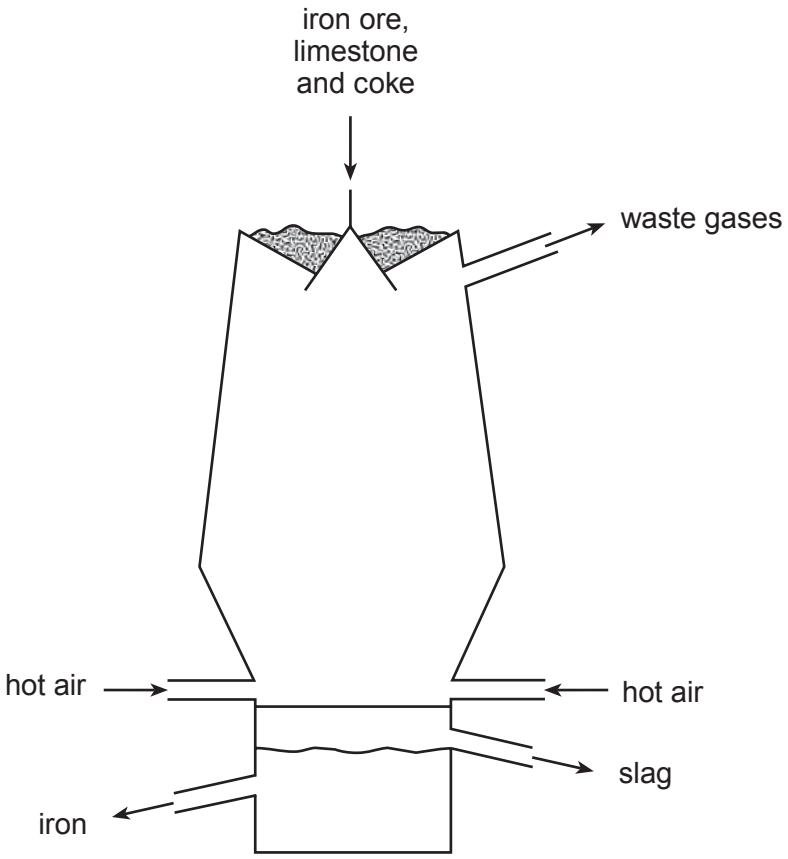
**10.** *(a)* Iron is extracted in the blast furnace. Iron ore, limestone, coke and hot air are the raw materials.




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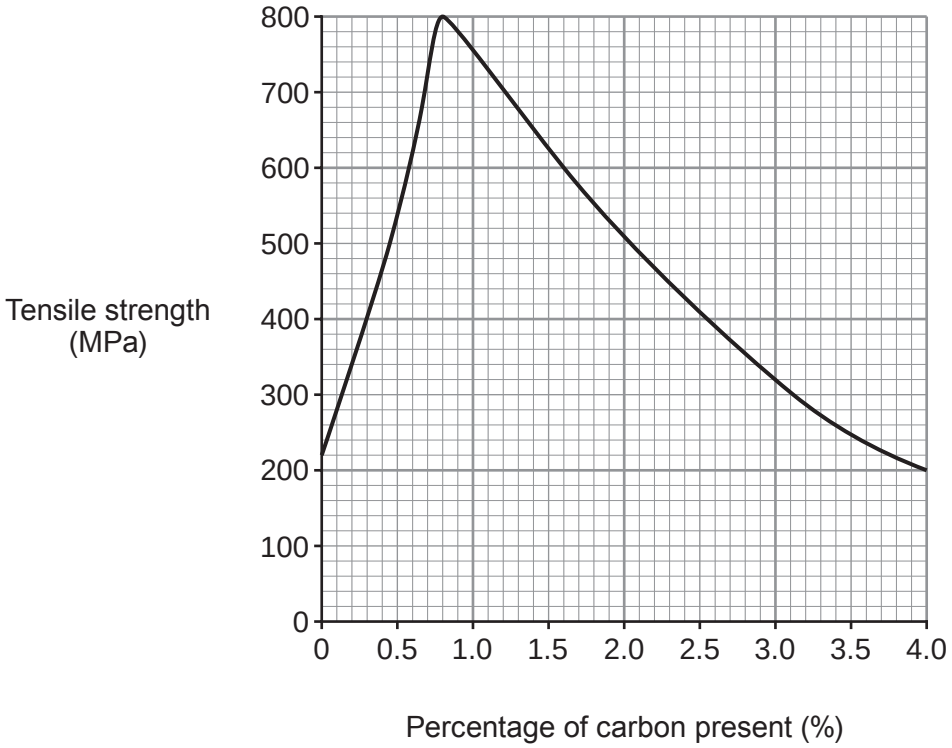
*(b)* The graph below shows how the tensile strength of iron alloys changes with the percentage of carbon present.




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

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6

**END OF PAPER**

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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 | | | | | | | | | | | 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: