

|               |               |                  |
|---------------|---------------|------------------|
| Surname       | Centre Number | Candidate Number |
| First name(s) |               | 0                |

**GCSE**

3430U50-1

**FRIDAY, 27 MAY 2022 – MORNING****SCIENCE (Double Award)****Unit 5 – CHEMISTRY 2****FOUNDATION TIER**

1 hour 15 minutes

| For Examiner's use only |              |              |
|-------------------------|--------------|--------------|
| Question                | Maximum Mark | Mark Awarded |
| 1.                      | 13           |              |
| 2.                      | 9            |              |
| 3.                      | 9            |              |
| 4.                      | 8            |              |
| 5.                      | 6            |              |
| 6.                      | 7            |              |
| 7.                      | 8            |              |
| <b>Total</b>            | <b>60</b>    |              |

**ADDITIONAL MATERIALS**

In addition to this examination 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. You may use a pencil for graphs and diagrams only.

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 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.

Question **5** is a quality of extended response (QER) question where your writing skills will be assessed.

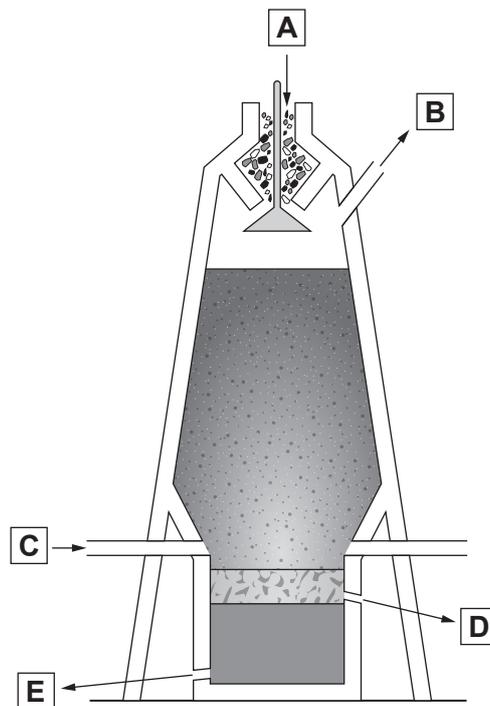
The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.



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Answer **all** questions.

1. (a) The diagram shows a blast furnace which is used to extract iron.  
Labels **A**, **B**, **C**, **D** and **E** show where substances enter and leave the furnace.

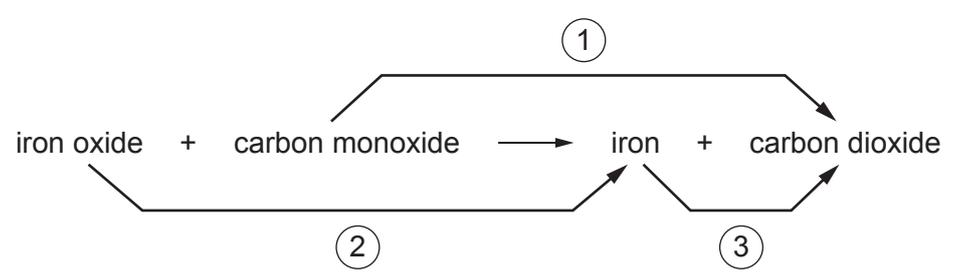


- (i) Give the letter, **A**, **B**, **C**, **D** or **E**, that shows where
- iron ore enters the furnace .....
- waste gases leave the furnace .....
- slag is removed .....

[3]



(ii) One of the main reactions inside the blast furnace is represented by the following equation.



Give the number of the arrow that shows oxidation. [1]

.....

(iii) Limestone is added to the furnace to remove impurities.

The chemical name for limestone is calcium carbonate.

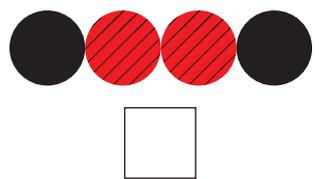
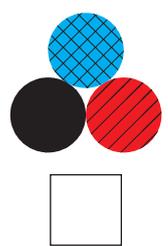
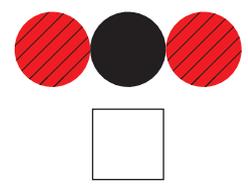
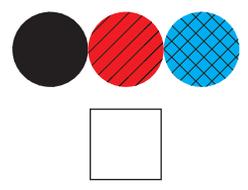
Calcium carbonate contains the ions  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$ .

Circle the correct formula for calcium carbonate. [1]

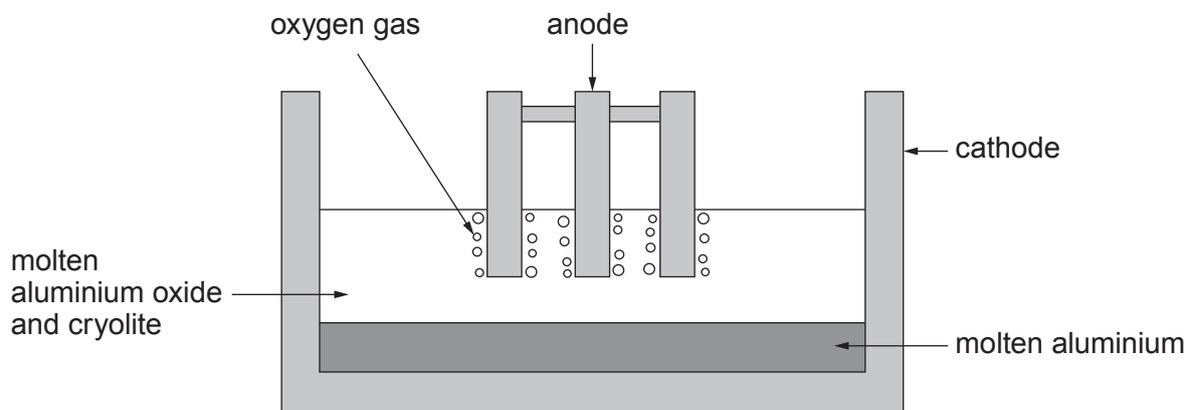
- CaCO**      **Ca<sub>2</sub>CO<sub>3</sub>**      **CaCO<sub>3</sub>**      **Ca(CO<sub>3</sub>)<sub>2</sub>**

(iv) One of the waste gases that leaves the blast furnace is carbon dioxide,  $\text{CO}_2$ .

Put a tick (✓) in the box next to the diagram that best represents a carbon dioxide molecule. [1]



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



(i) Draw **one** line from each term to its correct definition.

[3]

| Term         | Definition                                      |
|--------------|---|
| anode        | positive electrode                              |
| electrolyte  | a substance that removes impurities             |
| electrolysis | a substance that is split up during the process |
|              | using electricity to make a compound            |
|              | using electricity to split up a compound        |
|              | negative electrode                              |



- (ii) Underline the correct word in the brackets to complete each sentence. [3]

Cryolite is added to lower the ( **density / melting point / boiling point** ) of the electrolyte.

When choosing a location for an aluminium plant in the UK, it is important to be near a port to ( **import / export / clean** ) the aluminium ore.

At the temperature inside the cell, the aluminium is produced as a ( **solid / liquid / gas** ).

- (iii) The equation for the reaction that takes place during the extraction of aluminium is given below.



Choose a number from the box to balance the equation. [1]

|   |   |   |
|---|---|---|
| 2 | 4 | 6 |
|---|---|---|



2. (a) Hannah and Evan investigated the temperature increase when sodium hydroxide solution was added to dilute hydrochloric acid.

The method they used to collect their results is given below.

1. Measure  $25\text{ cm}^3$  of hydrochloric acid into a polystyrene cup.
2. Record the temperature of the hydrochloric acid.
3. Measure  $25\text{ cm}^3$  of sodium hydroxide and add it to the hydrochloric acid.
4. Record the highest temperature of the mixture.
5. Calculate the temperature increase for the reaction.

- (i) Choose apparatus from the box to complete the following sentences. [2]

|           |               |             |                    |
|-----------|---------------|-------------|--------------------|
| balance   | Bunsen burner | thermometer | measuring cylinder |
| test tube | stopwatch     | tongs       | beaker             |

Hannah and Evan used a ..... to measure  $25\text{ cm}^3$  of hydrochloric acid accurately.

Hannah and Evan used a ..... to measure the temperature of the mixture.

- (ii) Give **one** way that Hannah and Evan could check that the method produces consistent results. [1]

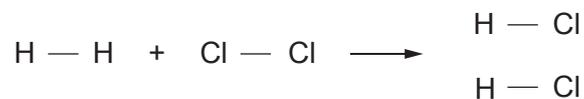
.....

- (iii) Hannah and Evan calculated a temperature increase of  $17^\circ\text{C}$ .  
Give the term used to describe a reaction that gives a temperature increase. [1]

.....



- (b) When chlorine reacts with hydrogen, hydrogen chloride is formed.



The bond energies are given in the table.

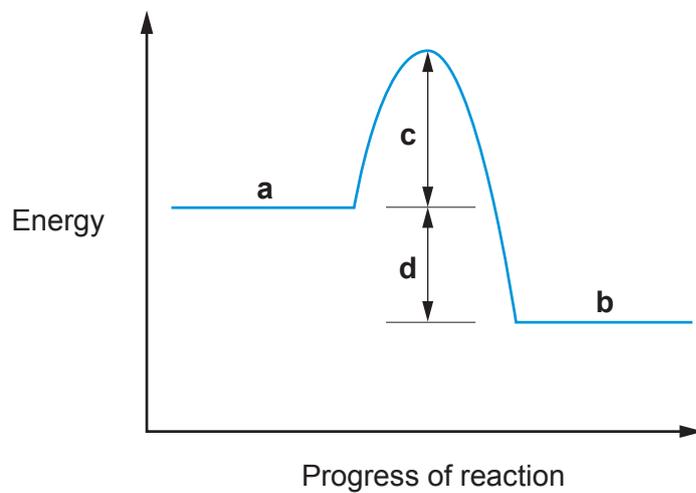
| Bond    | Bond energy (kJ) |
|---------|------------------|
| H — H   | 436              |
| Cl — Cl | 243              |
| H — Cl  | 432              |

- (i) The energy needed to break the bonds in the hydrogen and chlorine molecules is 679 kJ. Show how this value is calculated. [1]
- (ii) Calculate the energy released when **two** molecules of hydrogen chloride are formed. [2]

Energy released = ..... kJ



- (iii) The energy profile diagram for the reaction between hydrogen and chlorine is given below.



Give the letter that shows

the activation energy .....

the overall energy change for the reaction .....

[2]

|   |
|---|
|   |
| 9 |





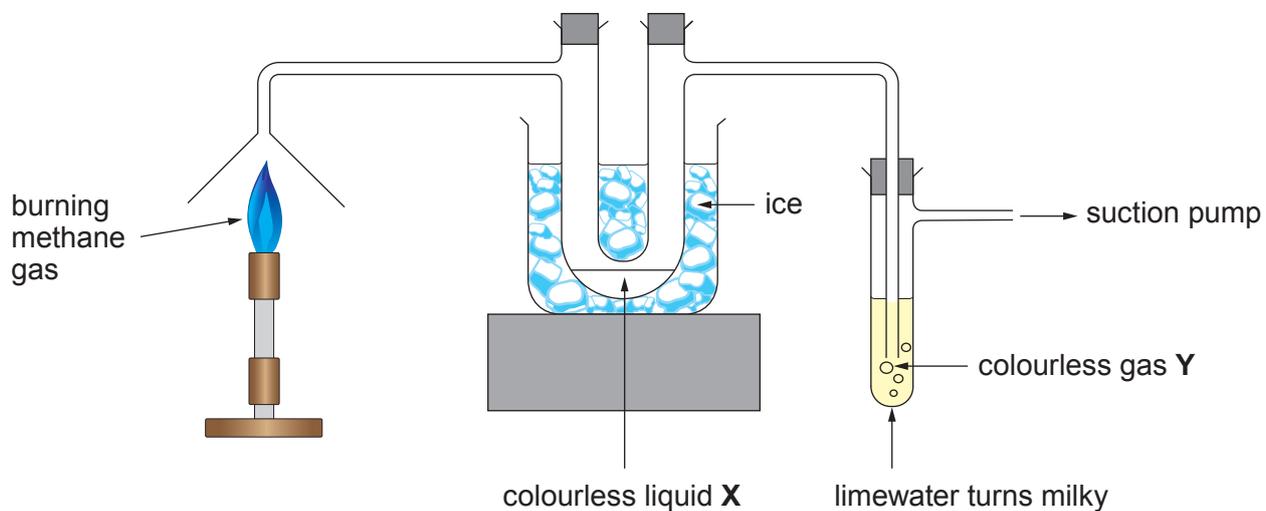
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09



3. (a) The diagram shows apparatus that can be used to investigate the products formed when methane gas burns. Methane has the formula  $\text{CH}_4$ .



- (i) Name the gas present in the air that is needed for methane to burn. [1]

.....

- (ii) Name the products formed. [2]

Colourless liquid **X** .....

Colourless gas **Y** .....

- (iii) Tick (✓) the box that gives the name of the group of substances that methane belongs to. [1]

alkenes

monomers

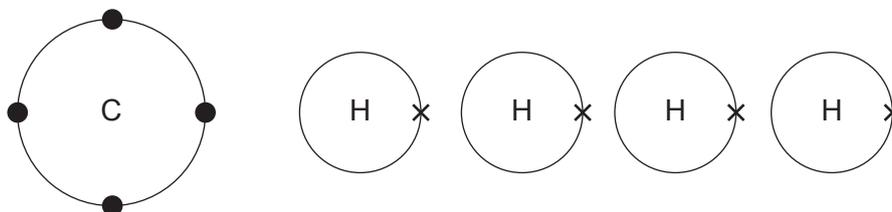
polymers

alkanes



(b) Methane has the formula  $\text{CH}_4$ . Its molecules consist of one carbon atom and four hydrogen atoms bonded together.

(i) Draw a diagram in the box to show how the atoms bond to form a methane molecule. [2]



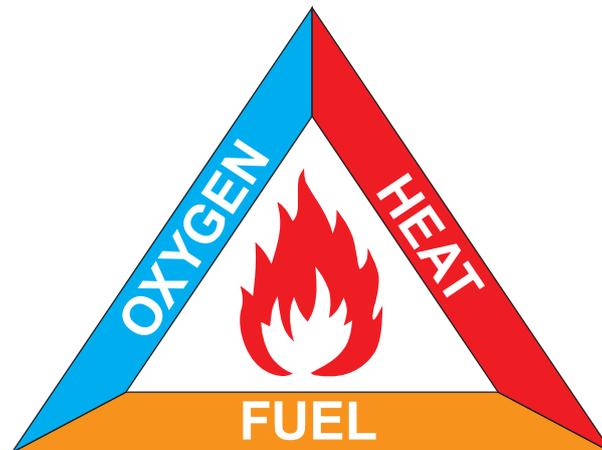
(ii) Give the name of this type of bonding.

[1]

.....



- (c) The fire triangle can be used to explain how fires are extinguished.



The following table gives information about three different types of fire and the methods used to extinguish them.

However, each of the three fires has an **error** in **one** of the columns.

| Fire | Type of fire    | Firefighting method | How method works |
|------|-----------------|---------------------|------------------|
| 1    | chip pan fire   | tea towel           | removes the heat |
| 2    | bonfire         | fire blanket        | removes the heat |
| 3    | electrical fire | fire breaks         | removes the fuel |

Circle the errors for fires **1** and **2** and then correct them in the table below.

The error for fire **3** has already been circled and the correction given.

[2]

| Fire | Correction                                       |
|------|--|
| 1    |  |
| 2    |  |
| 3    | Fire breaks are used to extinguish a forest fire |



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4. (a) Supermarkets across the UK now charge customers a minimum of 5p for every plastic carrier bag supplied.

The reason for the charge is to reduce the number of plastic carrier bags used by consumers and therefore reduce waste and litter.

Since the introduction of the charge for plastic carrier bags in Wales, the number of these bags used by consumers has fallen by over 70%.



Similarly, reports in England claim that supermarkets have issued 83% fewer bags since the charge was introduced.

It is estimated that every person in the UK currently uses around 25 plastic carrier bags per year, compared to around 140 before charges were introduced.

The majority of the money retailers generate from sales of carrier bags is donated to good causes. A survey of retailers across England and Wales reported that £87 million had been donated to good causes since the introduction of the 5p charge, amounting to 4p for every bag sold.

- (i) Use the information in the passage to decide whether the following statements are **true** or **false**.

Put a tick (✓) in the correct column for each statement.

[3]

| Statement  | True | False |
|--|------|-------|
| The number of plastic bags used in Wales and England has reduced since charging for them |      |       |
| Retailers donate all the money generated from the sale of plastic bags to good causes    |      |       |
| Plastic bags are no longer used  |      |       |
| The charge for plastic bags has totally stopped their use in Wales                       |      |       |
| The use of plastic bags leads to environmental problems                                  |      |       |
| The charge for plastic bags is beneficial to good causes                                 |      |       |



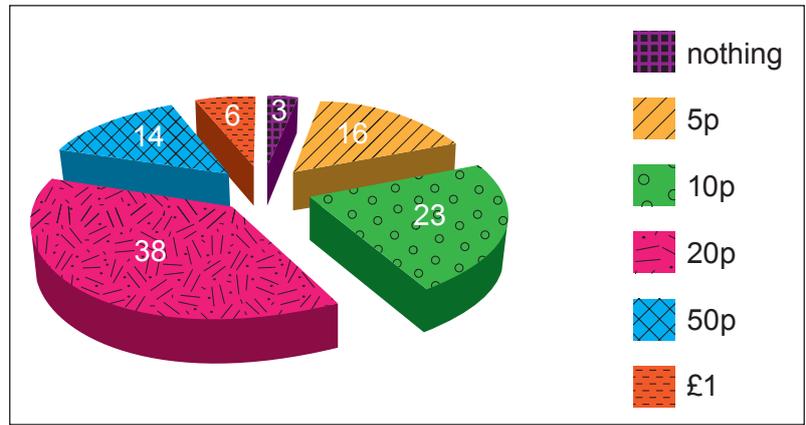
Examiner only

(ii) How many fewer plastic bags will each person in the UK use over a 5-year period, based on the estimated number of bags used per person before and after the charge was introduced? [2]

Number of bags = .....

(b) More than half of all consumers still regularly buy plastic bags.

The pie chart shows the results of a survey where 100 consumers were asked what is the most they would pay for a plastic bag.



Give the number of consumers that would be prepared to pay **more than** 5p for a plastic bag. [2]

Number of consumers = .....

(c) Give **one** property of plastics which leads to long-term environmental problems. [1]

.....

8





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6. Polymer gels are commonly used in disposable nappies.

A company that manufactures disposable nappies was investigating the effect of temperature on the mass of water the polymer gel in their nappies is able to absorb.

- (a) The results collected using water at 40 °C are given below. The initial mass of the polymer gel bead was 0.035 g.

| Time (hours) | Mass of bead (g) | Mass of water absorbed by bead (g) (to 1 decimal place) |
|--------------|------------------|---|
| 0            | 0.035            | 0.0   |
| 2            | 4.048            | 4.0   |
| 4            | 6.030            | 6.0   |
| 6            | 7.280            | 7.2   |
| 8            | 7.891            | 7.9   |
| 10           | 8.181            | 8.1   |
| 12           | 8.181            | 8.1   |

- (i) The percentage increase in the mass of the bead is calculated using the following equation.

$$\text{percentage increase} = \frac{\text{mass of water absorbed}}{\text{initial mass of bead}} \times 100$$

Calculate the percentage increase in the mass of the bead after 2 hours. Give your answer to the nearest whole number. [1]

Percentage increase = ..... %

- (ii) What property of polymer gels does the figure calculated in part (i) demonstrate? [1]

.....

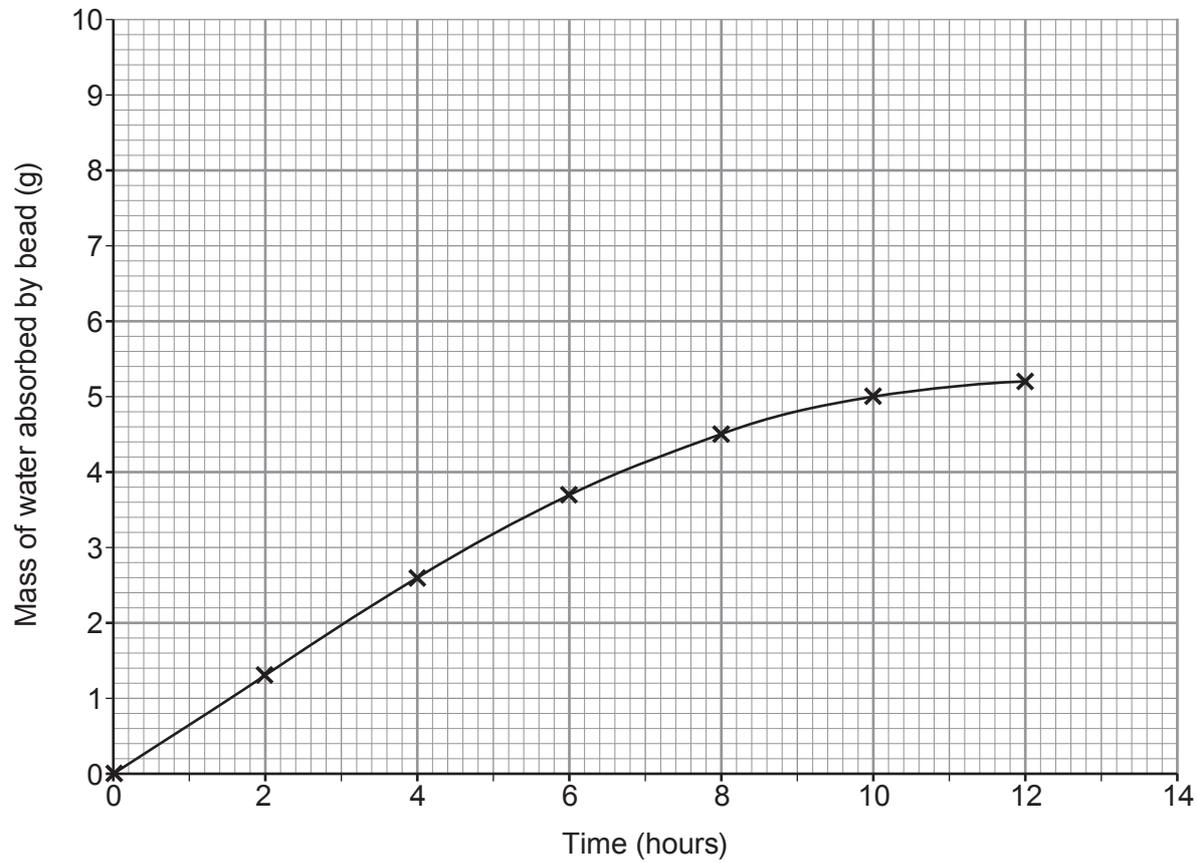


Examiner only

- (b) (i) On the grid below, plot the results using water at 40 °C and draw a suitable line. Use the mass of water absorbed by the bead to 1 decimal place.

The results using water at 10 °C have already been plotted.

[3]



- (ii) Give **two** differences between the absorbing properties of the bead using water at 10 °C and at 40 °C.

[2]

Difference 1 .....

.....

Difference 2 .....

.....

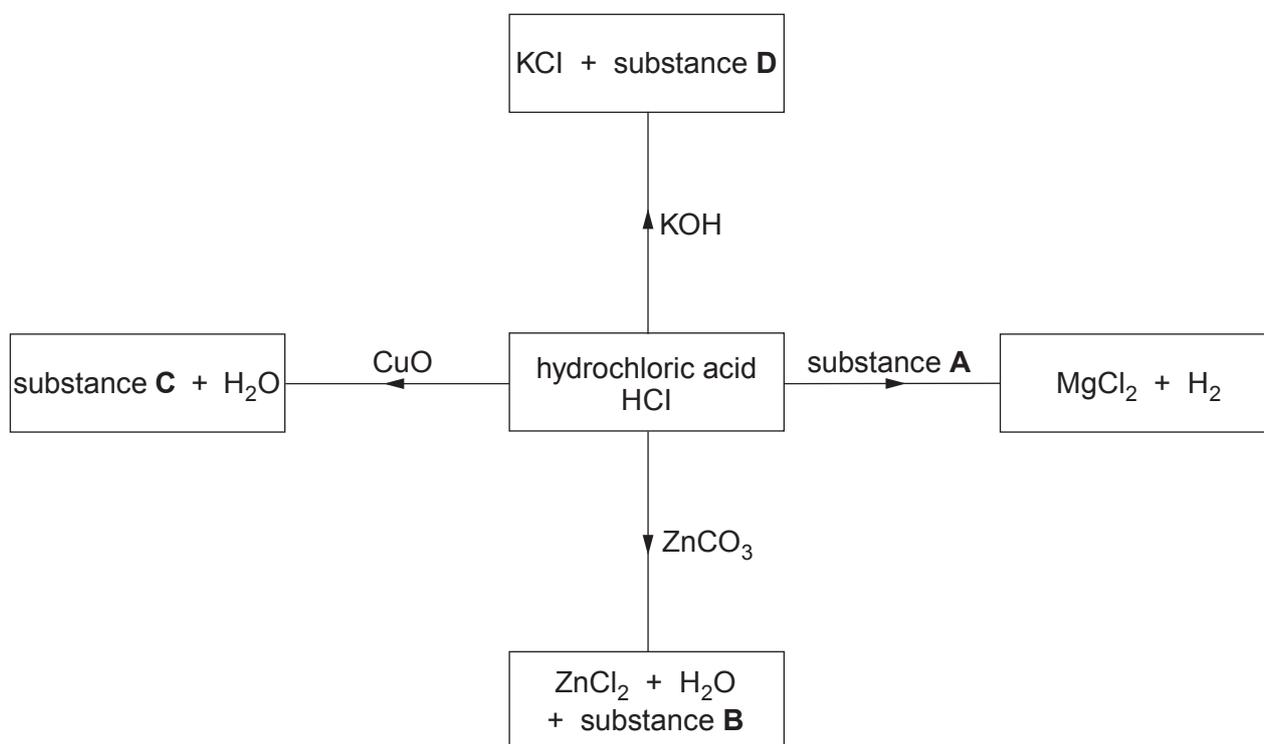
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7. The reactions of acids with metals, bases and carbonates are summarised in the following equations.

- acid + metal  $\rightarrow$  salt + hydrogen
- acid + base  $\rightarrow$  salt + water
- acid + carbonate  $\rightarrow$  salt + water + carbon dioxide

(a) The diagram shows some reactions of hydrochloric acid, HCl.



(i) Give the **names** of substances **A** and **B**. [2]

Substance **A** .....

Substance **B** .....

(ii) Give the **formulae** of substances **C** and **D**. [2]

Substance **C** .....

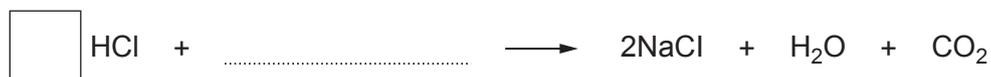
Substance **D** .....



(b) Complete the equation for the reaction between hydrochloric acid and sodium carbonate by

- writing the formula of sodium carbonate on the dotted line
- putting a number into the box to balance the equation

[2]

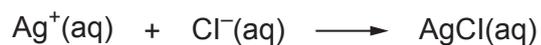


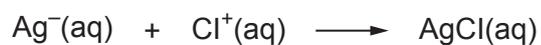
(c) Silver nitrate solution is used to identify the chloride ions present in hydrochloric acid.

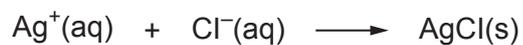
(i) Give the observation made when silver nitrate solution is added to hydrochloric acid. [1]

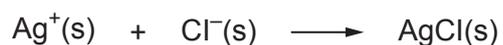
.....

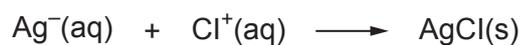
(ii) Put a tick (✓) in the box next to the correct ionic equation for the reaction between silver nitrate and hydrochloric acid. [1]












**END OF PAPER**





**FORMULAE FOR SOME COMMON IONS**

| POSITIVE IONS |                  | NEGATIVE IONS |                    |
|---------------|------------------|---------------|--------------------|
| Name          | Formula          | Name          | Formula            |
| aluminium     | $\text{Al}^{3+}$ | bromide       | $\text{Br}^-$      |
| ammonium      | $\text{NH}_4^+$  | carbonate     | $\text{CO}_3^{2-}$ |
| barium        | $\text{Ba}^{2+}$ | chloride      | $\text{Cl}^-$      |
| calcium       | $\text{Ca}^{2+}$ | fluoride      | $\text{F}^-$       |
| copper(II)    | $\text{Cu}^{2+}$ | hydroxide     | $\text{OH}^-$      |
| hydrogen      | $\text{H}^+$     | iodide        | $\text{I}^-$       |
| iron(II)      | $\text{Fe}^{2+}$ | nitrate       | $\text{NO}_3^-$    |
| iron(III)     | $\text{Fe}^{3+}$ | oxide         | $\text{O}^{2-}$    |
| lithium       | $\text{Li}^+$    | sulfate       | $\text{SO}_4^{2-}$ |
| magnesium     | $\text{Mg}^{2+}$ |               |                    |
| nickel        | $\text{Ni}^{2+}$ |               |                    |
| potassium     | $\text{K}^+$     |               |                    |
| silver        | $\text{Ag}^+$    |               |                    |
| sodium        | $\text{Na}^+$    |               |                    |
| zinc          | $\text{Zn}^{2+}$ |               |                    |



# THE PERIODIC TABLE

Group 1 2 3 4 5 6 7 0

|  |                             |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            |                              |                             |   |                              |                           |
|--|-----------------------------|------------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|----------------------------|------------------------------|----------------------------|----------------------------|------------------------------|-----------------------------|---|------------------------------|---------------------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <sup>1</sup><br/>H<br/>Hydrogen<br/>1         </div> |                             |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            |                              |                             | <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <sup>4</sup><br/>He<br/>Helium<br/>2         </div> |                              |                           |
| 7<br>Li<br>Lithium<br>3  | 9<br>Be<br>Beryllium<br>4   |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 19<br>F<br>Fluorine<br>9     | 20<br>Ne<br>Neon<br>10      |   |                              |                           |
| 23<br>Na<br>Sodium<br>11   | 24<br>Mg<br>Magnesium<br>12 |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 35.5<br>Cl<br>Chlorine<br>17 | 40<br>Ar<br>Argon<br>18     |   |                              |                           |
| 39<br>K<br>Potassium<br>19   | 40<br>Ca<br>Calcium<br>20   |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 79<br>Se<br>Selenium<br>34   | 84<br>Kr<br>Krypton<br>36   |   |                              |                           |
| 86<br>Rb<br>Rubidium<br>37   | 88<br>Sr<br>Strontium<br>38 |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 127<br>I<br>Iodine<br>53     | 131<br>Xe<br>Xenon<br>54    |   |                              |                           |
| 133<br>Cs<br>Caesium<br>55   | 137<br>Ba<br>Barium<br>56   |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 210<br>Po<br>Polonium<br>84  | 222<br>Rn<br>Radon<br>86    |   |                              |                           |
| 223<br>Fr<br>Francium<br>87  | 226<br>Ra<br>Radium<br>88   |                              |                             |                             |                              |                              |                              |                            |                              |                            |                            | 210<br>Po<br>Polonium<br>84  | 222<br>Rn<br>Radon<br>86    |   |                              |                           |
|  |                             | 45<br>Sc<br>Scandium<br>21   | 48<br>Ti<br>Titanium<br>22  | 51<br>V<br>Vanadium<br>23   | 52<br>Cr<br>Chromium<br>24   | 55<br>Mn<br>Manganese<br>25  | 56<br>Fe<br>Iron<br>26       | 59<br>Co<br>Cobalt<br>27   | 59<br>Ni<br>Nickel<br>28     | 63.5<br>Cu<br>Copper<br>29 | 65<br>Zn<br>Zinc<br>30     | 70<br>Ga<br>Gallium<br>31    | 73<br>Ge<br>Germanium<br>32 | 75<br>As<br>Arsenic<br>33   | 79<br>Se<br>Selenium<br>34   | 84<br>Kr<br>Krypton<br>36 |
|  |                             | 89<br>Y<br>Yttrium<br>39     | 91<br>Zr<br>Zirconium<br>40 | 93<br>Nb<br>Niobium<br>41   | 96<br>Mo<br>Molybdenum<br>42 | 99<br>Tc<br>Technetium<br>43 | 101<br>Ru<br>Ruthenium<br>44 | 103<br>Rh<br>Rhodium<br>45 | 106<br>Pd<br>Palladium<br>46 | 108<br>Ag<br>Silver<br>47  | 112<br>Cd<br>Cadmium<br>48 | 115<br>In<br>Indium<br>49    | 119<br>Sn<br>Tin<br>50      | 122<br>Sb<br>Antimony<br>51   | 128<br>Te<br>Tellurium<br>52 | 131<br>Xe<br>Xenon<br>54  |
|  |                             | 139<br>La<br>Lanthanum<br>57 | 179<br>Hf<br>Hafnium<br>72  | 181<br>Ta<br>Tantalum<br>73 | 184<br>W<br>Tungsten<br>74   | 186<br>Re<br>Rhenium<br>75   | 190<br>Os<br>Osmium<br>76    | 192<br>Ir<br>Iridium<br>77 | 195<br>Pt<br>Platinum<br>78  | 197<br>Au<br>Gold<br>79    | 201<br>Hg<br>Mercury<br>80 | 204<br>Tl<br>Thallium<br>81  | 207<br>Pb<br>Lead<br>82     | 209<br>Bi<br>Bismuth<br>83  | 210<br>Po<br>Polonium<br>84  | 222<br>Rn<br>Radon<br>86  |
|  |                             | 227<br>Ac<br>Actinium<br>89  |                             |                             |                              |                              |                              |                            |                              |                            |                            |                              | 210<br>Po<br>Polonium<br>84 | 222<br>Rn<br>Radon<br>86  |                              |                           |

### Key

