

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	
Total	60	

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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.

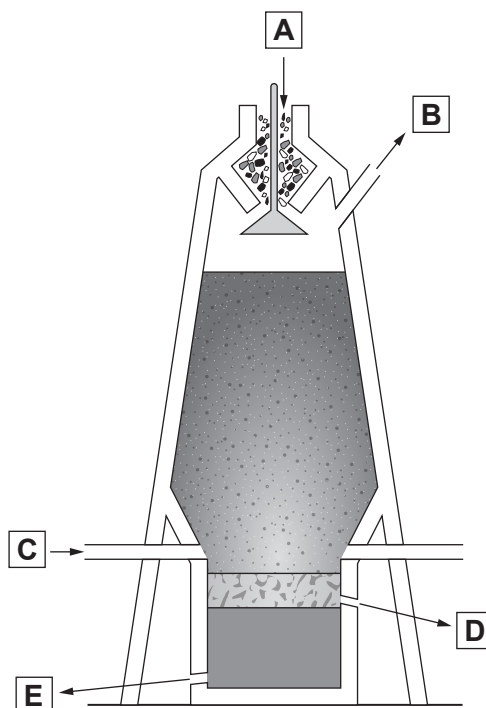


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Answer **all** questions.

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

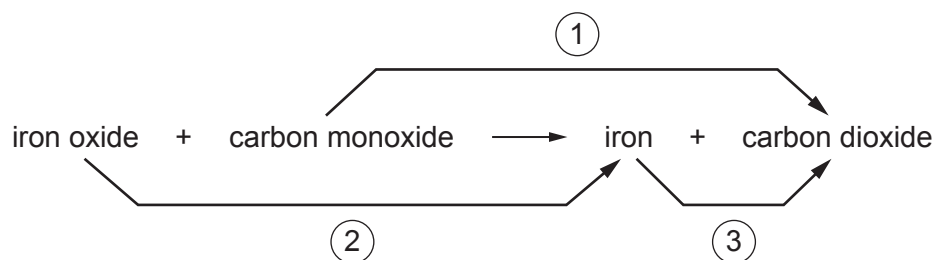
waste gases leave the furnace

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 Ca^{2+} and CO_3^{2-} .

Circle the correct formula for calcium carbonate.

[1]

CaCO

Ca₂CO₃

CaCO₃

Ca(CO₃)₂

- (iv) One of the waste gases that leaves the blast furnace is carbon dioxide, CO_2 .

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

[1]

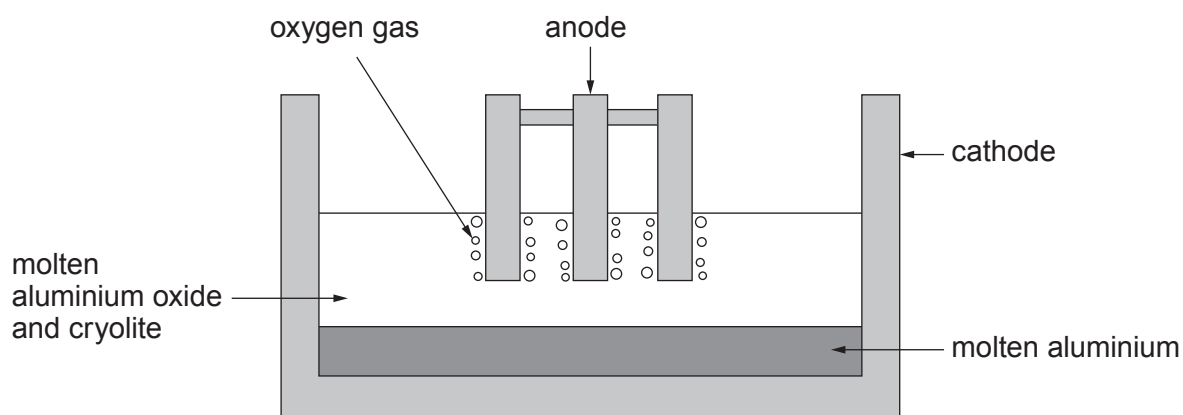

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(b) The diagram shows an electrolysis cell used in the extraction of aluminium.



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

[3]

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

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13



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 cm^3 of hydrochloric acid into a polystyrene cup.
2. Record the temperature of the hydrochloric acid.
3. Measure 25 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 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]

.....

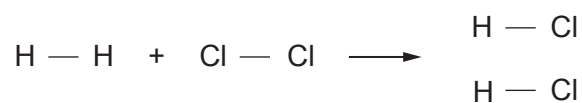
- (iii) Hannah and Evan calculated a temperature increase of 17°C .

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

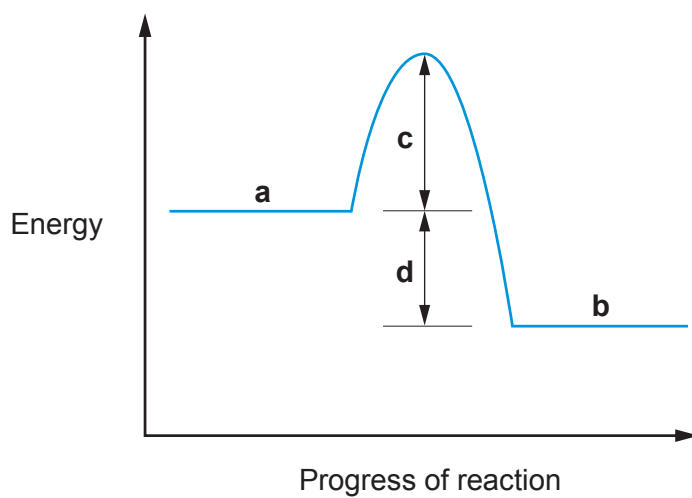
- (i) The energy needed to break the bonds in the hydrogen and chlorine molecules is 679 kJ. Show how this value is calculated. [1]

- (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]

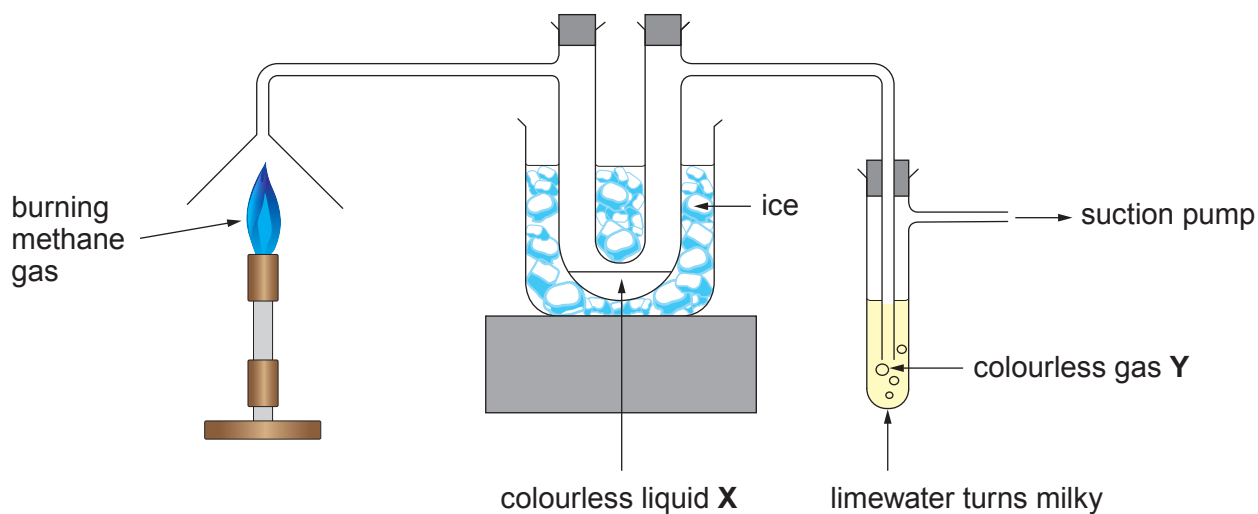


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3. (a) The diagram shows apparatus that can be used to investigate the products formed when methane gas burns. Methane has the formula CH_4 .



- (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

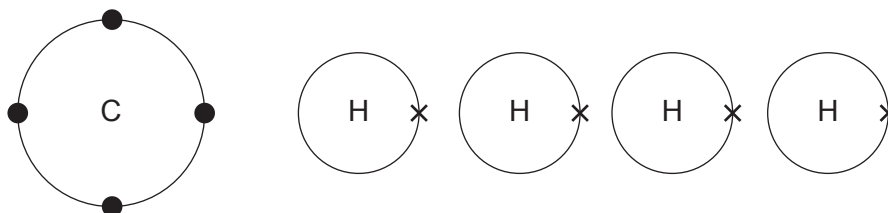
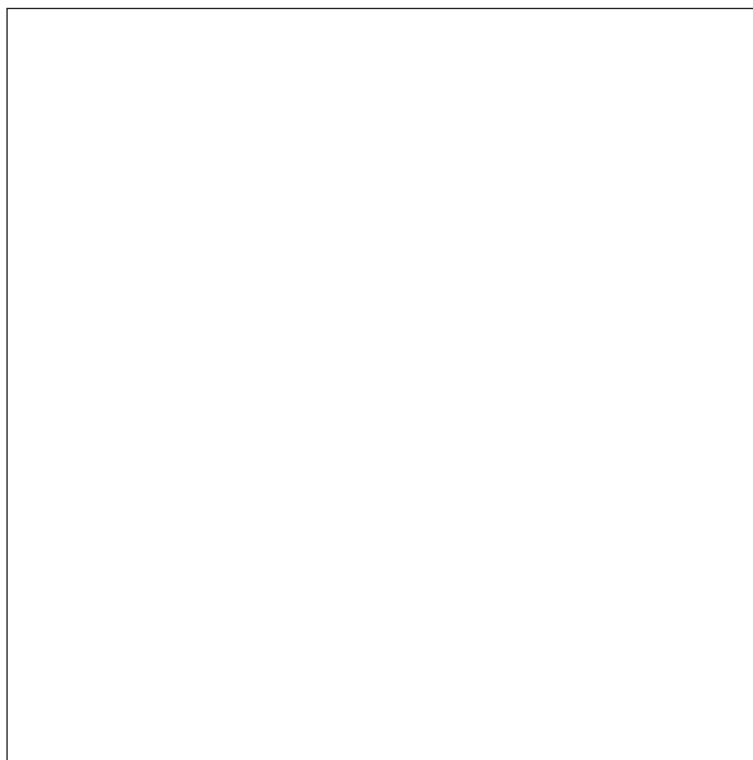
☐

alkanes

☐


- (b) Methane has the formula 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]



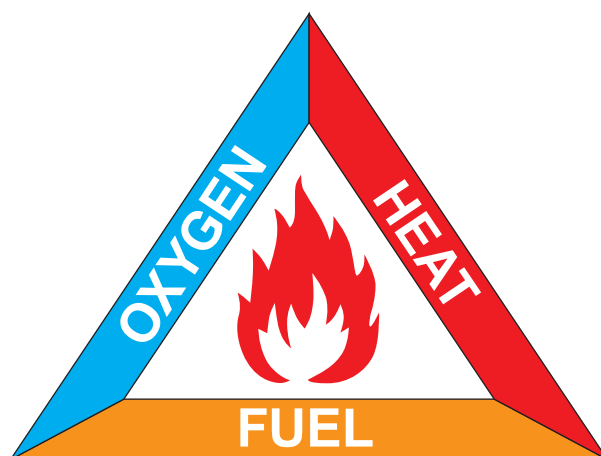
- (ii) Give the name of this type of bonding.

[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		

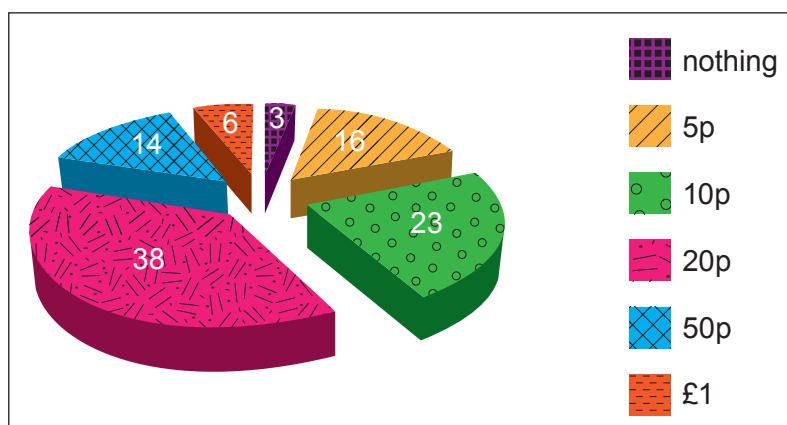


- (ii) How many fewer plastic bags will each person in the UK use over a 5-year period, based on the estimated number of bags used per person before and after the charge was introduced? [2]

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]

.....



- The table shows the results obtained when each metal was placed into solutions of the nitrates of the other metals.

	magnesium	iron	copper
magnesium nitrate		×	×
iron(II) nitrate	✓		×
copper(II) nitrate	✓	✓	

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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]

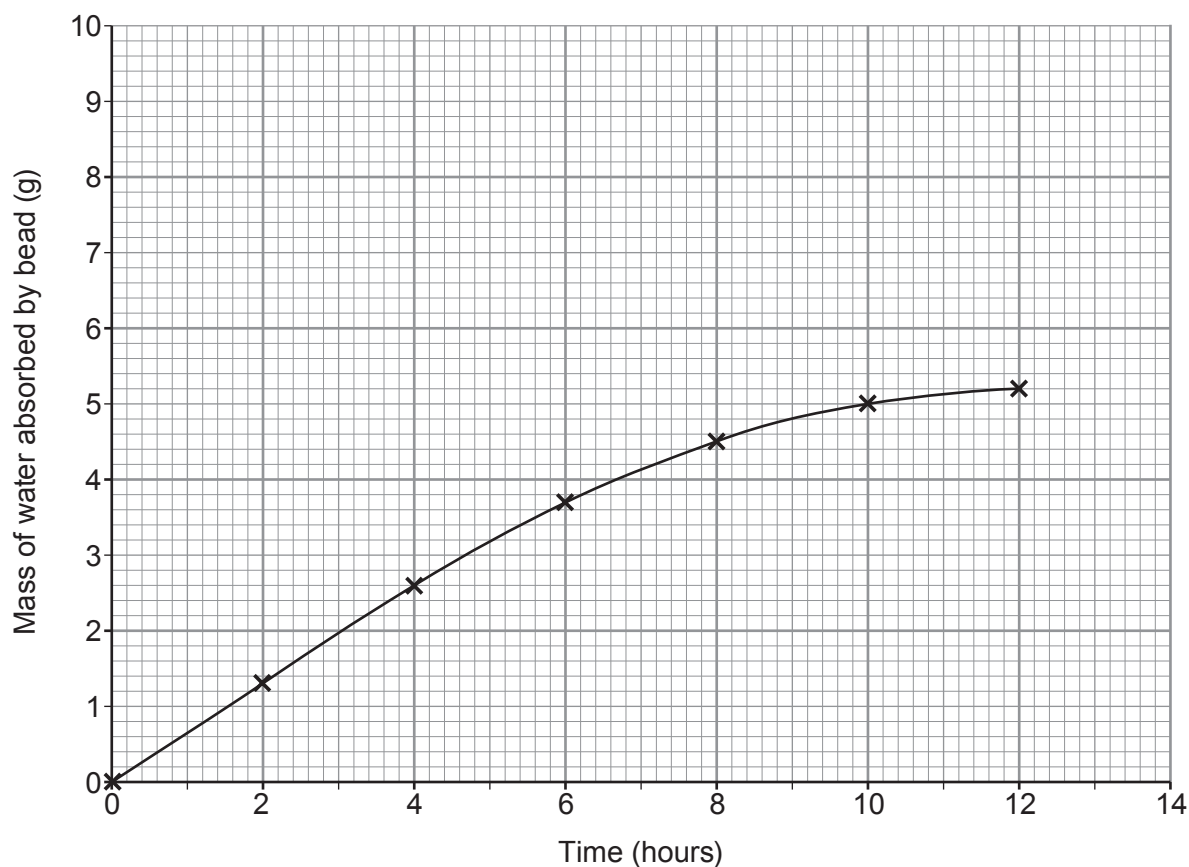
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- (b) (i) On the grid below, plot the results using water at 40 °C and draw a suitable line. Use the mass of water absorbed by the bead to 1 decimal place.

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

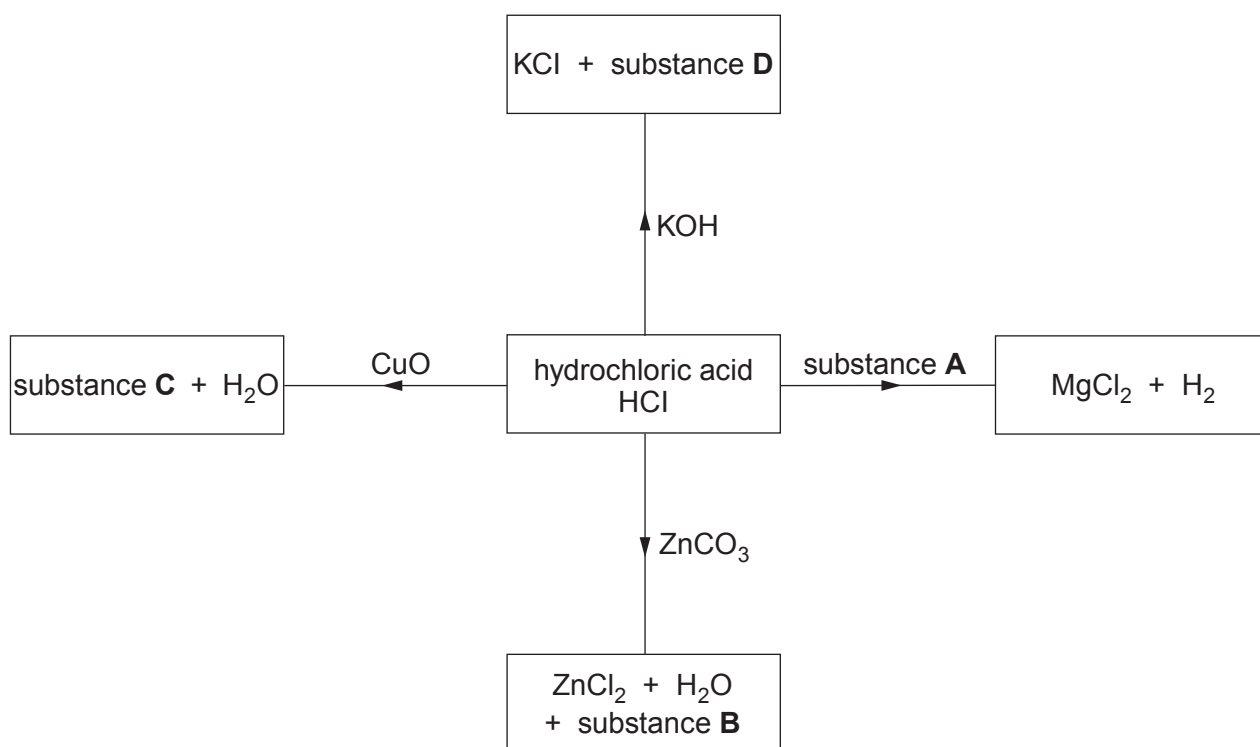
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7. The reactions of acids with metals, bases and carbonates are summarised in the following equations.

- 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**

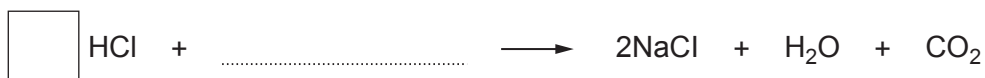
Substance **D**



- (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]

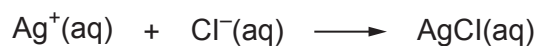
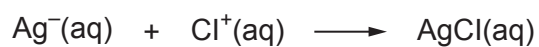
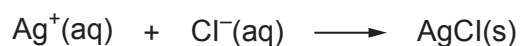
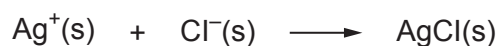
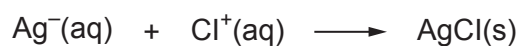


- (c) Silver nitrate solution is used to identify the chloride ions present in hydrochloric acid.

- (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]


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[illegible]

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+}		





THE PERIODIC TABLE

1 2

Group

3

4

5

6

7

0

¹ H Hydrogen 1

⁷ Li Lithium 3	⁹ Be Beryllium 4
²³ Na Sodium 11	²⁴ Mg Magnesium 12
³⁹ K Potassium 19	⁴⁰ Ca Calcium 20
⁸⁶ Rb Rubidium 37	⁸⁸ Sr Strontium 38
¹³³ Cs Caesium 55	¹³⁷ Ba Barium 56
²²³ Fr Francium 87	²²⁶ Ra Radium 88

¹¹ B Boron 5	¹² C Carbon 6	¹⁴ N Nitrogen 7	¹⁶ O Oxygen 8	¹⁹ F Fluorine 9	²⁰ Ne Neon 10
²⁷ Al Aluminium 13	²⁸ Si Silicon 14	³¹ P Phosphorus 15	³² S Sulfur 16	^{35.5} Cl Chlorine 17	⁴⁰ Ar Argon 18
⁷⁰ Ga Gallium 31	⁷³ Ge Germanium 32	⁷⁵ As Arsenic 33	⁷⁹ Se Selenium 34	⁸⁰ Br Bromine 35	⁸⁴ Kr Krypton 36
¹¹⁵ In Indium 49	¹¹⁹ Sn Tin 50	¹²² Sb Antimony 51	¹²⁸ Te Tellurium 52	¹²⁷ I Iodine 53	¹³¹ Xe Xenon 54
²⁰⁴ Tl Thallium 81	²⁰⁷ Pb Lead 82	²⁰⁹ Bi Bismuth 83	²¹⁰ Po Polonium 84	²¹⁰ At Astatine 85	²²² Rn Radon 86

⁶⁵ Zn Zinc 30	^{63.5} Cu Copper 29	⁵⁹ Ni Nickel 28	⁵⁹ Co Cobalt 27	⁵⁶ Fe Iron 26	⁵⁵ Mn Manganese 25	⁵² Cr Chromium 24	⁵¹ V Vanadium 23	⁴⁸ Ti Titanium 22	⁴⁵ Sc Scandium 21
¹¹² Cd Cadmium 48	¹⁰⁸ Ag Silver 47	¹⁰⁶ Pd Palladium 46	¹⁰³ Rh Rhodium 45	¹⁰¹ Ru Ruthenium 44	⁹⁹ Tc Technetium 43	⁹⁶ Mo Molybdenum 42	⁹³ Nb Niobium 41	⁹¹ Zr Zirconium 40	⁸⁹ Y Yttrium 39
²⁰¹ Hg Mercury 80	¹⁹⁷ Au Gold 79	¹⁹⁵ Pt Platinum 78	¹⁹² Ir Iridium 77	¹⁹⁰ Os Osmium 76	¹⁸⁶ Re Rhenium 75	¹⁸⁴ W Tungsten 74	¹⁸¹ Ta Tantalum 73	¹⁷⁹ Hf Hafnium 72	¹³⁹ La Lanthanum 57

Key

relative atomic mass

^{A_r} Symbol Name Z	atomic number
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