

Name:

Date:

C4 - Test 2  
CHEMICAL CHANGES  
Beginner

**GCSE**

**CHEMISTRY**

**AQA - Triple Science**

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

### Information

- The marks for the questions are shown in brackets

**1.**

Salts can be prepared by the reaction of acids with alkalis.

- (a) (i) The reactions of acids with alkalis can be represented by the equation below. Choose a substance from the box to complete the equation.

|  |
|--|
| <b>carbon dioxide    hydrogen    oxygen    water</b> |
|--|

acid + alkali → salt + \_\_\_\_\_

(1)

- (ii) Draw a ring around the word which best describes the reaction.

**displacement    neutralisation    oxidation    reduction**

(1)

- (b) Sodium sulphate is an important salt.

The table gives a list of some substances.

Put a tick (✓) next to the names of the acid **and** the alkali that would react to make sodium sulphate.

| <b>Substances</b>  | <b>(✓)</b> |
|--------------------|------------|
| Hydrochloric acid  |            |
| Nitric acid        |            |
| Potassium sulphate |            |
| Sodium hydroxide   |            |
| Sodium nitrate     |            |
| Sulphuric acid     |            |

(2)

**(Total 4 marks)**

2. Nitric acid can be neutralised by alkalis to make salts.

(i) The salt called potassium nitrate can be made from nitric acid.

Complete the word equation for this neutralisation reaction.  
Choose the correct substances from the box.

|                     |        |                    |
|---------------------|--------|--------------------|
| hydrogen            | oxygen | potassium chloride |
| potassium hydroxide |        | water              |

nitric acid + \_\_\_\_\_ → potassium nitrate + \_\_\_\_\_

(2)

(ii) Ammonium nitrate is another salt made from nitric acid.

Which **one** of the following is the main use of ammonium nitrate? Draw a ring around your answer.

dye                      fertiliser                      plastic                      fuel

(1)

(iii) Complete this sentence by choosing the correct ion from the box.

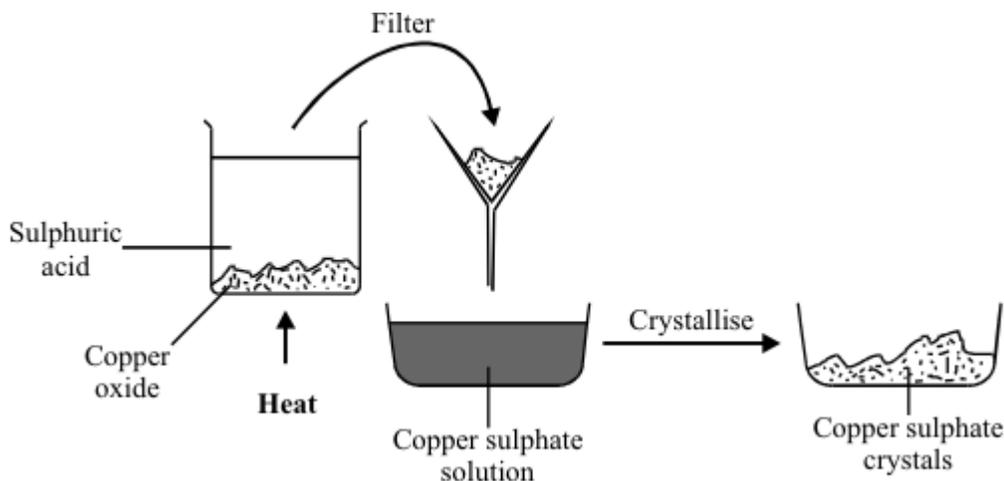
|                |                              |                              |                 |                 |
|----------------|------------------------------|------------------------------|-----------------|-----------------|
| H <sup>+</sup> | NH <sub>4</sub> <sup>+</sup> | NO <sub>3</sub> <sup>-</sup> | O <sup>2-</sup> | OH <sup>-</sup> |
|----------------|------------------------------|------------------------------|-----------------|-----------------|

The ion that makes solutions acidic is \_\_\_\_\_.

(1)

(Total 4 marks)

3. (a) The diagram shows one way of making crystals of copper sulphate.



(i) Why was the solution filtered?

\_\_\_\_\_

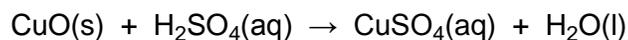
(1)

(ii) How could you make the crystals form faster from the copper sulphate solution?

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(1)

(iii) The chemical equation is shown for this reaction.



In the chemical equation what does (aq) mean?

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(1)

(b) Blue copper sulphate crystals go white when warmed. How could you use the white copper sulphate as a test for water?



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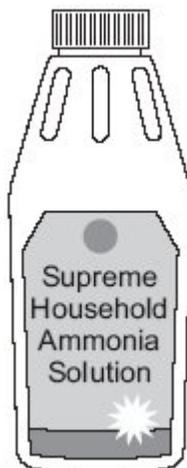
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(2)

(Total 5 marks)

4.



*Supreme* is used to clean and degrease tiles, work surfaces and windows. The active ingredient is ammonia solution, which is an alkali.

(a) Draw a ring around the correct answer to complete these sentences.

(i) Ammonia solution is alkaline because of

hydroxide  
magnesium  
sulfate

ions.

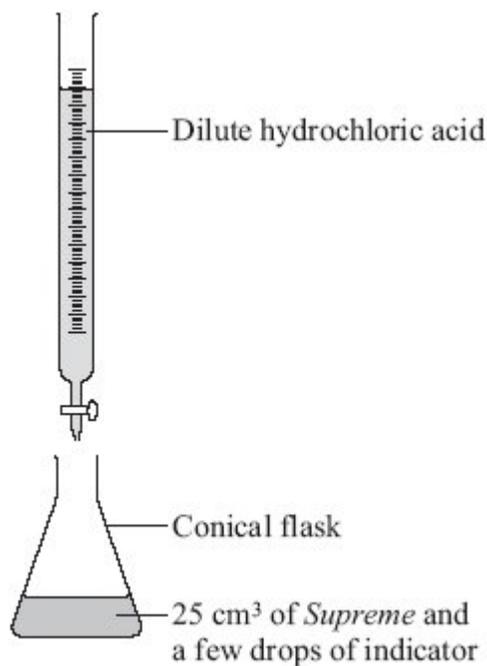
(1)

(ii) Ammonia solution turns litmus paper

blue.  
green.  
red.

(1)

(b) The diagram shows the apparatus a student could use for a titration.



Draw a ring around the correct answer to complete each sentence about how the student could do this titration.

(i) Measure 25 cm<sup>3</sup> of *Supreme* into a conical flask using a

pipette.  
test tube.  
thermometer.

(1)

(ii) Add a few drops of an indicator to the *Supreme* in the conical flask.

Then put hydrochloric acid into a

beaker.  
burette.  
measuring cylinder.

(1)

(iii) Add the acid to the *Supreme* until the indicator

changes colour.  
dissolves.  
forms a gas.

(1)

(c) The student recorded the volume of hydrochloric acid used.

Suggest how the student could check the reliability of this result.

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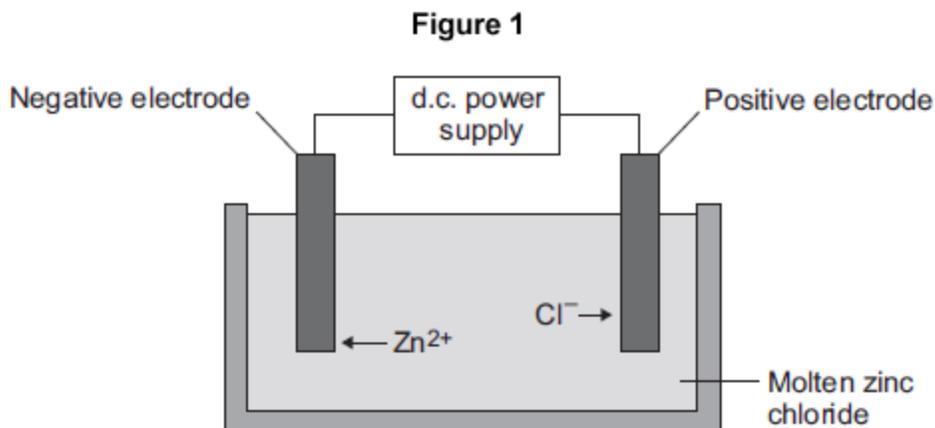
(1)

(Total 6 marks)

5.

This question is about zinc.

Figure 1 shows the electrolysis of molten zinc chloride.



(a) Zinc chloride is an ionic substance.  
Complete the sentence.

When zinc chloride is molten, it will conduct \_\_\_\_\_ .

(1)

(b) Zinc ions move towards the negative electrode where they gain electrons to produce zinc.

(i) Name the product formed at the positive electrode.

\_\_\_\_\_

(1)

(ii) Explain why zinc ions move towards the negative electrode.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)

(iii) What type of reaction occurs when the zinc ions gain electrons?

Tick (✓) **one** box.

Neutralisation

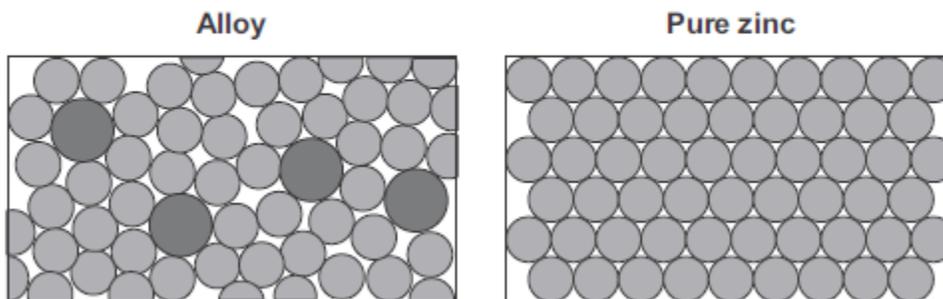
Oxidation

Reduction

(1)

- (c) Zinc is mixed with copper to make an alloy.
- (i) **Figure 2** shows the particles in the alloy and in pure zinc.

**Figure 2**



Use **Figure 2** to explain why the alloy is harder than pure zinc.

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(2)

- (ii) Alloys can be bent. Some alloys return to their original shape when heated.

What name is used for these alloys?

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(1)

(Total 8 marks)

**6.**

Metals and their alloys have many uses.

- (a) Dentists use a smart alloy to make braces that gently push teeth into the right position.

What is meant by a *smart alloy*?

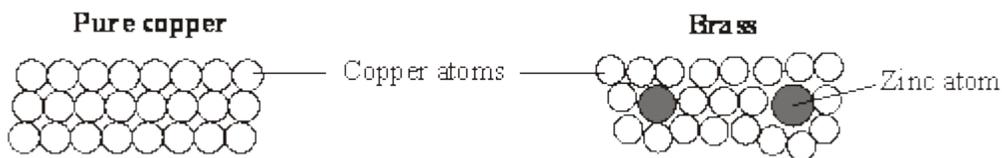
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(1)

- (b) Pure copper is made up of layers of copper atoms. Brass is an *alloy* of copper and zinc.



Why are the physical properties of brass different from the physical properties of pure copper?

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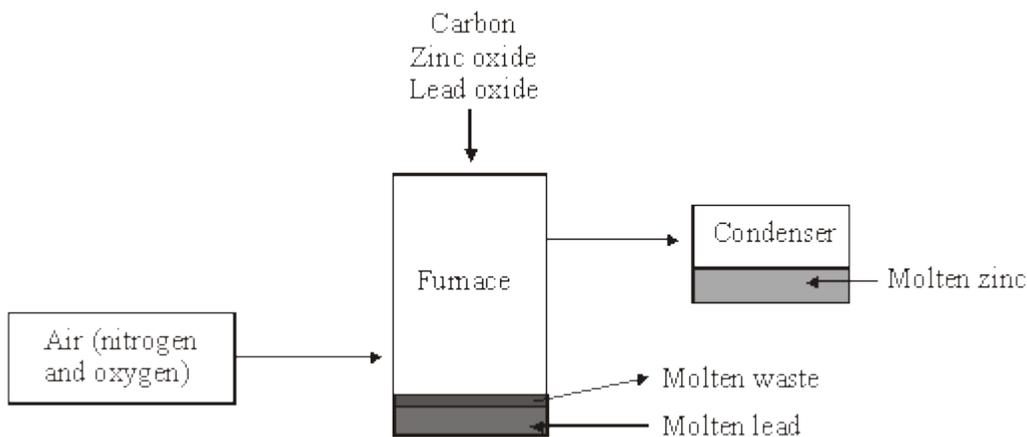
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(2)

- (c) Nearly all zinc is obtained from ores that also contain lead. The metals zinc and lead can be extracted by reducing their oxides using carbon.



- (i) Choose **one** element from the box below to complete the sentence about the reduction of zinc oxide.

|             |                 |               |
|-------------|-----------------|---------------|
| <b>lead</b> | <b>nitrogen</b> | <b>oxygen</b> |
|-------------|-----------------|---------------|

Zinc oxide is reduced by carbon, which takes away \_\_\_\_\_ to leave zinc metal.

(1)

- (ii) The melting points and boiling points of lead and zinc are given in the table.

| <b>Metal</b>               | <b>Lead</b> | <b>Zinc</b> |
|----------------------------|-------------|-------------|
| <b>Melting point in °C</b> | 328         | 420         |
| <b>Boiling point in °C</b> | 1740        | 907         |

The furnace operates at a temperature of 1200 °C.

Suggest how the lead metal and zinc metal are separated in the furnace.

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**(2)**  
**(Total 6 marks)**

7.

A student investigated the reactivity of three different metals.

This is the method used.

1. Place 1 g of metal powder in a test tube.
2. Add 10 cm<sup>3</sup> of metal sulfate.
3. Wait 1 minute and observe.
4. Repeat using the other metals and metal sulfates.

The student placed a tick in the table below if there was a reaction and a cross if there was no reaction.

|                   | Zinc | Copper | Magnesium |
|-------------------|------|--------|-----------|
| Copper sulfate    | ✓    | X      | ✓         |
| Magnesium sulfate | X    | X      | X         |
| Zinc sulfate      | X    | X      | ✓         |

(a) What is the dependent variable in the investigation?

Tick **one** box.

Time taken

Type of metal

Volume of metal sulfate

Whether there was a reaction or not

(1)

(b) Give **one** observation the student could make that shows there is a reaction between zinc and copper sulfate.

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(1)

(c) The student used measuring instruments to measure some of the variables.

Draw **one** line from each variable to the measuring instrument used to measure the variable.

| Variable                | Measuring instrument |
|-------------------------|----------------------|
|                         | Balance              |
| Mass of metal powder    | Measuring cylinder   |
|                         | Ruler                |
| Volume of metal sulfate | Burette              |
|                         | Thermometer          |
|                         | Test tube            |

(2)

(d) Use the results shown in table above to place zinc, copper and magnesium in order of reactivity.

Most reactive \_\_\_\_\_



Least reactive \_\_\_\_\_

(1)

(e) Suggest **one** reason why the student should **not** use sodium in this investigation.

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(1)

(f) Which metal is found in the Earth as the metal itself?

Tick **one** box.

Calcium

Gold

Lithium

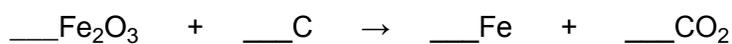
Potassium

(1)

(g) Iron is found in the Earth as iron oxide ( $\text{Fe}_2\text{O}_3$ ).

Iron oxide is reduced to produce iron.

Balance the equation for the reaction.



(1)

(h) Name the element used to reduce iron oxide.

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(1)

(i) What is meant by reduction?

Tick **one** box.

Gain of iron

Gain of oxide

Loss of iron

Loss of oxygen

(1)

(Total 10 marks)

**8.**

An ore contains zinc carbonate ( $\text{ZnCO}_3$ ).

- (a) Complete the table to show the number of atoms of each element in the formula of zinc carbonate.

Zinc has been done for you.

| Element   | Number of atoms in the formula<br>$\text{ZnCO}_3$ |
|-----------|---|
| Zinc, Zn  | 1   |
| Carbon, C |   |
| Oxygen, O |   |

(2)

- (b) Draw a ring around the correct answer to complete the sentence and the word equation.

- (i) Zinc carbonate decomposes in a similar way to calcium carbonate

when

|                 |
|-----------------|
| water is added. |
| cooled.         |
| heated.         |

(1)

(ii) zinc carbonate  $\longrightarrow$  zinc oxide +

|                |
|----------------|
| carbon dioxide |
| hydrogen       |
| oxygen         |

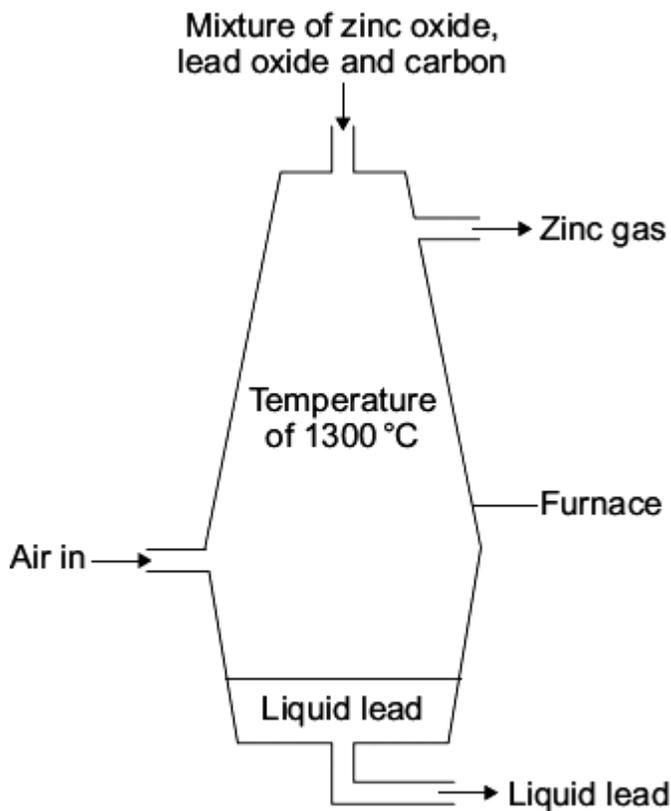
(1)

(c) Another ore contains a mixture of zinc carbonate and lead carbonate.

The metals zinc and lead are produced from this ore in two stages:

**Stage 1** decomposing the carbonates to produce a mixture of zinc oxide and lead oxide.

**Stage 2** mixing the oxides with carbon and heating in a furnace.



Some of the reactions in the furnace are:



Use the information given to help you to answer these questions.

(i) Draw a ring around the correct answer to complete the sentence.

The reaction between carbon and oxygen that heats the

furnace is called

combustion.

decomposition.

evaporation.

(1)

(ii) Tick (✓) **one** reason why carbon reacts with zinc oxide to produce zinc.

| Reason                                  | Tick (✓) |
|---|----------|
| carbon is less reactive than zinc       |          |
| carbon is more reactive than zinc       |          |
| carbon is similar in reactivity to zinc |          |

(1)

(iii) In the furnace zinc is a gas but lead is a liquid.

Suggest why.

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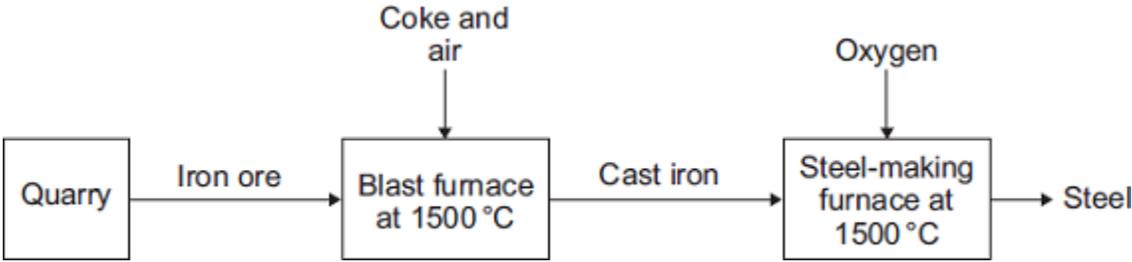
(2)

(Total 8 marks)

9.

The iron produced from iron ore in a blast furnace is called cast iron.

Cast iron is converted into steel in a furnace.



Iron ore contains iron oxide.

Coke contains carbon.

(a) Quarrying iron ore will have an impact on everything near to the quarry.

(i) Describe **one** positive impact and **one** negative impact of quarrying iron ore.

positive impact \_\_\_\_\_  
 \_\_\_\_\_  
 negative impact \_\_\_\_\_  
 \_\_\_\_\_

(2)

(ii) Draw a ring around the correct answer to complete the sentence.

Ores contain enough metal to make extraction of the metal

- carbon neutral.
- economical.
- reversible.

(1)

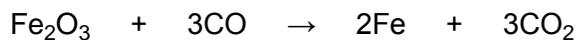
(b) Many chemical reactions take place in a blast furnace. Use the flow diagram to help you to answer this question.

Suggest how the blast furnace is heated.

\_\_\_\_\_  
 \_\_\_\_\_

(1)

(c) A chemical reaction for the extraction of iron is:



(i) Complete the word equation for this chemical reaction.

\_\_\_\_\_ + carbon monoxide → iron + \_\_\_\_\_

(2)

(ii) Draw a ring around the correct answer to complete the sentence.

Iron is extracted from its ore by

decomposition.

oxidation.

reduction.

(1)

(d) Cast iron contains about 4% carbon.

Cast iron is converted into low-carbon steels.

(i) Low-carbon steel is produced by blowing oxygen into molten cast iron.

Suggest how oxygen removes most of the carbon.

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(2)

(ii) Draw a ring around the correct answer to complete the sentence.

Metals, such as nickel, are added to low-carbon steels to make

the steel

corrode easily.

easy to shape.

much harder.

(1)

(e) Recycling steel uses less energy than producing steel from iron ore.

Tick (✓) **one** advantage and Tick (✓) **one** disadvantage of recycling steel.

| Statement  | Advantage<br>Tick (✓) | Disadvantage<br>Tick (✓) |
|--|-----------------------|--------------------------|
| Iron is the second most common metal in the Earth's crust. |                       |                          |
| Less carbon dioxide is produced.                           |                       |                          |
| More iron ore needs to be mined.                           |                       |                          |
| There are different types of steel which must be sorted.   |                       |                          |

(2)

(Total 12 marks)

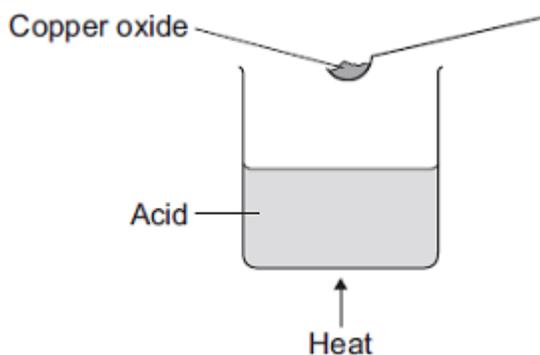
10.

A student added copper oxide to an acid to make copper sulfate.

The student heated the acid.

The student added copper oxide until no more reacted.

(a) The diagram shows the first stage in the experiment.



(i) Complete the word equation.

Copper oxide + \_\_\_\_\_ acid → copper sulfate + water

(1)

(ii) Which **one** of these values could be the pH of the acid?

Draw a ring around the correct answer.

1

7

11

(1)

(iii) Why is the acid heated?

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(1)

(b) After the reaction is complete, some solid copper oxide remains. Why?

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(1)

(c) The student removed the solid copper oxide from the solution. Suggest what the student should do to the solution to form copper sulfate crystals.

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(1)

(d) The mass of copper sulfate crystals was less than the student expected.

Tick (✓) the **one** statement that explains why the mass of copper sulfate crystals was less than expected.

| Statement   | Tick (✓) |
|---|----------|
| Some copper sulfate may have been lost during the experiment. |          |
| The student added too much copper oxide.                      |          |
| The copper sulfate crystals were wet when they were weighed.  |          |

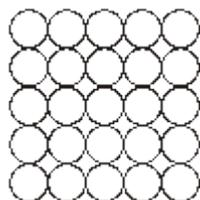
(1)

(Total 6 marks)

11.

Iron is the main structural metal used in the world.

(a) The diagram represents the particles in iron, Fe.



Draw a ring around the correct word in the box to complete the sentence.

Iron is described as an element because all the

atoms

compounds

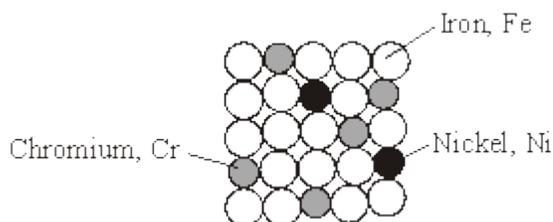
metals

are the same.

(1)

(b) Stainless steel is mostly iron.

The diagram represents the particles in stainless steel.



Use the correct words from the box to complete the sentences about alloys.

**metal**

**mixture**

**molecule**

**polymer**

**smart**

**structure**

Stainless steel is an alloy because it is a \_\_\_\_\_ of iron, chromium and nickel.

An alloy is made up of more than one type of \_\_\_\_\_ .

Stainless steel alloys are harder than iron because the different sized atoms added change the \_\_\_\_\_ .

An alloy that can return to its original shape after being deformed is called a \_\_\_\_\_ alloy.

(4)

- (c) In the UK, we use about 1.8 billion steel cans every year but only 25% are recycled. Used steel cans are worth about £100 per tonne.

Recycling saves raw materials and reduces waste that would end up in landfill. Producing steel by recycling used cans saves 75% of the energy that would be needed to produce steel from iron ore. This also reduces carbon dioxide emissions.

- (i) Give **two** reasons, from the information above, to explain why recycling used steel cans is a good idea.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

**(2)**

- (ii) Suggest how the local council could increase the percentage of used steel cans that are recycled.

\_\_\_\_\_

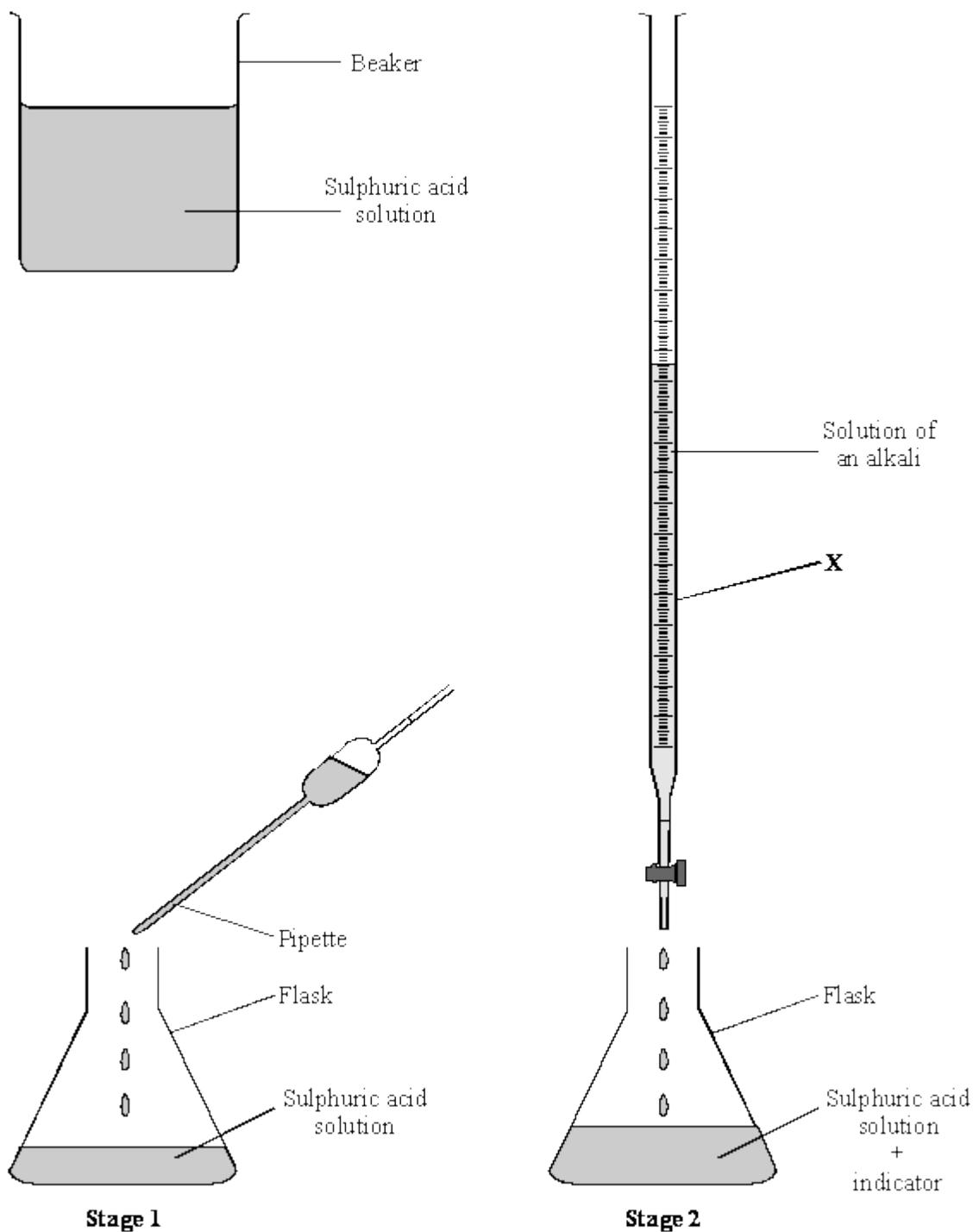
\_\_\_\_\_

**(1)**

**(Total 8 marks)**

12.

A titration was used to find the concentration of the sulphuric acid solution in the beaker.



**Stage 1** 25.0 cm<sup>3</sup> of the sulphuric acid solution was added to a flask using a pipette.

**Stage 2** A solution of an alkali was added to the acid until the solution was neutral.  
The volume of the alkali was noted.

(a) What would be the pH of the sulphuric acid solution?

(1)

(b) Why was a pipette used instead of a measuring cylinder in **Stage 1**?

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(1)

(c) Name the apparatus labelled **X** which is used to add the alkali in **Stage 2**.

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(1)

(d) Name an alkali that could be used in **Stage 2**.

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(1)

(e) (i) Name an indicator that you could use to find out when the solution was neutral.

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(1)

(ii) How would you know that the solution was neutral?

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(1)

**(Total 6 marks)**