Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 14 May 2020

Morning (Time: 1 hour 45 minutes) | Paper Reference **1CH0/1F**

Chemistry

Paper 1

Foundation Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for each question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 2 0 8 3 R A 0 1 3 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution?

(1)

☒ **A** crystallising

☒ **B** diluting

☒ **C** dissolving

☒ **D** melting

(b) Sodium reacts with hydrochloric acid to form sodium chloride and hydrogen.

(i) Write the word equation for this reaction.

(2)

sodium + hydrochloric acid (1) → sodium chloride + hydrogen (1)

(ii) The hazard symbol shown in Figure 1 is used on containers of sodium.

Figure 1

What is the meaning of this hazard symbol?

(1)

☒ **A** corrosive

☒ **B** flammable

☒ **C** oxidising

☒ **D** toxic

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(iii) Hydrogen has one electron in its electron shell.
Figure 2 shows the incomplete dot and cross diagram of a hydrogen molecule.

Complete Figure 2 to show the electrons in the covalent bond between the two atoms of hydrogen.

(1)

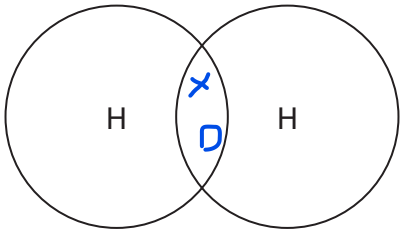

Figure 2

(c) The pH of a sodium chloride solution was measured.

(i) State what could be used to measure the pH of a solution.

(1)

pH meter

(ii) Sodium chloride solution is neutral.

Give the pH of this solution.

(1)

7

(Total for Question 1 = 7 marks)

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2 Chlorine has an atomic number of 17.

(a) Figure 3 shows the arrangement of electrons in an atom of chlorine.

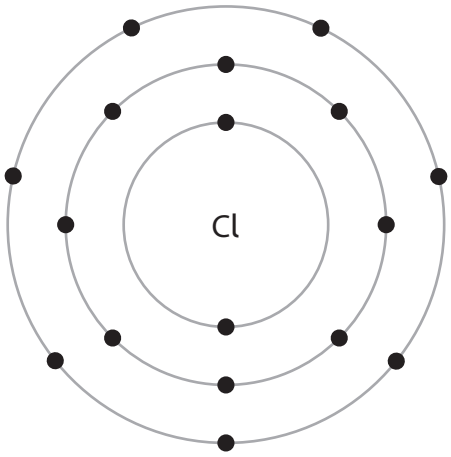

Figure 3

(i) What is the electronic configuration of this atom?

(1)

☒ **A** 10.7

☒ **B** 17

☒ **C** 2.8.7

☒ **D** 7.8.2

(ii) Explain, using Figure 3, why chlorine belongs to group 7 of the periodic table.

(2)

An explanation linking

• number of electrons in outer shell (1)

• is the same as group number (1)

(b) The nucleus of an atom is made up of protons and neutrons.
Atoms of chlorine contain 17 protons.

Figure 4 shows some information about a proton, a neutron and an electron.

	relative mass	relative charge
proton	1	+1
neutron	1	0
electron	very small	−1

Figure 4

(i) Explain, using the information in Figure 3 and Figure 4, why atoms of chlorine have no overall charge.

(2)

An explanation linking

• same number of electrons and protons (1)
• so charges {cancel / balance one another} (1

(ii) Atoms of chlorine-37 have a mass number of 37.

Calculate the number of neutrons in atoms of chlorine-37.

(1)

37 – 17 (1) (= 20) (neutrons)

number of neutrons = ...

(iii) There are two isotopes of chlorine, chlorine-35 and chlorine-37.

Explain the meaning of the term **isotopes**.

(2)

An explanation linking

• atoms {of same element / with same number of protons} / same atomic number (1)

• different number of neutrons / different mass number (1)

(Total for Question 2 = 8 marks)

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3 In industry, ammonia is manufactured by reacting nitrogen with hydrogen.

(a) (i) Give the name of the industrial process used to manufacture ammonia.

(1)

Haber

(ii) Write the word equation for this reaction, including the correct symbol to show that the reaction is reversible.

(3)

nitrogen + hydrogen ----> ammonia (3)
reactants (1) <---- product (1)
(1)

(b) The formula of ammonia is NH_3.

State what the formula of ammonia shows about the number of nitrogen atoms and the number of hydrogen atoms combined in a molecule of ammonia.

(1)

one nitrogen (atom) and three hydrogen (atoms) (1)

(c) Most of the ammonia manufactured in industry is used to produce fertilisers.

(i) A fertiliser is made by reacting ammonia with nitric acid.

What is the name of this fertiliser?

(1)

☒ **A** ammonia nitrate

☐ **B** ammonia nitric

☐ **C** ammonium nitrate

☐ **D** ammonium nitric

(ii) Explain the importance of fertilisers in farming.

(2)

An explanation linking any two from
• crops require fertilisers to grow (1)

• fertilisers contain N / P / K compounds (1)
• promote plant growth (1)
• increased yield (means greater profits) (1)

(Total for Question 3 = 8 marks)

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4 (a) In the 19th century, Mendeleev arranged the elements known at the time to form his periodic table.
Mendeleev's periodic table is different from the modern periodic table.

State **one** difference between Mendeleev's periodic table and the modern periodic table.

(1)

arranged by order of (relative) atomic mass / (in Mendeleev's early periodic table) gaps / missing elements / fewer elements / noble gases were not present

(b) Aluminium oxide reacts with hydrochloric acid to form a salt and water.

(i) State the name of the salt formed.

(1)

aluminium chloride

(ii) In this reaction aluminium oxide is a base.

State the type of reaction that takes place when an acid reacts with a base.

(1)

neutralization

(c) Gallium, Ga, is in the same group of the modern periodic table as aluminium.

The formula of aluminium oxide is Al_2O_3.

(i) Predict the formula of gallium oxide.

(1)

Ga2O3

(ii) Gallium oxide has a very high melting point.
Gallium oxide does not conduct electricity when solid but does conduct electricity when molten.

What type of substance is gallium oxide?

(1)

☒ **A** giant covalent

☒ **B** ionic

☒ **C** metallic

☒ **D** simple molecular

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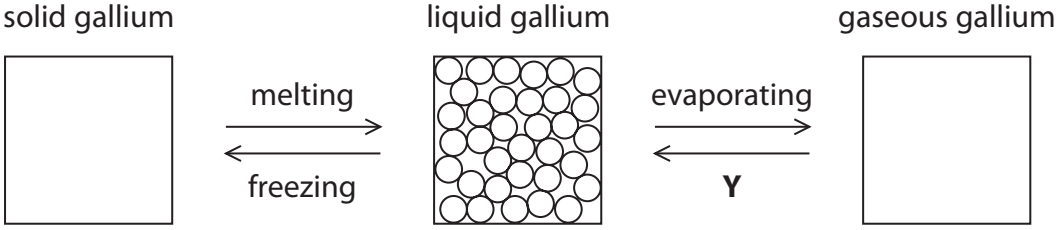
(d) Figure 5 shows the changes of state for gallium and the arrangement of particles in liquid gallium.



solid (1)
(regular arrangement and touching)

gas (1)
(widely spaced, fewer shown)

Figure 5

(i) Complete the boxes for solid gallium and gaseous gallium by drawing the arrangement of the particles in each of these physical states.

(2)

(ii) Give the name of the change of state labelled **Y** in Figure 5.

(1)

condensing / condensation

(e) Gallium metal is a conductor of electricity.

Explain how metals conduct electricity.

(2)

An explanation linking
- electrons (1)
- can move / are delocalised (1)

(Total for Question 4 = 10 marks)

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5 Transition metals have many uses.

(a) The pie chart in Figure 6 shows the uses of one transition metal.

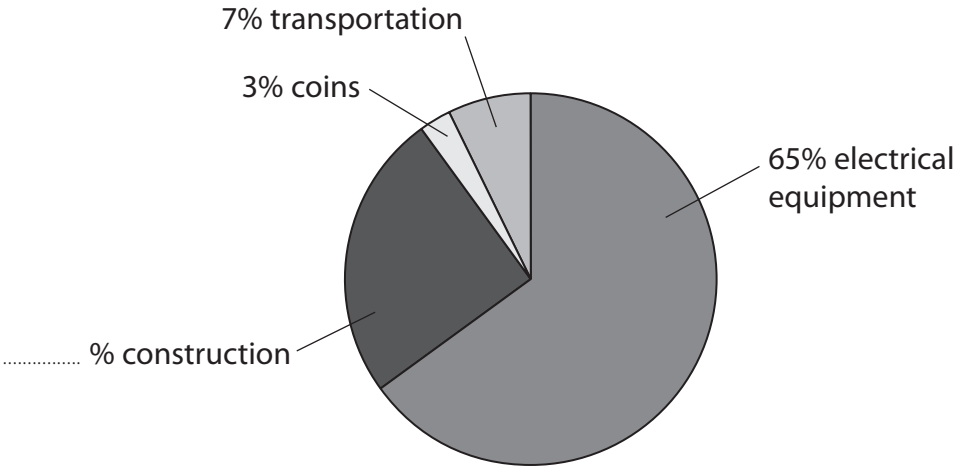

Figure 6

Calculate the percentage of this transition metal used in construction.

(1)

100 – 65 – 7 – 3 (1) (= 25)

.....

percentage of this transition metal used in construction = ...

(b) Figure 7 shows five statements about iron.

Put ticks (✓) in the boxes in Figure 7 to show which statements are true and which statements are false.
The first one has been done for you.

(3)

	true	false
iron is a poor conductor of heat		✓
iron can act as a catalyst	✓	
iron forms compounds that are coloured	✓	
iron has a low density		✓
iron has a very high melting point	✓	

Figure 7

(c) Most iron produced is converted into alloys of iron.

(i) State why alloys have more uses than pure metals.

(1)

alloys stronger / pure metals weaker /
alloys more corrosion resistant

(ii) An alloy of iron contains 0.40 % of molybdenum.

Calculate the mass of molybdenum contained in a 30 g sample of this alloy of iron.

(2)

0.40 x 30 (1) (= 12)

$\frac{12\ (1)\ (= 0.12)(g)}{100}$

mass of molybdenum = 0.12 g

(d) Many transition metals are used to make the reactants in chemical cells.

Figure 8 shows a graph of the voltage produced by a chemical cell as it is used in a torch for many hours.

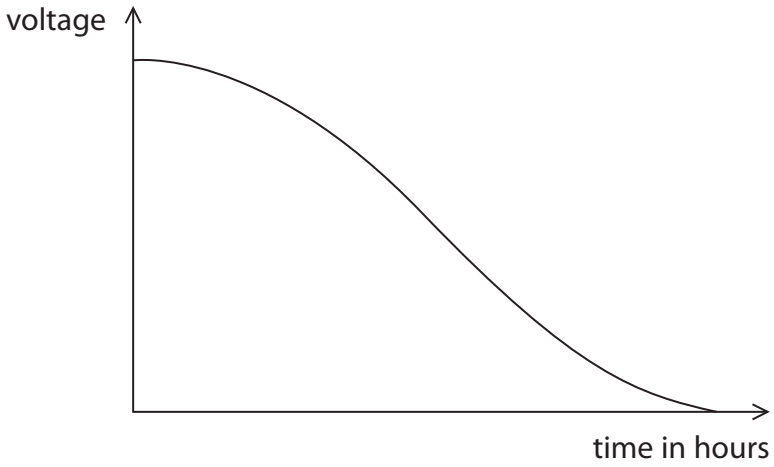

Figure 8

Suggest an explanation for the shape of the graph.

(2)

An explanation linking

• voltage decreases

• as {reactant / transition metal} used up

(Total for Question 5 = 9 marks)

6 Some metals are found in the Earth's crust as uncombined elements.
Reactive metals are found in ores.

In ores, metals are combined with other elements.

(a) Which of these metals is found as the uncombined element in the Earth's crust?

(1)

☒ **A** aluminium

☒ **B** gold

☒ **C** potassium

☒ **D** zinc

(b) Give **two** advantages of recycling metals rather than extracting metals from their ores.

(2)

1 Any two from
preserves ore reserves / reduces waste
/ reduces energy needed for metal
extraction / preserves {habitats/
landscape / resources}

2

(c) An ore of iron is mostly iron oxide, Fe_2O_3.
Iron can be extracted from this iron oxide by heating it with carbon.

Balance this equation for the reaction that takes place.

(1)

$2Fe_2O_3 +$ 3 $C \rightarrow$ 4 $Fe +$ 3 CO_2

(d) Most copper ores are described as low grade.
This means that the percentage of copper in the ore is very small.

5000 kg of one copper ore was found to contain 42.5 kg of copper.

Calculate the percentage of copper in this ore.

(2)

42.5 (1) x 100 (1) (= 0.85)
5000

percentage of copper in ore = 0.85

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(e) In one stage of the extraction of lead from its ore, lead oxide is heated strongly with carbon.

The equation for the reaction is

$$2PbO + C \rightarrow 2Pb + CO_2$$

Explain, using this equation, which substance has been oxidised in this reaction.

(2)

An explanation linking

• carbon / C (1)
• gained oxygen (to form carbon dioxide) (1)

(f) A titanium ore was analysed and found to contain 12 g of titanium atoms combined with 8.0 g of oxygen atoms.

Calculate the empirical formula of this titanium compound.
(relative atomic masses: Ti = 48, O = 16)

You must show your working.

(3)

Ti $\frac{12}{48}$ = 0.25 and O $\frac{8.0}{16}$ = 0.5 (1)

simplest ratio 1:2 (1)

empirical formula TiO2 (1)

empirical formula = TiO2

(Total for Question 6 = 11 marks)

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7 (a) Iron rusts when it is left in certain conditions.

(i) Figure 9 shows the apparatus used to investigate the rusting of some iron nails.

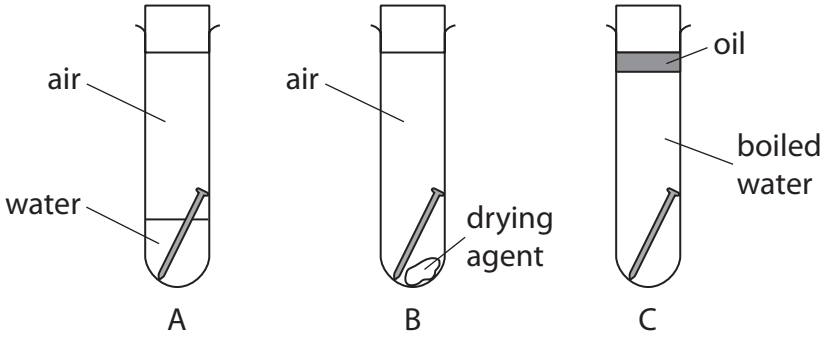

Figure 9

Explain why the iron nail in tube A would rust but the iron nails in tubes B and C would not rust.

(3)

An explanation linking

• both {air/oxygen} and water needed for rusting (1)
then any two from

• tube a – {air/oxygen} and water present (1)
• tube b – only dry {air/oxygen} present / no water (1)

• tube c – only water present (with nail) / no {air/oxygen} (1)

(ii) Magnesium is more reactive than iron.
Figure 10 shows an iron nail with a strip of magnesium wrapped around it, placed in some water.
The tube was left for a few days.

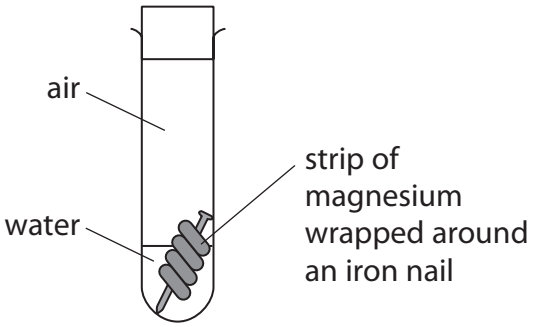

Figure 10

State what would happen to this iron nail.

(1)

No rusting / remains clean / does not corrode

(iii) When iron rusts, a brown solid forms on the surface of the iron.

What happens to the iron as the rust forms?

(1)

- ☒ **A** the iron is hydrated
- ☒ **B** the iron is neutralised
- ☒ **C** the iron is oxidised
- ☒ **D** the iron is reduced

(b) Give **one** reason why metals are electroplated.

(1)

improve appearance / more corrosion resistant

*(c) The pure metals aluminium, copper and gold and the alloys brass and magnalium are used to make many useful articles.

The way in which these metals and alloys are used is related to their properties, such as their density, electrical conductivity, resistance to corrosion and strength.

State some uses of aluminium, copper, gold, brass and magnalium and explain how each use is related to their properties.

(6)

suitable use of aluminium eg cooking foil
• related property – malleable, low toxicity, low reactivity

• suitable use of copper eg water pipes
• related property – low reactivity
(6)
• suitable use of gold eg electronic contacts
• related property – does not corrode, good electrical conductor

• suitable use of brass eg pins for electric plugs
• related property – strong and hard wearing

• suitable use of magnalium eg aircraft parts
• related property – low density

Possible candidate responses

• copper is used in electrical wiring because it is a good conductor of electricity so a current can pass through it. Magnalium is used in aircraft parts because it has a low density

• gold is used in jewellery because it is unreactive and so will not cause irritation to the wearer. Brass is used for making electrical plug pins because it is strong, so will not break easily – upper part of level

(Total for Question 7 = 12 marks)

8 Figure 11 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

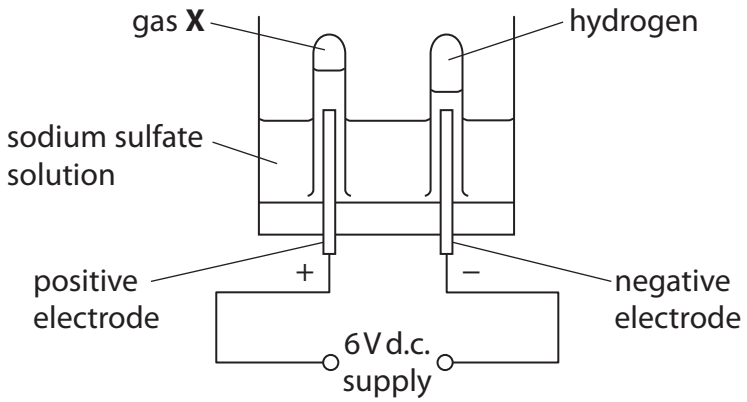

Figure 11

(a) Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

A description including

• apply lighted splint (1)

• gas burns / (squeaky) pop (1)

(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

☒ **A** ammonia

☒ **B** oxygen

☒ **C** nitrogen

☒ **D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

electrical energy / electricity (1)

• {decomposes / breaks down / splits} {electrolytes / (ionic) compounds / substances} (1)

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(b) The sodium sulfate solution was made by dissolving 28.4 g of sodium sulfate in water to make 250 cm^3 of solution.

Calculate the concentration of this solution in g dm^{-3}.

Give your answer to three significant figures.

(3)

final answer of 114 (g dm-3) with or without working (3)

OR

$\frac{28.4}{250}$ (1) (= 0.1136)

0.1136 x 1000 (1) (= 113.6)

concentration = 114 g dm^{-3}

(c) The ions present in sodium sulfate are

sodium	Na^+
sulfate	SO_4^{2-}

Write the formula of sodium sulfate using this information.

(1)

Na2SO4

(d) (i) In Figure 11, the gases given off at the electrodes are collected in test-tubes. However, the actual volume of gases cannot be measured using these test-tubes.

Suggest what apparatus could be used in place of the test-tubes in Figure 11 to measure the volume of gases given off.

(1)

measuring cylinder(s)

(ii) State what could be added into the circuit to show a current is flowing during electrolysis.

(1)

ight bulb / lamp / ammeter

(Total for Question 8 = 11 marks)

9 The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

(a) (i) Complete the balanced equation for this reaction.

(2)

$CuCO_3$ + H2SO4 (1) → CuSO4 (1) + CO_2 + H_2O

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

63.5 + 12 + 3x16 (1)

= 123.5 (1)

relative formula mass of $CuCO_3$ = 123.5

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

☒ **A** bubble the gas through limewater, limewater turns cloudy

☒ **B** put damp blue litmus paper in the gas, litmus paper turns red

☒ **C** put a lighted splint into the gas, splint is extinguished

☒ **D** measure the pH of the gas, pH = 4

(b) Figure 12 shows a conical flask containing dilute sulfuric acid.
Copper carbonate is added to the acid in the flask.
The copper carbonate is added one spatula measure at a time until the reaction has finished.

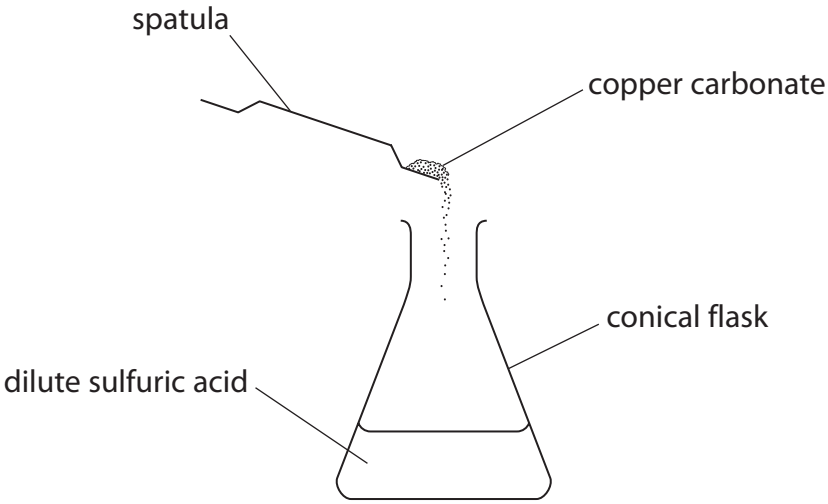

Figure 12

(i) State **two** observations that would show the reaction has finished.

(2)

Any TWO from

1 • no more bubbles / fizzing (1)

• no further change in colour (1)

2 • {solid / copper carbonate} remains at bottom of flask / no more {solid / copper carbonate} dissolves (1)

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*(ii) Describe how you would obtain a solution of copper sulfate from the mixture and how you would obtain pure, dry copper sulfate crystals from this solution.

Your description should include the apparatus you would use.

You may wish to use diagrams in your answer.

(6)

filter mixture

- using filter funnel and paper
- collect filtrate / copper sulfate solution
- in conical flask / suitable (named) container
- pour into an evaporating basin
- heat on water bath / on tripod over Bunsen
- until half volume / concentrated / partially evaporated / crystals start to appear around the edge
- remove from heat and cover with filter paper
- allow to cool
- and crystallise

- separate crystals using a suitable method

- put/place crystals onto absorbent/filter paper
- dry in a warm place

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(Total for Question 9 = 13 marks)

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10 Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

(a) A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

(i) Write the steps in the correct order.

Some of the steps have been completed for you.

(1)

first step				**last step**
K	L	J	N	**M**

(ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm^3 of potassium hydroxide solution.

(1)

(volumetric) pipette

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(b) A student was then asked to produce a pure sample of solid potassium chloride.

After finding the volume of acid reacted in step M, the student added this volume of acid to a fresh 25.0 cm^3 sample of the potassium hydroxide solution.
This mixture was then evaporated.

(i) Explain why this new mixture was evaporated rather than the original mixture from the titration, to produce a pure sample of solid potassium chloride.

(2)

An explanation linking

• solution from titration contains an indicator (1)

• therefore second solution used with no indicator / indicator would contaminate salt (1)

(ii) After evaporation, the mass of the potassium chloride was determined.

The theoretical yield of the experiment was 0.70 g.
The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.

(2)

final answer of 120% with or without working (2) OR

$\frac{0.84}{0.70}$ (=1.2) (1)

$\frac{0.84}{0.70}$ x 100 (=120(%)) (1)

percentage yield = 120%

(iii) Suggest a reason why the actual yield was greater than the theoretical yield.

(1)

{the salt/solid/potassium chloride}
was still wet/ not all of the water had
been evaporated off

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(iv) The equation for the reaction between potassium hydroxide solution and dilute hydrochloric acid is

$$KOH + HCl \rightarrow KCl + H_2O$$

Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.
(relative formula masses: KOH = 56.0, HCl = 36.5, KCl = 74.5, H_2O = 18.0)

Give your answer to one decimal place.

(4)

final answer of 80.5 with or without working (4) OR

total mass: $\frac{56 + 36.5 (=92.5)}{74.5 + 18 (=92.5)}$ / (1)

74.5 (= 0.8054) (1)
92.5

74.5 x 100 (=80.540) (1)
92.5

atom economy = 80.5 %

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

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The periodic table of the elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											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
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.