

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

125/01

SCIENCE: CHEMISTRY

FOUNDATION TIER (Grades G-C)

A.M. WEDNESDAY, 14 June 2006

(2 hours)

For Examiner's use only	
Total Marks	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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 of the necessity for good English and orderly presentation in your answers.

You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

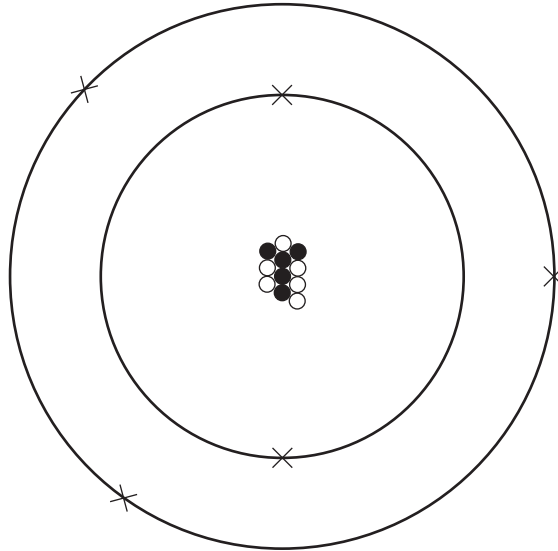
A mark is available for the quality of written communication in question 5.

The Periodic Table is printed on page 28 and the formulae for some common ions on page 27.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** questions in the spaces provided.

1. (a) The diagram below shows the electrons, neutrons and protons found in an atom of boron.



- (i) Give the total number of particles found in the nucleus of an atom of boron. [1]

- (ii) Name the neutral particle found in the nucleus of an atom. [1]
- (iii) Name the particles which are always found in equal numbers in an atom.
 and [1]
- (b) The chemical formula for sulphurous acid is H_2SO_3 .
- (i) Give the number of sulphur atoms in a molecule of H_2SO_3 [1]
- (ii) Give the total number of atoms in a molecule of H_2SO_3 [1]

2. Read the information in the box below.

Air is a mixture of gases. It contains about 78% nitrogen, 21% oxygen, 1% inert gases and a very small amount of carbon dioxide. The inert gases are mainly made up of argon. Nitrogen is used to make ammonia and oxygen is used in breathing equipment. Argon is used in light bulbs. One way that air can be polluted is by the burning of fossil fuels.

Use only the information in the box above to answer the following questions.

(i) Name

I. an element, [1]

II. a compound. [1]

(ii) Name the **most** abundant

I. gas found in the air, [1]

II. noble gas found in the air. [1]

(iii) Name the gas used in

I. breathing equipment, [1]

II. light bulbs. [1]

(iv) State **one** way that air can be polluted. [1]

.....

3. (a) The table below shows some properties common to both iron and copper.

<i>Properties of iron and copper</i>
good electrical conductor
good heat conductor
malleable (can be beaten into a sheet)
ductile (can be drawn into wire)
high melting point
high density

Use only properties from the table above to answer part (a).

- (i) Choose **two** properties that make iron suitable as a material for saucepans.

Property 1. [1]

Property 2. [1]

- (ii) Choose **two** properties that make copper suitable as a material for electrical wiring.

Property 1. [1]

Property 2. [1]

- (iii) Steel (mainly iron) is used to make cars but not aeroplanes.

I. Give **one** property of iron that makes it suitable to use for car bodies. [1]

.....

II. Give **one** property of iron that makes it *unsuitable* to use for aeroplanes. [1]

.....

- (b) Refer to the table of common ions on page 27 of this examination paper to answer this question.

Copper and iron form ions. Tick (✓) the box below which gives the charge found on both ions. [1]

positive

negative

neutral

- (c) (i) Iron is used as a catalyst in the Haber process to make ammonia.
State what is meant by the term *catalyst*.

[1]

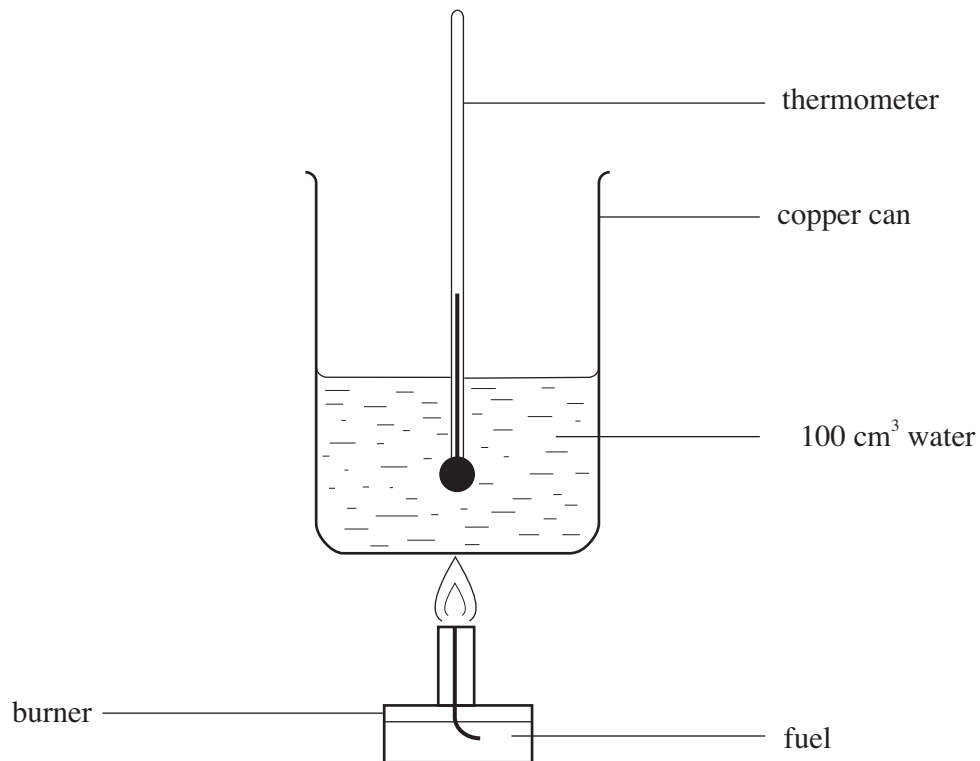
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- (ii) Refer to the Periodic Table of Elements shown on the **back page** of the examination paper to answer this question.

Name the section of the Periodic Table of Elements in which both iron and copper are found.

[1]

.....

4. The diagram below shows an apparatus used to investigate the effect of burning four fuels, **A**, **B**, **C** and **D**.

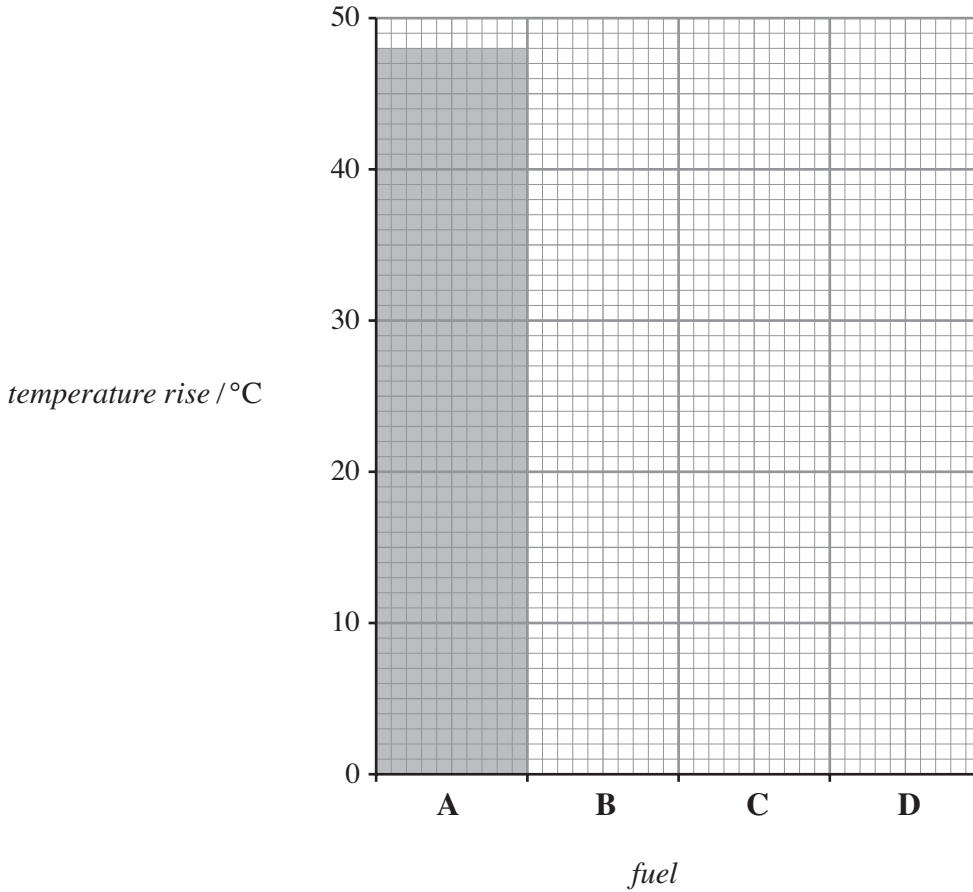


The table below shows the temperature rise when equal volumes of water were heated by burning each fuel for 3 minutes. The can was cooled down to room temperature before each experiment. A fresh supply of water was used each time.

<i>Fuel</i>	<i>Temperature rise /°C</i>
A	48
B	33
C	16
D	20

- (i) Complete the bar chart of the results on the grid below.
One bar has been done for you.

[2]



- (ii) Give the **letter** of the fuel which gives out the most heat when burned for 3 minutes.

[1]

.....

- (iii) State **three** ways in which the investigation was made a fair test.

[3]

1.

2.

3.

5. Small amounts of fluoride compounds are added to drinking water in some areas. Some people agree that fluoride compounds should be added to our drinking water. Other people disagree.

Give **one** advantage and **one** disadvantage of adding fluoride compounds to drinking water. [2+1]

One mark is available for the quality of written communication in your answer.

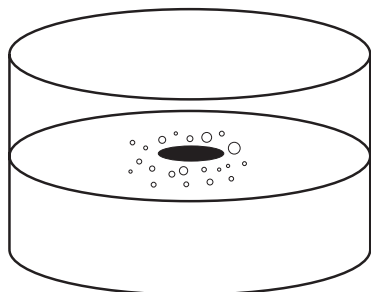
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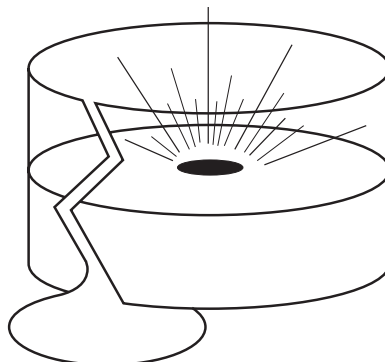
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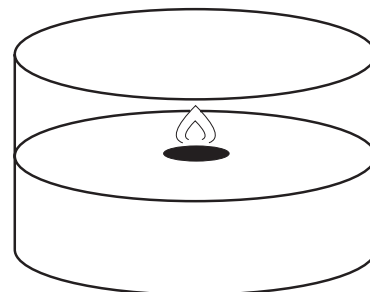
6. All Group I elements react with water giving off the same gas, **D**.
The diagrams below show three Group I metals being put in separate glass troughs of water.

**Metal A**

Metal fizzes gently,
forming gas **D**.

**Metal B**

Explosive reaction,
cracking the trough.

**Metal C**

Metal reacts violently;
gas burns with a lilac flame.

Use the information in the diagrams above and the Periodic Table of elements on the back page of the examination paper to answer part (i).

- (i) I. Give the letter **A**, **B** or **C** which represents the metal

Lithium

Potassium

Caesium

[2]

- II. Name the gas **D**.

[1]

- (ii) Put a tick (✓) in the box next to the word which describes the solution formed when Group I metals react with water.

acidic

alkaline

neutral

[1]

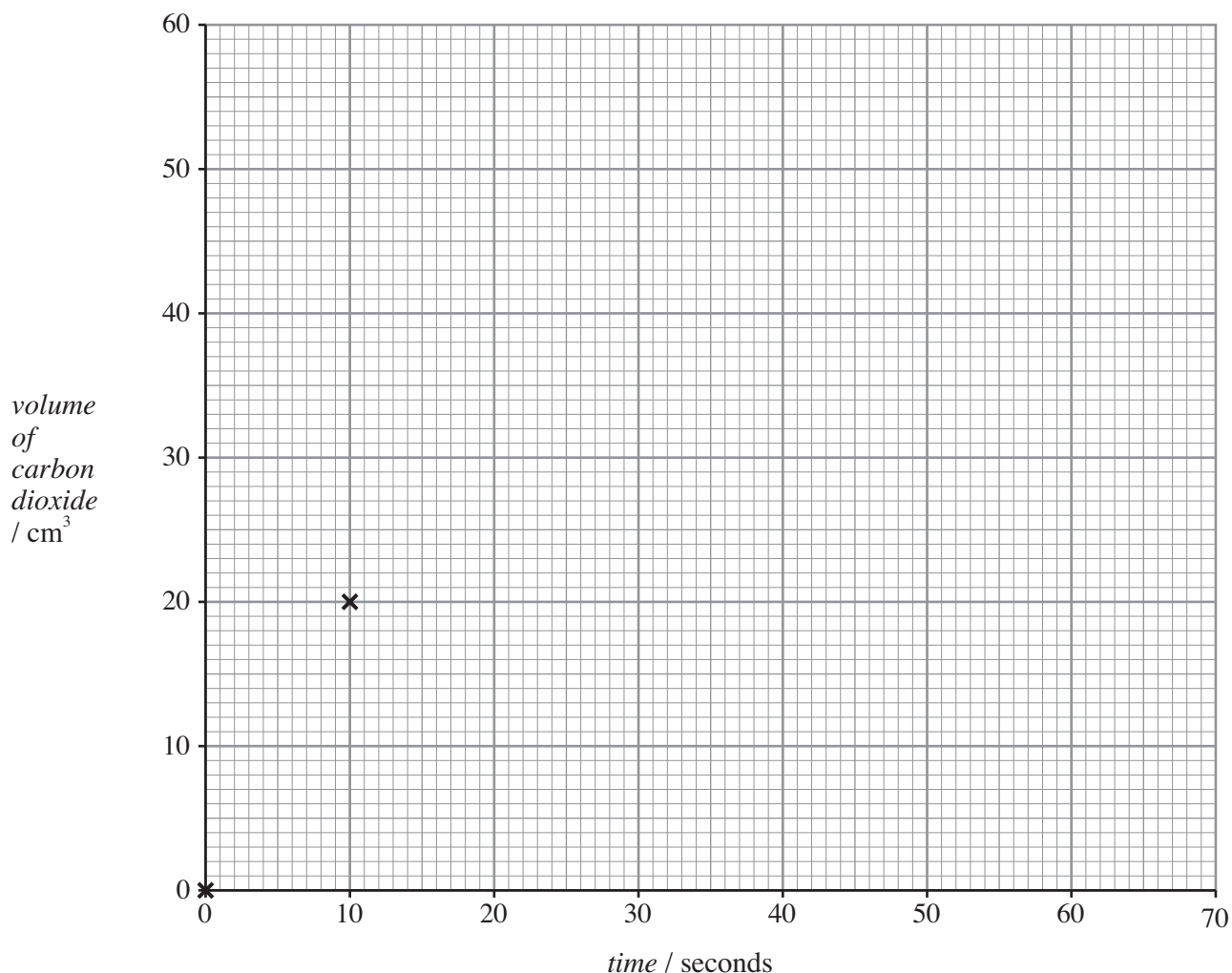
7. Marble chips (calcium carbonate) react with dilute hydrochloric acid forming carbon dioxide.

Marble chips were placed in excess dilute hydrochloric acid. The volume of carbon dioxide produced was recorded every 10 seconds. The experiment was carried out at room temperature. The results obtained are shown below.

<i>Time /seconds</i>	0	10	20	30	40	50	60	70
<i>Volume of carbon dioxide /cm³</i>	0	20	32		45	49	50	50

The volume for 30 seconds was not recorded.

- (i) Plot the results from the table on the grid below and draw a smooth curve through the points. [3]
The first two points have been plotted for you.



- (ii) Use the graph to estimate
- I. the volume of carbon dioxide produced after 30 seconds, cm³ [1]
 - II. the time it takes to produce 25 cm³ of carbon dioxide. seconds [1]
- (iii) State what you would do to the **marble chips** to make the reaction go faster. [1]

8. (i) Iron nails corrode when left in the atmosphere.

iron chloride	iron oxide	nitrogen	oxidation	oxygen	reduction	water
---------------	------------	----------	-----------	--------	-----------	-------

Use only the information from the box above to answer part (i) I, II and III.

- I. Give the **chemical name** for the orange/brown solid formed when iron corrodes. [1]

- II. Name the **two** substances in the atmosphere needed for iron to corrode.
 and [2]
- III. Give the term used to describe what happens when iron corrodes. [1]

- (ii) The rusting of five identical nails was investigated by treating each nail as shown in the table below.

All five nails were left exposed to the atmosphere for several months.

<i>Nail</i>	<i>Treatment used</i>	<i>Mass of nail and coating before exposure to the atmosphere / g</i>	<i>Mass of nail and coating after exposure to the atmosphere / g</i>
A	oil	2.0	2.3
B	tin plated	2.0	2.0
C	chromium plated	2.0	2.0
D	painted	2.0	2.2
E	untreated	1.9	2.9

Using only the information in the table above, give

- I. the letter of the **two** treatments which give the best protection,
 and [2]
- II. the increase in mass if no treatment is used, g [1]
- III. the letter of the treatment which is usually used to protect the following from rusting:
- bathroom taps; [1]
- food cans; [1]
- garden gates. [1]

9. Read the information in the box about the fire triangle.

The fire triangle shows the three factors necessary to start and maintain a fire. The factors are heat, oxygen and a fuel. Removing any one of these factors will cause the fire to go out. Fire breaks are used to tackle forest fires by removing trees. Water is used to tackle house fires by removing heat. Carbon dioxide is used on burning electrical sockets to remove oxygen. Water must never be used on electrical fires or burning sodium.

Use only the information in the box above to answer the following questions.

- (i) Name
- I. an element, [1]
- II. a compound. [1]
- (ii) I. Name the **three** factors necessary to maintain a fire.
....., and [3]
- II. Give the fire-fighting method used to tackle
- forest fires, [1]
- electrical fires, [1]
- house fires. [1]
- (iii) Name **two** situations when water must never be used to tackle the fire.
..... and [2]

10. (a) Use the **data** and the **key** on the Periodic Table of Elements, shown on the **back page** of the examination paper, to complete the following sentences.

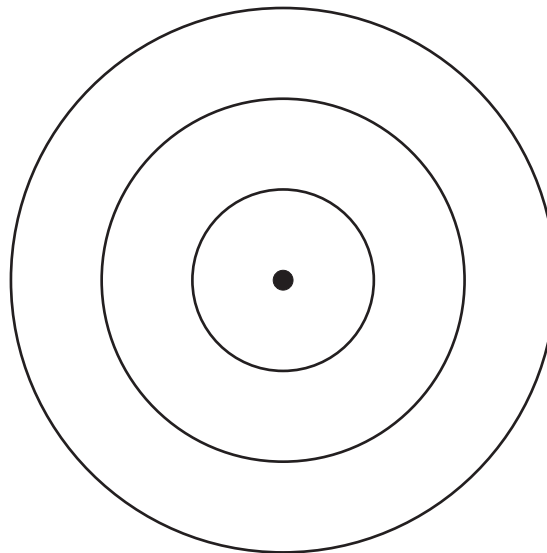
(i) The chemical symbol for krypton is [1]

(ii) The atomic number of krypton is [1]

(iii) The number of protons in an atom of potassium is [1]

(iv) The element which has the electronic structure 2, 2 is [1]

(b) Using **X** to represent an electron, complete the following diagram to show the electronic structure for an atom of aluminium. [1]



11. (a) The table below shows some information relating to Group VII elements.

<i>Element</i>	<i>Atomic Number</i>	<i>Melting Point / °C</i>	<i>Boiling Point / °C</i>	<i>Density / g cm⁻³</i>
Chlorine	17	-101	-35	0.0029
Bromine	35	-7	59	3.1
Iodine	53	114	184	4.9

Use the information in the table above to help you answer part (a).

- (i) State the information that determines the position of the elements in Group VII. [1]

.....

- (ii) A sample of bromine is put in a test tube in a water bath at 60 °C. Describe what will happen to it. [1]

.....

- (iii) Fluorine, not shown in the table, is above chlorine in Group VII. Predict the state (solid, liquid or gas) of fluorine at room temperature, 20 °C. [1]

.....

- (b) (i) Sodium reacts vigorously with chlorine, Cl₂, to form sodium chloride.

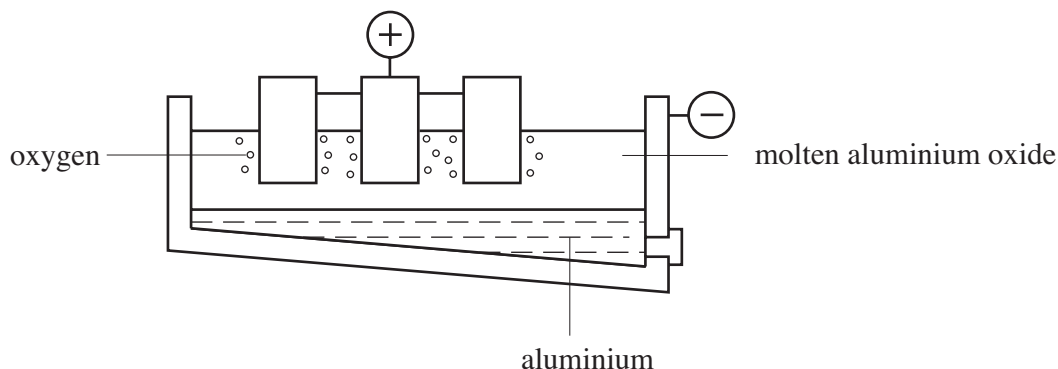
Write a balanced **symbol** equation for the reaction between sodium and chlorine. [3]

..... + →

- (ii) All Group VII elements react with sodium. Give the name of the Group VII element which would react **more** violently with sodium than chlorine does. [1]

.....

12. (a) The diagram below shows the extraction of aluminium by the electrolysis of molten aluminium oxide.



- (i) Refer to the table of common ions on page 27 of this examination paper to answer this question.
Give the **formulae** of the **ions** present in molten aluminium oxide.

..... and [2]

- (ii) Explain why aluminium is formed at the negative electrode during electrolysis. [1]

.....
.....

- (iii) State why the extraction of aluminium by the electrolysis of aluminium oxide is an expensive process. [1]

.....

- (b) Several factors, such as available work force, transport systems and distance from built-up areas are considered when locating a new chemical plant.

Give **one** other factor that is important when locating a new **aluminium** extraction plant. [1]

.....

- (c) Aluminium is used to make over-head power cables.

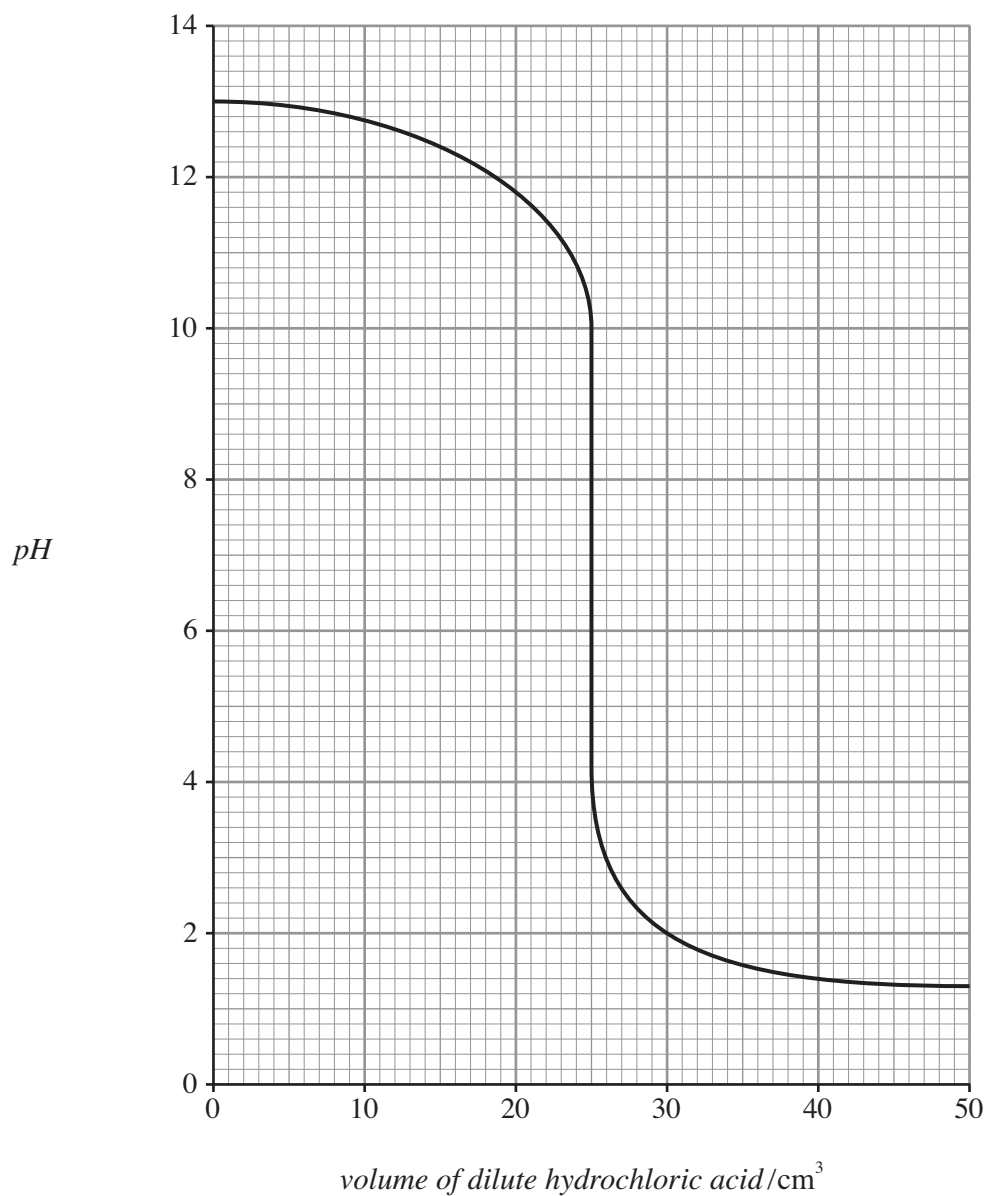
Give **two** properties of aluminium which make it suitable for this use.

Property 1 [1]

Property 2 [1]

13. 50 cm^3 of dilute hydrochloric acid was added to 50 cm^3 of dilute sodium hydroxide solution.

The graph below shows how the pH of the reaction mixture changed *as the acid was added*.



(i) Use the graph to find the

I. pH of the sodium hydroxide solution before any acid was added, [1]

.....

II. pH of the reaction mixture when 30 cm^3 of dilute hydrochloric acid is added, [1]

.....

III. volume of hydrochloric acid needed to neutralise the 50 cm^3 of sodium hydroxide solution. [1]

..... cm^3

(ii) The following table shows the colours of Universal indicator at different pH values.

<i>Colour</i>	<i>Red</i>	<i>Orange</i>	<i>Yellow</i>	<i>Green</i>	<i>Blue</i>	<i>Navy Blue</i>	<i>Purple</i>
pH	0 - 2	3 - 4	5 - 6	7	8 - 9	10 - 12	13 - 14

Give the **colour** of the reaction mixture when the volume of hydrochloric acid added is

I. 20 cm³, [1]

II. 40 cm³. [1]

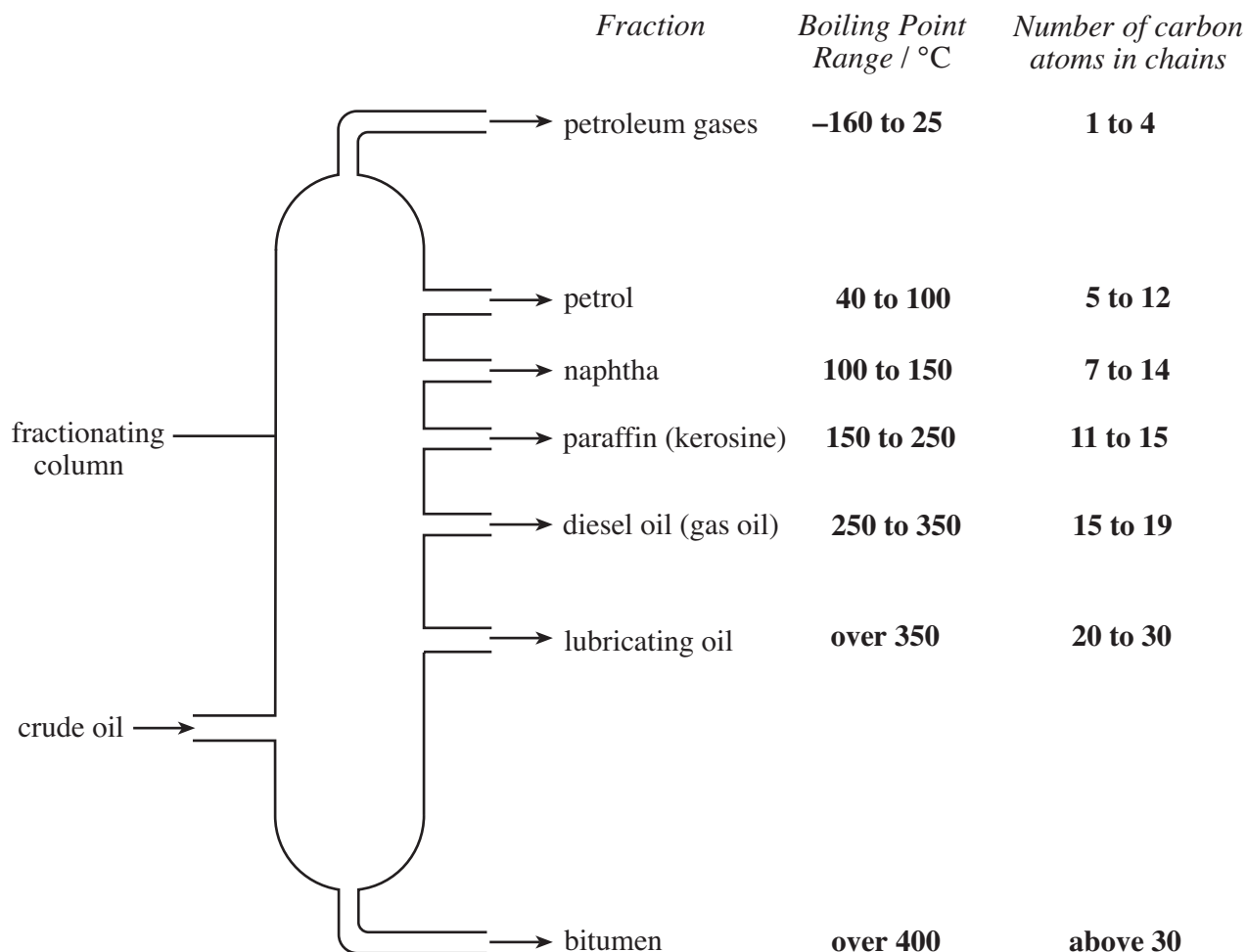
(iii) The neutral solution is evaporated to dryness to leave a white solid.

Name the

I. colourless liquid removed during evaporation, [1]

II. white solid that remains. [1]

14. (a) Crude oil (petroleum) is a mixture of compounds called hydrocarbons which can be separated into fractions in a fractionating column.



Use only the information in the diagram above to answer parts (i) to (iii).

- (i) Name the fraction which contains the compound with the
- I. boiling point of -89°C , [1]
- II. formula C_5H_{12} , [1]
- (ii) Give the number of carbon atoms in the hydrocarbon compound found in both paraffin and diesel oil. [1]
-
- (iii) State the physical property of hydrocarbons that determines the height up the column at which a fraction is removed. [1]
-

(iv) Apart from the petroleum gases, all the other fractions leave the column at different levels as liquids.

I. Give the term used to describe the process of a vapour changing into a liquid. [1]

.....

II. Give the reason why all fractions, apart from the petroleum gases, leave the column as liquids. [1]

.....

(b) The fractional distillation of crude oil takes place at oil refineries.

Give the reason why British oil refineries are located

(i) away from built up areas, [1]

.....

(ii) in coastal positions. [1]

.....

15. Chemists have designed a wide variety of steels to suit particular uses.

Some steels simply contain iron and carbon only, whereas others contain one or more other metals.

The table below shows the content and properties of some steels.

<i>Type of steel</i>	<i>Content of steel</i>	<i>Properties</i>
Mild steel	Iron plus 0.25% carbon only	easily shaped, not brittle
High carbon steel	Iron plus 1.5% carbon only	hard and brittle
Cast iron	Iron plus 4% carbon only	very hard and very brittle
Stainless steel	Iron plus 18% chromium and 8% nickel	tough and does not corrode

Use only the information in the table above to answer this question.

(i) Give **two** effects of increasing the percentage of carbon in steel. [2]

1.

2.

(ii) Choose, giving a reason, the type of steel you would use to make

I. car bodies,

Steel: [1]

Reason: [1]

II. hip replacement joints.

Steel: [1]

Reason: [1]

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16. The table below shows the labels found on bottles of three different mineral waters **A**, **B** and **C**.

<i>Ions present</i>	<i>Typical analysis/mg dm⁻³</i>		
	A	B	C
calcium	47.5	78	27
magnesium	16.5	24	6.9
sodium	5.7	5	6.6
potassium	0.4	1	0.8
hydrogencarbonate	206	357	103
chloride	9.0	4.5	6.4
sulphate	8.0	10.0	10.6
nitrate	3.5	3.8	2.0
pH	7.8	7.2	4.6

Answer parts (i) and (ii) using only the information in the table above.

- (i) I. Give the **letter (A, B or C)** of the **hardest** mineral water. [1]
- II. Give **two** reasons for your choice in part (i) I. [2]
1.
2.
- (ii) I. Give the **letter** of the **acidic** mineral water. [1]
- II. Give the reason for your choice in part (ii) I. [1]
-

(iii) Different samples of water can be tested for hardness using soap solution.
Describe an experiment you would do to show which is the hardest mineral water.
Include in your answer

- any measurements which need to be taken,
- the observations you would expect to see.

[4]

.....

.....

.....

.....

.....

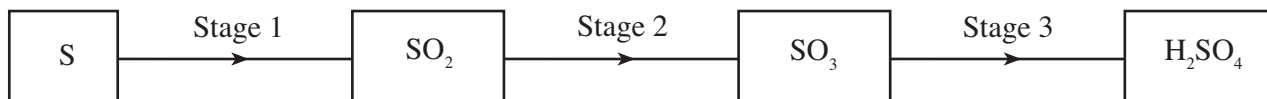
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.....

.....

17. The flow diagram below shows the manufacture of sulphuric acid, H_2SO_4 .



- (i) Write the word equation for Stage 1. [2]

..... + →

- (ii) Stage 2 requires vanadium(V) oxide, a temperature of $450\text{ }^{\circ}\text{C}$ and a pressure of 2-3 atmospheres.

- I. State the purpose of the vanadium(V) oxide. [1]

.....

- II. State what happens to the mass of the vanadium(V) oxide. [1]

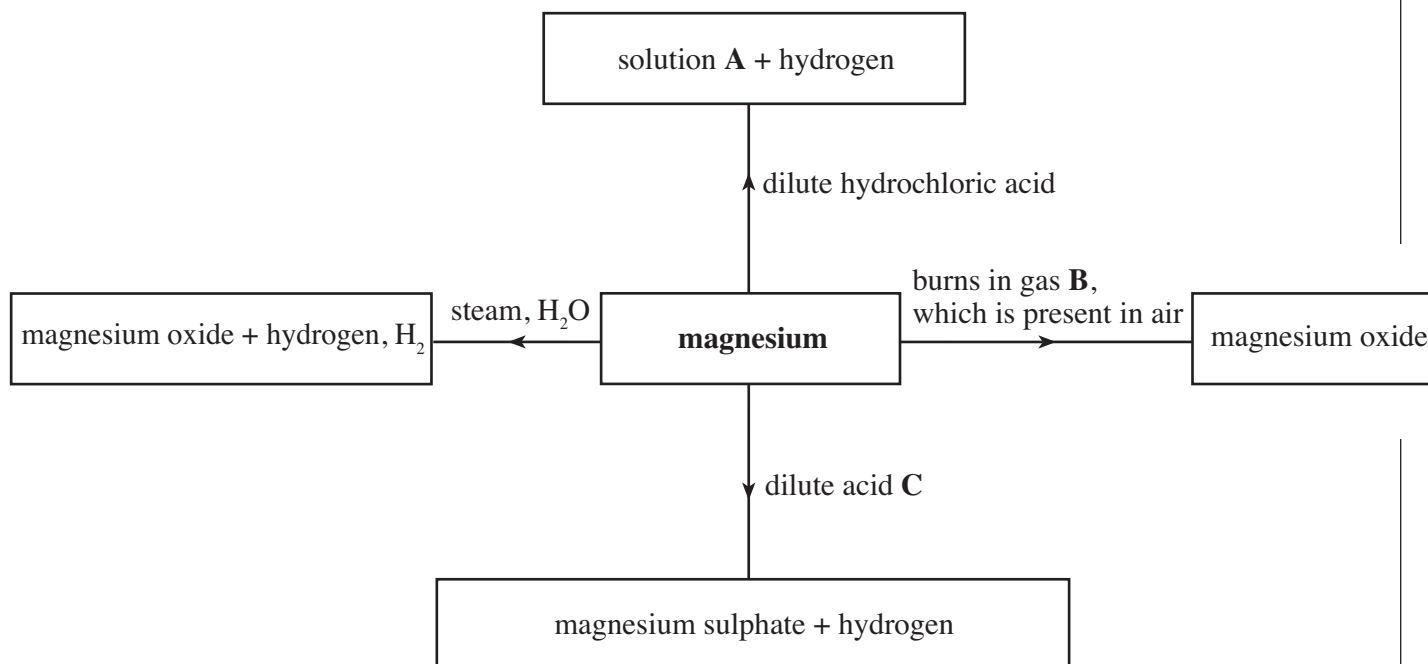
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- (iii) Give the **main** reason for **not** allowing any of the sulphur dioxide to escape into the atmosphere. [1]

.....

.....

18. The diagram below shows some reactions of magnesium.



(a) Give the chemical name for

(i) solution **A**, [1]

(ii) gas **B**, [1]

(iii) dilute acid **C**. [1]

(b) Write the balanced **symbol** equation for the reaction between magnesium and steam. [3]

..... + \longrightarrow +

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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^+	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^+		
Silver	Ag^+		
Sodium	Na^+		

PERIODIC TABLE OF ELEMENTS

I II

Group

III

IV

V

VI

VII

0

$\begin{matrix} 1 & \text{H} \\ & 1 \end{matrix}$ Hydrogen

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

Key:

