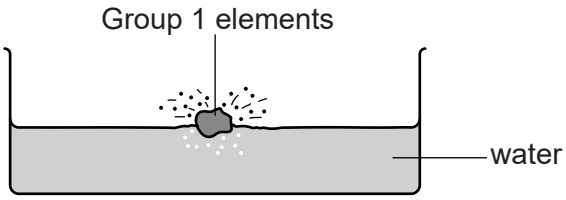
1 This question is about the reaction of Group 1 elements with water.

Lithium, sodium and potassium are Group 1 elements.

They all react with water.



Look at the table.

Group 1 element	Time for 0.5 g of metal to react in seconds	Observations
sodium	15	melts moves across surface of water makes a gas which burns with a ‘pop’ makes an alkaline solution
potassium	7	melts and catches fire moves quickly across surface of water makes a gas which burns with a ‘pop’ makes an alkaline solution
lithium	25	moves slowly across surface of water makes a gas which burns with a ‘pop’ makes an alkaline solution

Rubidium is another Group 1 element.

It is **below** potassium in Group 1 of the periodic table.

Predict the reaction time, and name the products, of the reaction between rubidium and water.

Include a **balanced symbol** equation for the reaction.



The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

2 Look at the table. It shows information about the Group 1 metals.

Element	Symbol	Electronic structure	Melting point in °C	Boiling point in °C	Atomic radius in nm
lithium	Li	2.1	181	1342	0.152
sodium	Na	2.8.1	.....	883	0.185
potassium	K	2.8.8.1	64	760	0.227
rubidium	Rb	2.8.18.8.1	39	688	.....

(a) Predict the melting point of sodium and the atomic radius of rubidium.

Write your answers in the table. **[2]**

(b) Sodium reacts with water.

Sodium hydroxide, NaOH, and hydrogen, H_2, are made.

Write a **balanced symbol** equation for this reaction.

..... **[2]**

(c) The Group 1 elements all react in a similar way.

Explain why.

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..... **[1]**

(d) Sodium reacts with fluorine. Sodium ions and fluoride ions are made.

The electronic structure of fluorine is 2.7.

Draw a 'dot and cross' diagram to show the electronic structure of a sodium ion and of a fluoride ion. Include the charges on the ions.

[2]

[Total: 7]

3 Lithium, Li, is in Group 1 of the Periodic Table.

Laura's teacher adds a small piece of lithium to a bowl of water.



The lithium reacts with the water, H_2O.

The lithium moves about on the surface of the water.

Laura sees bubbles of hydrogen, H_2, being made.

The piece of lithium gets smaller and smaller until it has completely reacted.

A solution of lithium hydroxide, LiOH, is made.

Caesium, Cs, is another element in Group 1.

Predict, including a balanced symbol equation, how the reaction of **caesium** with water compares with the reaction of **lithium** with water.

The quality of written communication will be assessed in your answer to this question.

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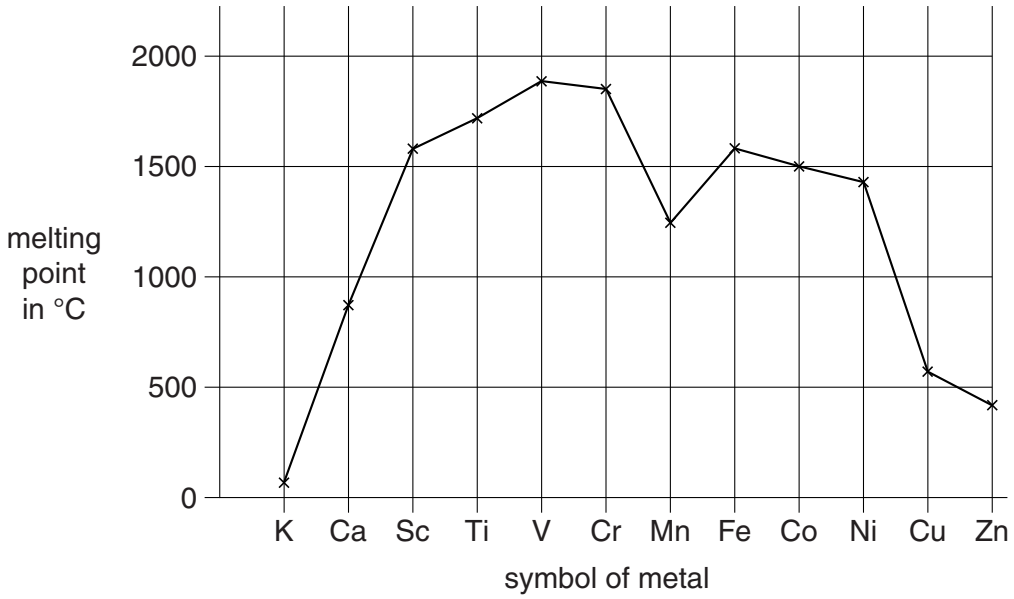
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[Total: 6]

4 Most metals have high melting points.

Look at the graph. It shows the melting points of some metals.



(a) Write the symbol of the metal which has the **weakest** metallic bonds.

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(b) Describe, using a labelled diagram, what is meant by metallic bonding.

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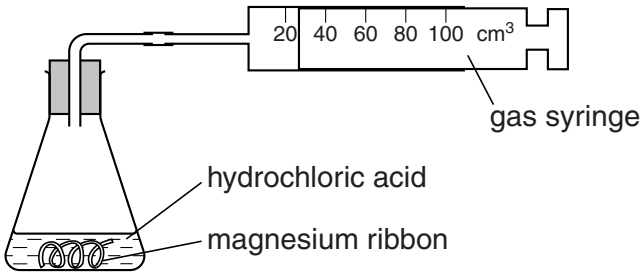
..... **[2]**

[Total: 3]

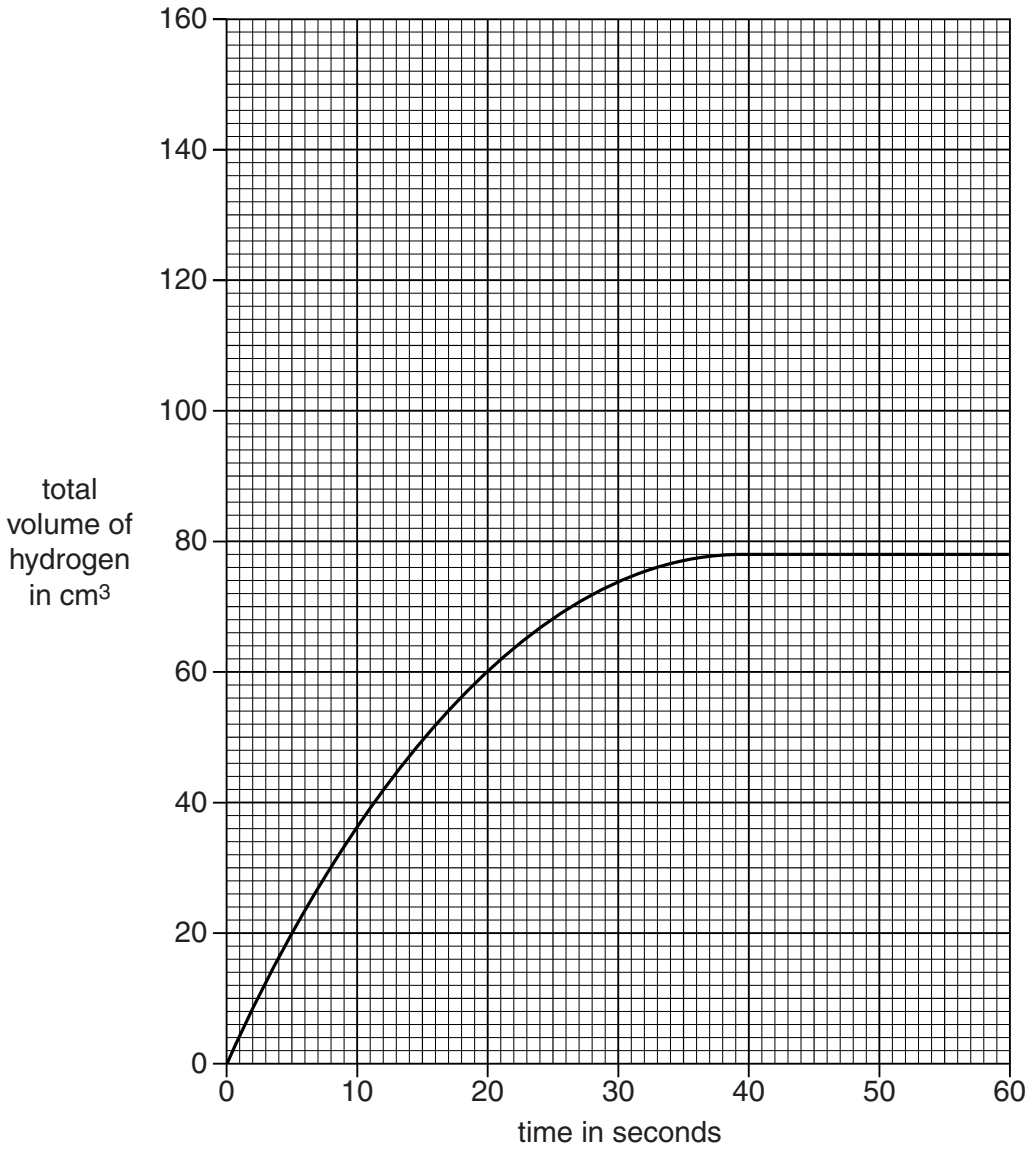
5 Trevor and Julie investigate the reaction between magnesium and hydrochloric acid at 20 °C.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Look at the diagram. It shows the apparatus they use.



Look at the graph. It shows their results.



(a) (i) What is the volume of hydrogen made after 25 seconds?

answer ..... cm^3 **[1]**

(ii) How long does it take for the reaction to stop?

answer ..... seconds **[1]**

(iii) Trevor and Julie repeat the experiment.

They keep everything the same except the temperature.

They increase the temperature from 20 °C to 35 °C.

On the grid, sketch the graph of the results they should get. **[1]**

(b) Magnesium is the **limiting reactant** in this reaction.

What is meant by limiting reactant?

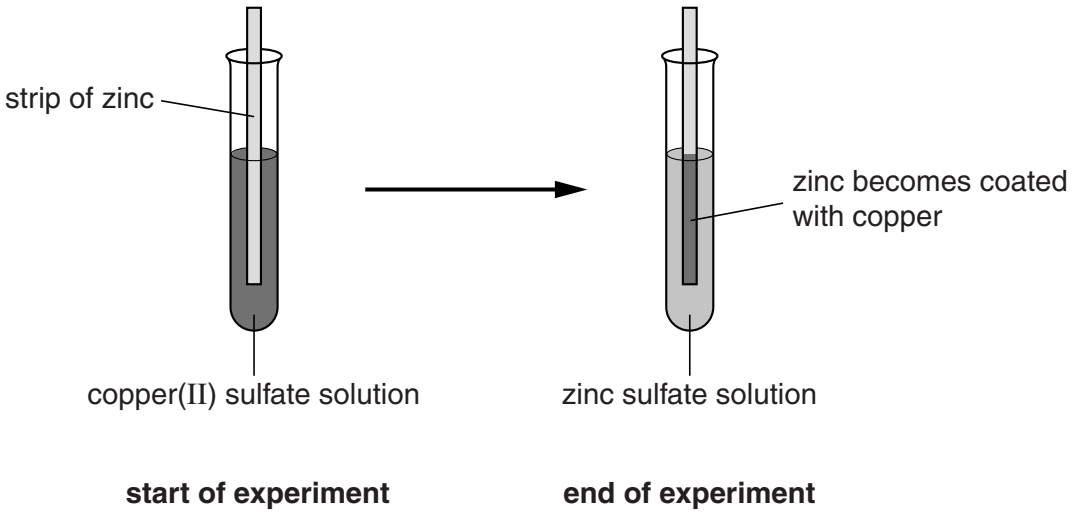
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..... **[1]**

[Total: 4]

6 Jill investigates the reactivity of some metals.

Look at the diagram. It shows what happens when she puts a strip of zinc into copper(II) sulfate solution.



(a) Write the **word** equation for the reaction between zinc and copper(II) sulfate solution.

..... + ... → ..... + ...

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[1]

(b) Iron rusts in the presence of oxygen and water.

Look at the equations for two reactions that happen during rusting.

$$Fe - 2e^- \rightarrow Fe^{2+}$$

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

Which reaction is oxidation and which is reduction?

Explain your answer.

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..... **[2]**

[Total: 3]

7 This question is about substances that are found in different types of water.

(a) River water contains dissolved substances.

River water has to be purified before it can be drunk.

The water purification process has three stages.

These are

- filtration
- sedimentatio
- chlo ination.

Pollutants such as fertilisers are still in the water after this purification.

Explain why.

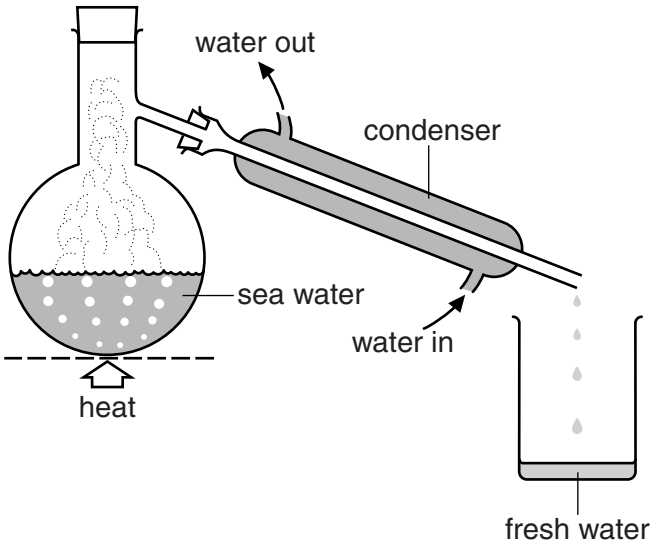
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..... [1]

(b) Sea water can be made into drinking water.

One way this can be done is by distillation.

Look at the diagram. It shows the apparatus used to distil water in the laboratory.



Explain the disadvantages of using distillation to make large amounts of drinking water.

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..... [2]

(c) Pete analyses two samples.

Look at Pete's results.

Sample	Addition of sodium hydroxide solution	Addition of barium chloride solution
A	blue solid made	white solid made
B	brown solid made	no reaction

Pete thinks that sample A is copper sulfate.

He thinks that sample B is iron(III) sulfate.

Is Pete right about each sample?

Explain your answer.

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..... [4]

8 Hydrochloric acid is a **strong** acid.

Ethanoic acid is a **weak** acid.

Both acids contain hydrogen ions, H^+.

(a) Explain why hydrochloric acid is a strong acid and ethanoic acid is a weak acid.

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..... **[2]**

(b) An excess of both acids react with 0.1 g of magnesium to make hydrogen gas.

Both acids have a concentration of 1 mol / dm^3.

(i) Ethanoic acid reacts more slowly with magnesium than hydrochloric acid.

Explain why.

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..... **[2]**

(ii) Both reactions make the same volume of hydrogen.

Explain why.

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..... **[1]**

[Total: 5]