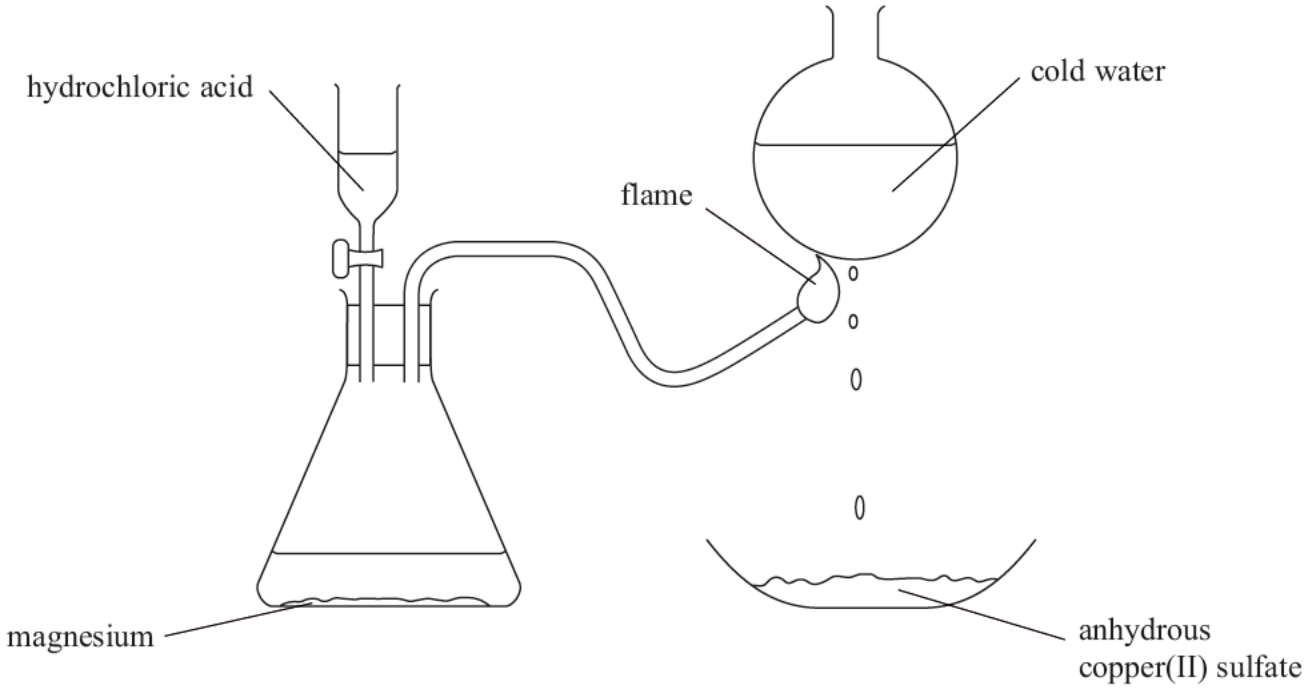
1 A student set up the following apparatus.



(a) The reaction between magnesium and hydrochloric acid forms hydrogen gas.

(i) State **one** observation the student would make during this reaction.

(1)

.....

.....

(ii) Identify the other product formed during this reaction.

(1)

.....

(b) The hydrogen gas burns in air to form steam. The steam changes to water on the surface of the round flask.

(i) Write a chemical equation for the burning of hydrogen in air.

(2)

.....

(ii) What name is used for the process in which steam changes into water?

(1)

.....

(c) The water drips onto anhydrous copper(II) sulfate and causes a reaction.
The product of this reaction has the formula $CuSO_4.5H_2O$

(i) State the final colour of the copper(II) sulfate in this reacti

(1)

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(ii) The colour change of the anhydrous copper(II) sulfate shows that the liquid contains water.

Describe a test to show that the water is pure.

(2)

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(Total for Question 1 8 marks)

2 This question is about hydrogen (H_2) and water.

(a) Hydrogen is a gas at room temperature. It exists as simple molecules.

(i) Draw a dot and cross diagram to show the arrangement of the electrons in a hydrogen molecule.

(1)

(ii) Explain why hydrogen has a very low boiling point.

(2)

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.....

(b) The symbols for the three isotopes of hydrogen are

^{1}H ^{2}H ^{3}H

(i) State what is meant by the term **isotopes**.

(2)

.....

.....

.....

.....

(ii) Complete the table to show the number of protons, neutrons and electrons in each of the three isotopes of hydrogen.

(3)

	Isotope		
	^{1}H	**^{2}H**	**^{3}H**
number of protons			
number of neutrons			
number of electrons			

(c) When hydrogen burns in oxygen, heat energy is transferred to the surroundings.

(i) State the name given to a reaction in which heat energy is transferred to the surroundings.

(1)

.....

(ii) Write a chemical equation to represent the reaction that takes place when hydrogen burns in oxygen.

(2)

.....

(iii) Describe a chemical test to show that the product is water.

(2)

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(iv) Describe a physical test to show that the product is pure water.

(2)

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(Total for Question 2 = 15 marks)

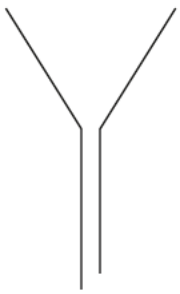
3 A student adds dilute sulfuric acid to a beaker containing calcium chloride solution. He obtains a mixture containing a precipitate of calcium sulfate in a solution of hydrochloric acid.

(a) Complete the equation for this reaction by inserting state symbols.

(1)

$$CaCl_2(\ldots\ldots) + H_2SO_4(\ldots\ldots) \rightarrow CaSO_4(\ldots\ldots) + 2HCl(\ldots\ldots)$$

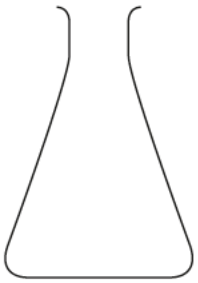
(b) The student uses this apparatus to separate the mixture into a residue and a filtrate.



filter funnel



folded filter paper



conical flask

Draw a diagram to show how he should assemble the apparatus for the filtration.

(2)

(c) The student carries out a flame test on the filtrate he obtains and observes a brick-red colour.

(i) Identify the ion responsible for this colour.

(1)

.....

(ii) Suggest why this ion is present in the filtrate.

(1)

.....

.....

(d) The student tests the filtrate for chloride ions by adding silver nitrate solution.

(i) State what he would observe in this test.

(1)

.....

.....

(ii) State the name of the substance responsible for this observation.

(1)

.....

(iii) He reads in a textbook that dilute nitric acid should be added before the silver nitrate solution in the test.

Suggest why the student does **not** need to add dilute nitric acid in the test.

(1)

.....

.....

(e) The calcium sulfate residue he obtains is impure because it contains some hydrochloric acid.

Describe how he can obtain a pure dry sample of calcium sulfate from this residue.

(2)

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(Total for Question 3 = 10 marks)

4 This question is about elements in Group 7 of the Periodic Table.

(a) Complete the table to show the physical state at room temperature of fluorine and astatine, and the colour of liquid bromine.

(2)

Element	Colour	Physical state at room temperature
fluorine	pale yellow	
chlorine	pale green	gas
bromine		liquid
iodine	dark grey	solid
astatine	black	

(b) Chlorine reacts with hydrogen to form hydrogen chloride.

A piece of magnesium ribbon is added to hydrogen chloride in three separate experiments under different conditions.

The table below shows the observations made under these different conditions.

Experiment	Conditions	Observations
1	Hydrogen chloride gas	No visible change
2	Hydrogen chloride dissolved in water	The magnesium ribbon gets smaller and bubbles are seen
3	Hydrogen chloride dissolved in methylbenzene	No visible change

(i) Write the formulae of two ions formed in the solution produced in experiment 2.

(2)

Positive ion.....

Negative ion.....

(ii) Identify the gas formed in experiment 2 and give a test for it.

(2)

gas .....

test .....

.....

(iii) Silver nitrate solution and dilute nitric acid are added to the solution produced in experiment 2.

State what is observed and name the substance responsible for this observation.

Explain why dilute nitric acid is added.

(3)

observation .....

.....

substance responsible .....

explanation .....

.....

(iv) Explain why there is no reaction in experiment 3.

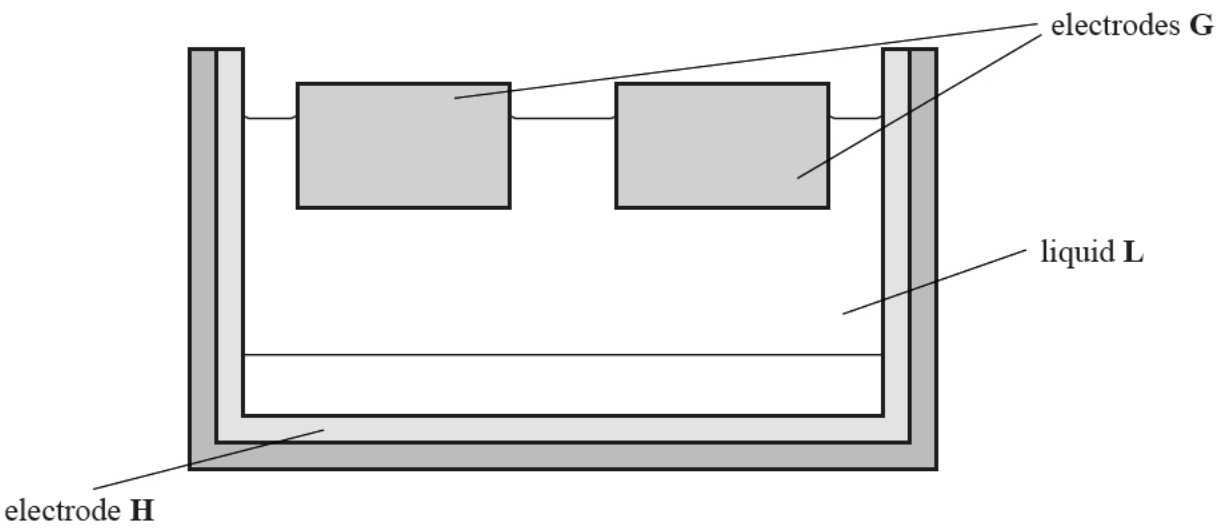
(1)

.....

.....

(Total for Question 4 = 10 marks)

5 The diagram shows how aluminium is extracted in industry.



(a) (i) Name the process used to extract aluminium.

(1)

(ii) Identify the element used to make the electrodes labelled **G**.

(1)

(iii) State whether electrode **H** is positive or negative.

(1)

(iv) Liquid **L** contains aluminium oxide and one other substance.

Name this other substance and give **one** reason for its use in the extraction of aluminium.

(2)

Other substance

Reason for use

(b) The product formed at electrode **G** reacts with the electrode to form carbon monoxide and carbon dioxide.

(i) Identify this product.

(1)

(ii) State why carbon monoxide is poisonous.

(1)

(iii) Describe a simple chemical test, and its result, for carbon dioxide.

(2)

Test

Result

(c) The uses of aluminium depend on its structure and physical properties.

(i) The strength of solid aluminium depends on the electrostatic force of attraction between two types of particle in its structure.

Name these two types of particle.

(2)

and

(ii) Aluminium is described as ductile because it can easily be pulled into a wire. Explain, in terms of its structure, why it is ductile.

(2)

(iii) Explain, in terms of its structure, why aluminium is a good conductor of electricity.

(2)

(iv) State a property that makes aluminium suitable for manufacturing aircraft bodies.

(1)

(Total for Question 5 = 16 marks)