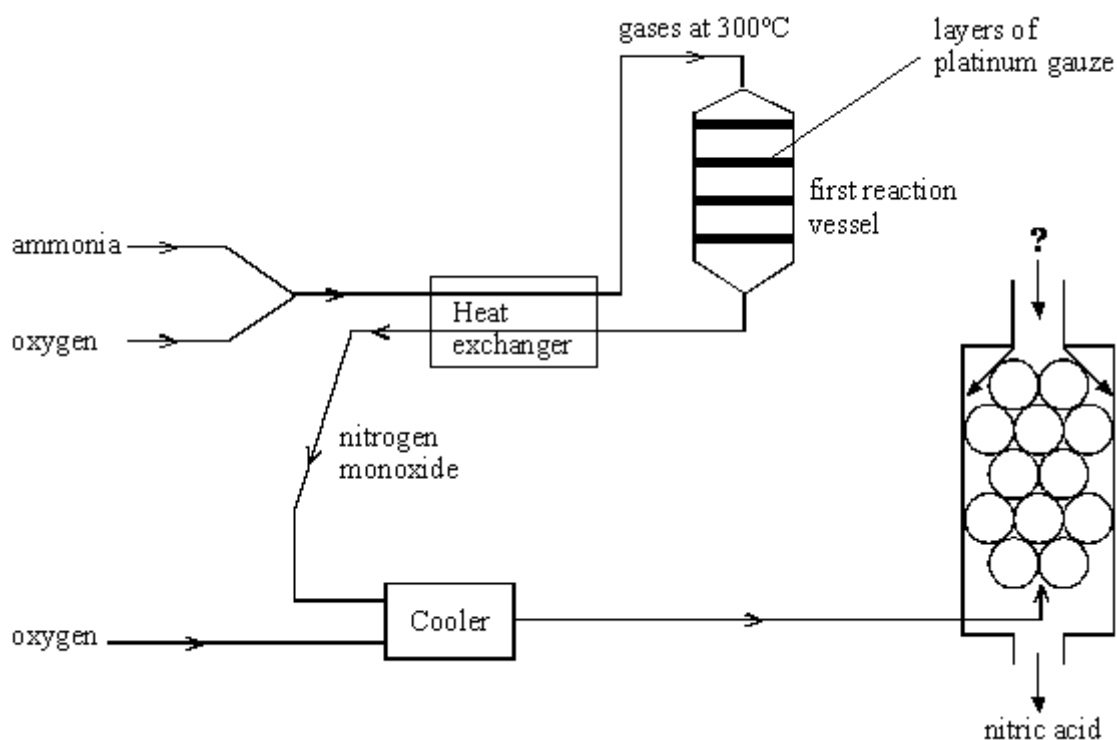
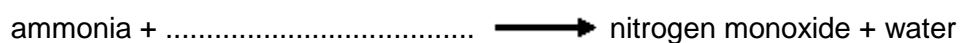


Q1. The chart shows the processes involved in the manufacture of nitric acid from ammonia.



- (a) Complete the word equation for the reaction that takes place in the first reaction vessel.



(1)

- (b) What is the use of the platinum gauze in the reaction vessel?

.....

(1)

- (c) To convert nitrogen monoxide into nitric acid, **two** further reactants are needed. What are they?

..... and

(1)

- (d) Complete the word equation below, to show how to make the fertiliser, ammonium nitrate.

..... + \longrightarrow ammonium nitrate + water

(2)

- (e) Calculate the percentage of nitrogen in the fertiliser, ammonium nitrate NH_4NO_3 .

.....
.....
.....
.....

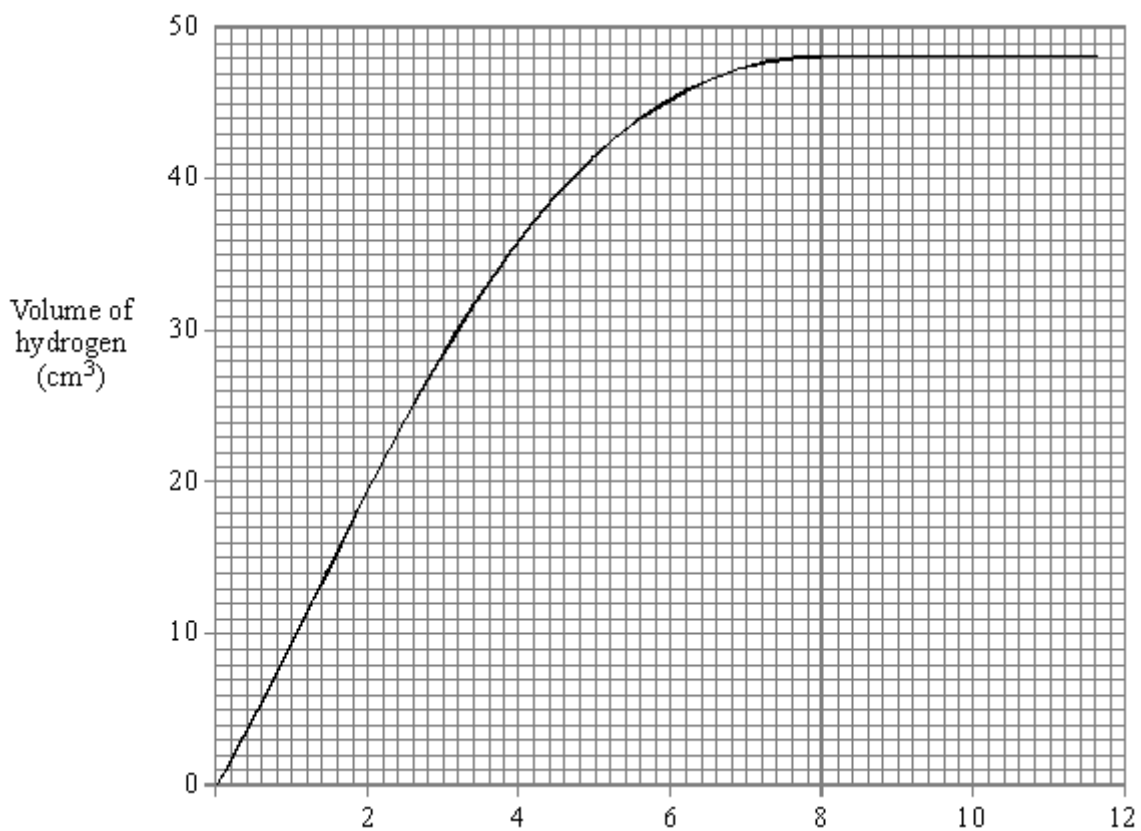
(2)

(Total 7 marks)

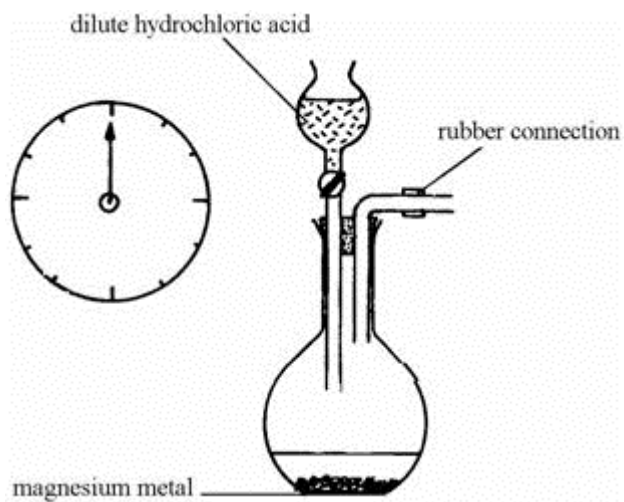
- Q2.** A student does an experiment to examine the rate of reaction between magnesium and dilute hydrochloric acid.
She adds 25 cm^3 of the acid to a weighed amount of the metal.
The reaction produces hydrogen gas.

Magnesium + hydrochloric acid \longrightarrow magnesium + hydrogen
acid chloride

She collects the gas and measures the volume collected at one minute intervals.
All the metal reacted but there was some acid left unreacted.
Her results are shown on the graph.



- (a) The diagram shows part of the apparatus she used for the experiment. Complete the diagram to show how the student could collect the hydrogen produced and measure the volume after each minute.



(2)

- (b) (i) When is the rate of reaction at its fastest?

.....

(1)

(ii) State **one** way in which she could increase the rate of reaction.

.....

(1)

(c) (i) What is the total volume of hydrogen collected in the experiment?

..... cm³

(1)

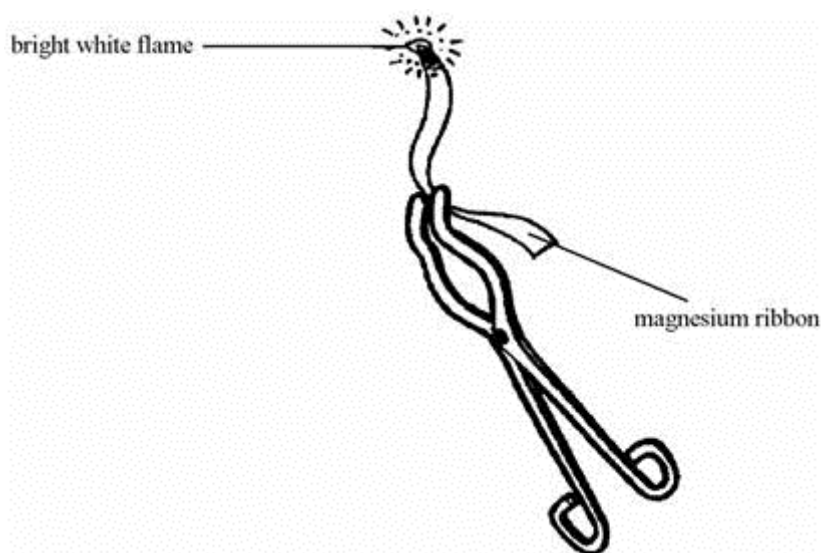
(ii) State **one** way in which she could increase the final volume of hydrogen collected.

.....

(1)

(Total 6 marks)

Q3. The diagram shows some magnesium ribbon burning.



(a) Choose words from the list to complete the sentences below.

electrical

heat

light

kinetic

an endothermic an exothermic a neutralisation a reduction

When magnesium burns, it transfers
and energy to the surroundings.
We say that it is reaction.

(3)

(b) Complete the word equation for the reaction.

magnesium + _____ \longrightarrow magnesium oxide

(1)

(Total 4 marks)

Q4. (a) Write down the symbols for

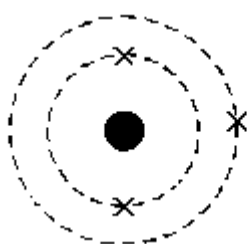
lithium

fluorine

(2)

(b) The electronic structure of a lithium atom can be shown like this:

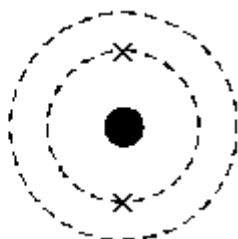
2,1 or



where **x** is an electron.

In a similar way, complete this diagram to show the electronic structure of a fluorine atom.

2,7 or



(1)

- (c) A lithium atom can lose one electron to form a lithium ion which can be written **(2)⁺**
 A fluorine atom can gain one electron to form a fluoride ion.

Choose from the list the correct way to write the fluoride ion.

(2,6)⁺ (2,7)⁺ (2,7)⁻ (2,8)⁺ (2,8)⁻

Answer

(2)
(Total 5 marks)

Q5. This question is about the structure of atoms.

- (a) Choose words from the list to complete the sentences below.

electrons ions neutrons protons

In an atom, the particles with a negative charge are called

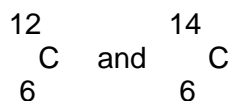
Particles in the nucleus with no charge are called

An atom has no overall charge because it has the same number of electrons and

.....

(3)

- (b) Two isotopes of the element carbon are:

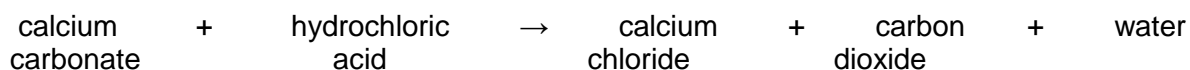


Complete the table of information for these two isotopes.

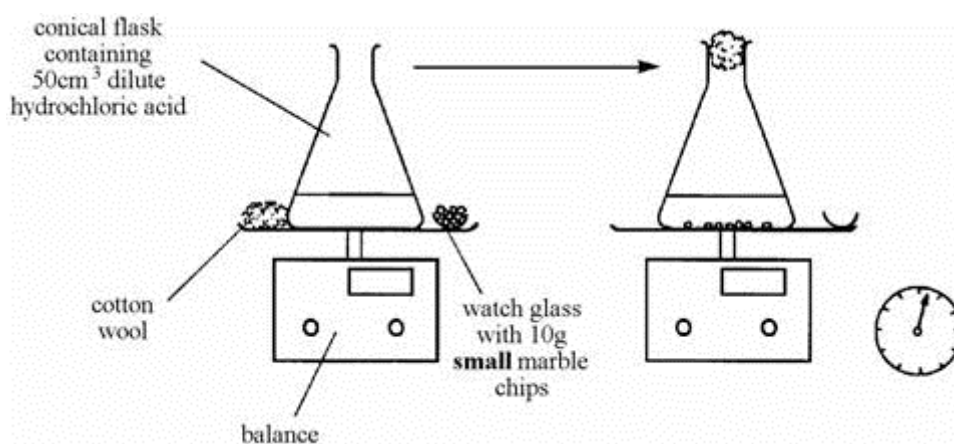
	ATOMIC NUMBER	MASS NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS
Isotope $\begin{array}{c} 12 \\ \text{C} \\ 6 \end{array}$	6	12	6	6
Isotope $\begin{array}{c} 14 \\ \text{C} \\ 6 \end{array}$	6		6	

(2)
(Total 5 marks)

Q6. Marble chips (calcium carbonate) react with dilute hydrochloric acid.



A student wanted to find out if the size of the marble chips made a difference to how fast the reaction took place.



(a) What readings should she take?

.....

.....

.....

(2)

(b) She repeated the experiment but this time used the same mass (10g) of **large** marble chips.
In both experiments there was some marble left in the flask when the reaction stopped.

These are the results of the two experiments.

TIME (minutes)	0	2	4	6	8	10	12
Loss in mass (g), using small chips	0.00	0.40	0.72	0.91	1.04	1.04	1.04

Loss in mass (g), using large chips	0.00	0.28	0.52	0.70	0.84	0.94	1.04
-------------------------------------	------	------	------	------	------	------	------

(i) Explain the loss in mass in the two experiments.

.....

(1)

(ii) What difference does the size of the chips make?

.....

(1)

(c) A chemical reaction occurs when reacting particles collide with sufficient energy. The reaction between marble and hydrochloric acid is faster if the acid is at a higher temperature. Explain why.

.....

(3)

(Total 7 marks)

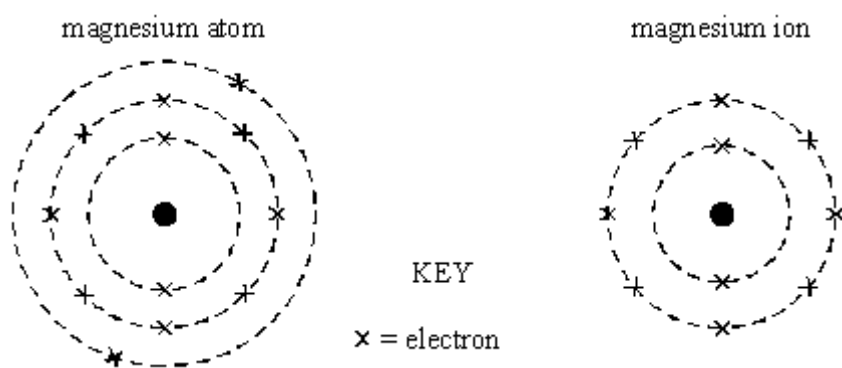
Q7. The formula for the chemical compound magnesium sulphate is MgSO_4 .

Calculate the relative formula mass (M_r) of this compound. (Show your working.)

.....

.....
.....
(Total 2 marks)

Q8. (a) The diagrams below show the electronic structure of a magnesium atom and a magnesium ion.



What is the charge on the magnesium ion? **(2)**

(b) Calcium bromide has the formula CaBr_2 .

What does this tell you about the ions in this compound?

.....
.....
(2)
(Total 4 marks)

Q9. Calculate the formula mass (M_r), of the compound

calcium hydroxide, $\text{Ca}(\text{OH})_2$.

(Show your working)

.....

.....
.....
.....
.....
.....

(Total 3 marks)

##

Here is a symbol equation, with state symbols, for a chemical reaction between solutions of lead nitrate and potassium chloride.



The equation tells you the formulae of the two products of the reaction.

(a) What are the names of the **two** products?

1

2

(2)

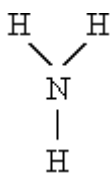
(b) What else does the equation tell you about these products?

.....
.....
.....

(2)

(Total 4 marks)

Q11. The diagram shows one molecule of the compound ammonia.



Write down everything that the diagram tells you about each molecule of ammonia.

.....

.....

.....

.....

.....

.....

(Total 4 marks)

##

Atoms of calcium, phosphorus and fluorine are represented below, each with its mass number and proton number.

40	31	19	←	mass numbers
Ca	P	F		
20	15	9	←	proton numbers

(a) Use this information to complete the table.

	CALCIUM	PHOSPHOROUS	FLUORINE
Number of protons in the nucleus	20		9
Number of neutrons in the nucleus	20	16	
Number of electrons		15	9

(3)

(b) Calcium and fluorine atoms can combine to form the compound calcium fluoride,

CaF₂.

The fluoride ion is represented by F⁻.

(i) Explain how the fluorine atom forms a fluoride ion.

.....
.....

(2)

(ii) How is the calcium ion represented?

.....

(2)

(c) Phosphorus and fluorine form a covalent compound, phosphorus trifluoride.

Complete the sentences below which are about this compound.

Phosphorus trifluoride is made up of phosphorus and fluorine

These are joined together by sharing pairs of to form
phosphorus trifluoride

(3)

(d) (i) Sodium chloride, an ionic compound, has a high melting point whereas paraffin wax, a molecular compound, melts easily.

Explain why.

.....
.....
.....
.....

(2)

(ii) Molten ionic compounds conduct electricity but molecular compounds are non-conductors, even when liquid.

Explain why.

.....
.....
.....

(2)
(Total 14 marks)

Q13. The information on the Data Sheet will be helpful in answering this question.

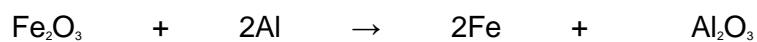
- (a) Calculate the formula mass (M_r) of the compound iron (III) oxide, Fe_2O_3 .
(Show your working.)

.....
.....
.....
.....
.....

(3)

- (b) Calculate the mass of iron produced when 32g of iron (III) oxide is completely reduced by aluminium.

The reaction is shown in the symbol equation:



(Show your working.)

.....
.....
.....
.....

Answer = grams

(3)
(Total 6 marks)

Q14. You will find it helpful to use the information on the Data Sheet when answering this question.

In the nucleus of an aluminium atom are:

13 protons
and 14 neutrons.

(a) Complete these sentences.

(i) The mass number of the aluminium atom is

(ii) In an atom of aluminium there are electrons.

(2)

(b) Why is an aluminium atom electrically neutral?

.....
.....
.....

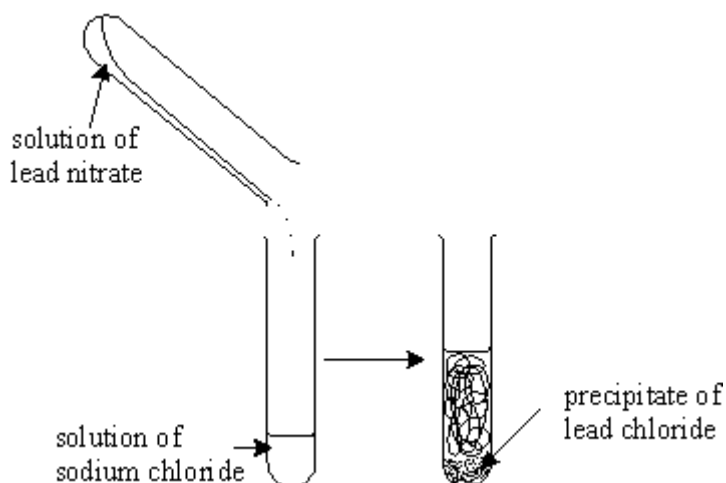
(2)

(c) Complete the table for the element fluorine.

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom	9		9
Fluoride atom		10	

(3)
(Total 7 marks)

Q15. When a solution of lead nitrate is added to a solution of sodium chloride, a white precipitate of lead chloride is produced.



(a) (i) Why is a precipitate formed?

.....

(1)

(ii) Complete and balance the equation for this precipitation reaction.

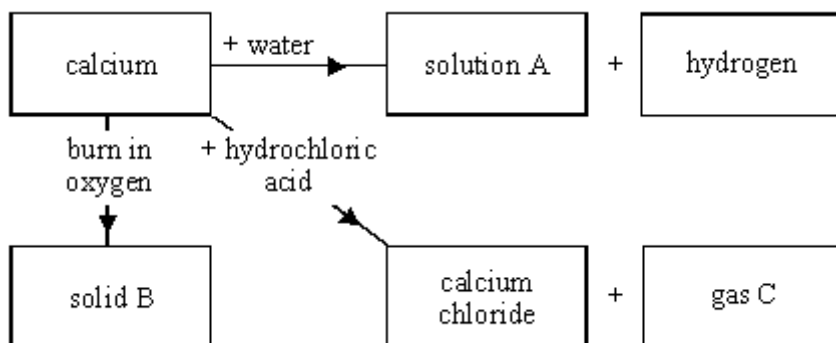


(3)

(b) Complete the table below by writing in the name and formula of the precipitate formed for each reaction. If there is no precipitate, write "no precipitate".

SOLUTION 1	ADDED TO	SOLUTION 2	NAME OF PRECIPITATE FORMED	FORMULA
(i) copper sulphate	→	sodium hydroxide		
(ii) lead nitrate	→	magnesium sulphate		
(iii) sodium chloride	→	zinc nitrate		

Q16. (a) The chart shows the reactions of the metal calcium with water, oxygen and dilute hydrochloric acid.



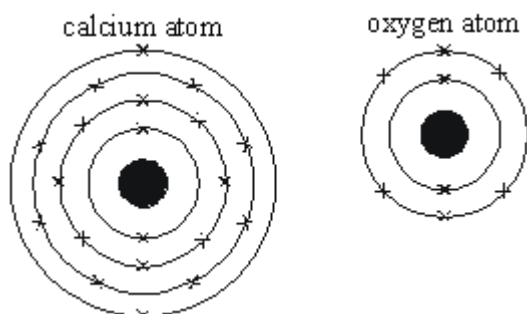
Name (i) solution A

(ii) solid B

(iii) gas C

(3)

(b) The diagrams below show the electronic structure of an atom of calcium and an atom of oxygen.



Describe fully what happens to its electrons when:

- (i) a calcium atom forms a calcium ion. State the charge on the calcium ion formed.

.....
.....
.....

(3)

- (ii) an oxygen atom forms an oxygen ion. State the charge on the oxygen ion formed.

.....
.....
.....

(3)

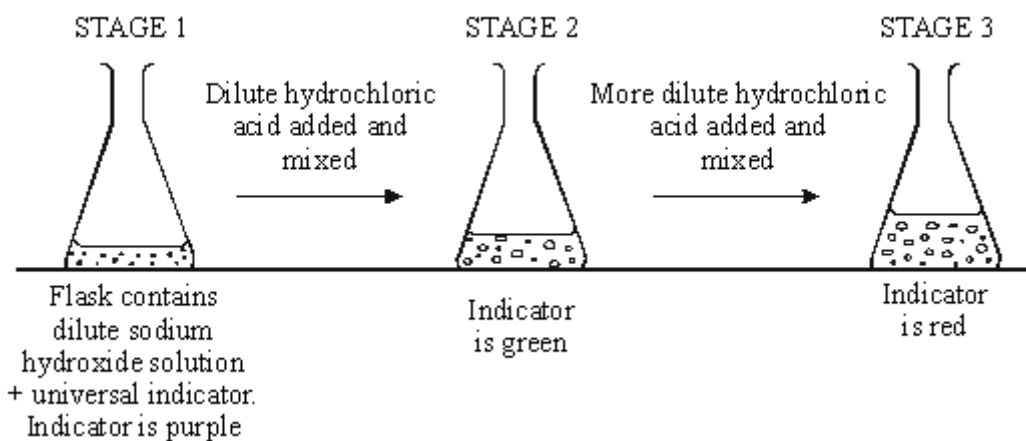
- (c) Calcium oxide is an ionic compound. Why do ionic compounds have high melting points?

.....
.....
.....

(2)

(Total 11 marks)

Q17. The diagrams show what happens when an acid is added to an alkali.



(a) What is present in the solution at stages 2 and 3 apart from universal indicator and water?

(i) At stage 2

(ii) At stage 3.....

(3)

(b) Write an ionic equation to show how water is formed in this reaction and state the sources of the ions.

.....
.....
.....
.....

(3)

(Total 6 marks)

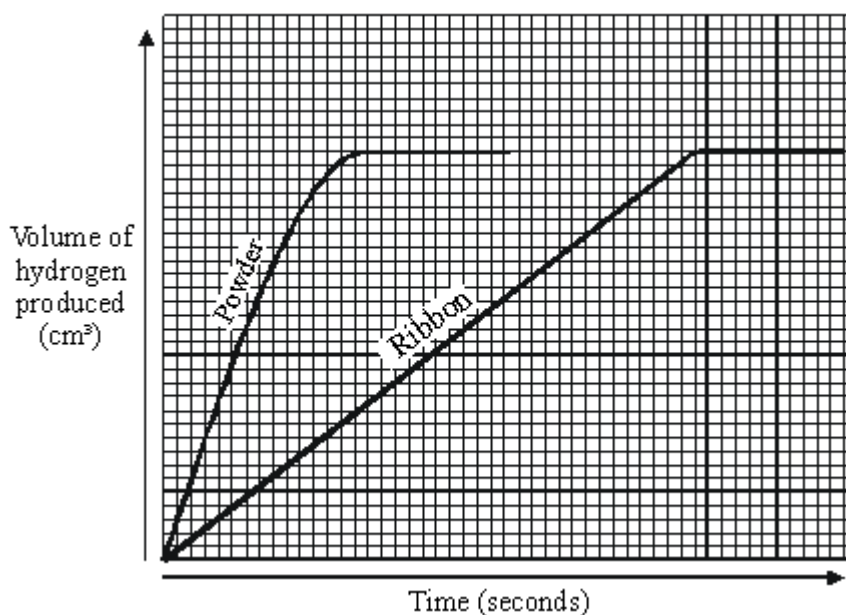
Q18. Some students were investigating how fast hydrogen gas is released in the reaction between magnesium and dilute hydrochloric acid.

To begin with they used 0.1 g of magnesium ribbon.

Next, they repeated the experiment using 0.1 g of magnesium powder.

In each case, they used enough acid to react with all the metal.

(a) Their results are shown on the graph below.



Hydrogen is produced in both the reactions.

Use the information on the graph to describe **two other** ways in which the two reactions are similar.

1.
-
2.
-

(2)

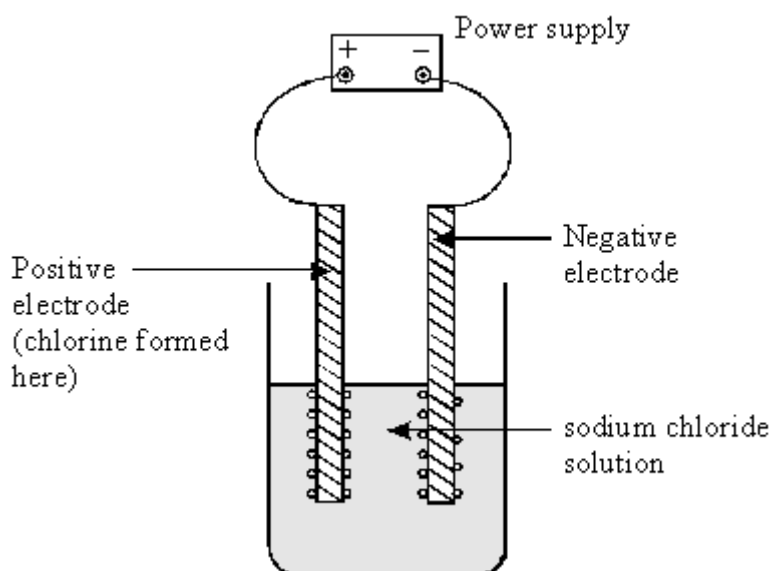
(b) Describe **one** way in which the reactions are different.

-
-

(1)

(Total 3 marks)

Q19. The diagram below shows the electrolysis of sodium chloride solution, in the laboratory.



(a) Which gas forms at the negative electrode?

(1)

(b) Explain why chlorine gas forms at the positive electrode.

.....

(2)

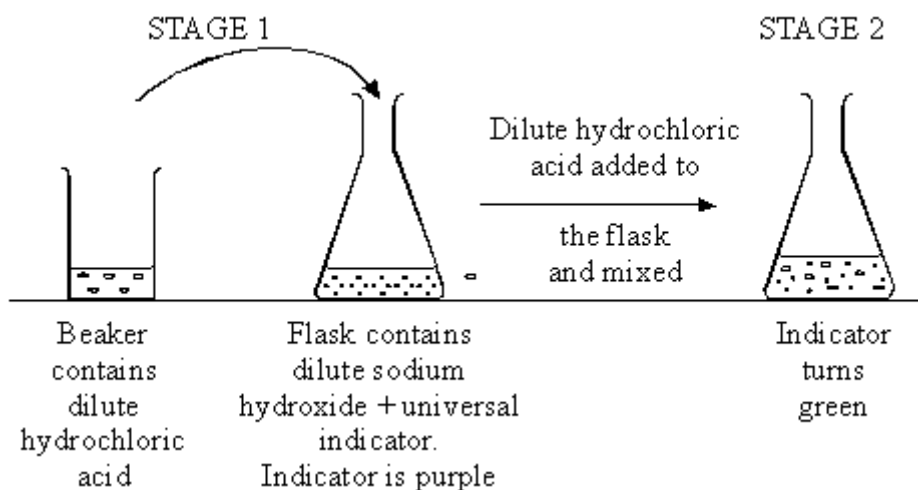
(c) State **one** use of chlorine gas.

.....

(1)

(Total 4 marks)

Q20. The diagrams show what happens when an acid is added to an alkali.



(a) What is present in the flask at stage 2, besides universal indicator and water?

.....

(1)

(b) Write an ionic equation to show how water is formed in this reaction and state the sources of the ions.

.....

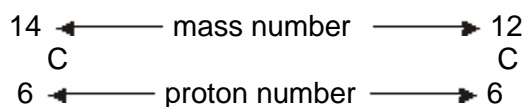
(3)

(Total 4 marks)

Q21. The two carbon atoms represented below are isotopes.

ISOTOPE 1

ISOTOPE 2



(a) Describe **two** ways in which the isotopes are similar.

.....

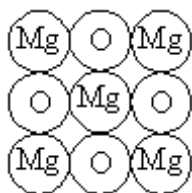
..... (2)

(b) Describe as fully as you can **one** way in which they are different.

.....
.....
.....

(2)
(Total 4 marks)

Q22. Magnesium oxide is a compound, made up of magnesium ions and oxide ions.



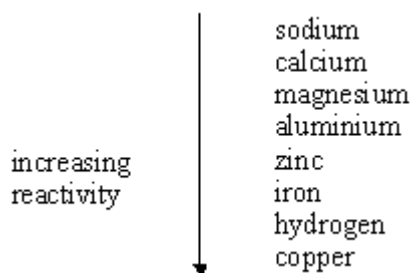
(a) What is the charge on each magnesium ion? (1)

(b) Explain how the magnesium ions get this charge.

.....
.....
.....

(2)
(Total 3 marks)

Q23. Part of a reactivity series is:



- (a) Carbon is used in blast furnaces to obtain iron and zinc from their oxides, but electrolysis has to be used to obtain aluminium from its oxide.

Draw an arrow on the reactivity series above to show where carbon fits into the series.

(1)

- (b) Predict the method of extraction used to obtain calcium from its ore and explain your answer.

.....
.....
.....

(2)

- (c) The formula for zinc oxide is ZnO. Write a balanced equation for the extraction of zinc in the blast furnace.

.....

(2)

(Total 5 marks)

Q24. (a) The equation for the reaction that takes place when ammonium chloride is heated is:

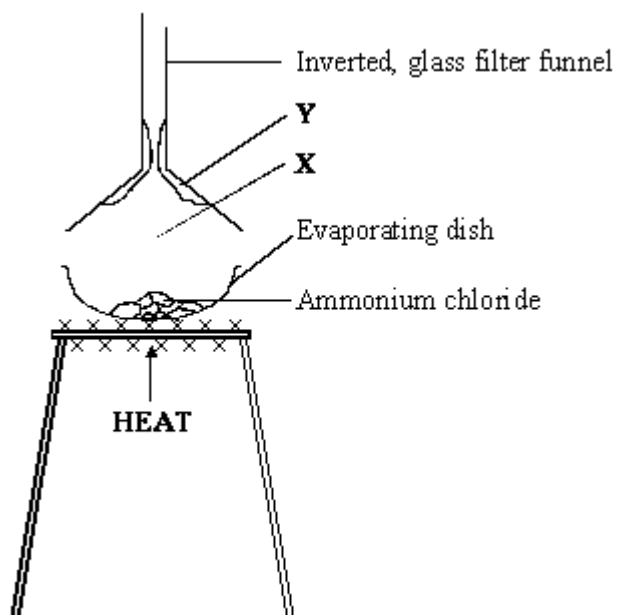


ammonium chloride

ammonia

hydrogen chloride

The diagram shows how a teacher demonstrated this reaction. The demonstration was carried out in a fume cupboard.



- (i) Apart from the gases normally in the atmosphere, which two gases would be at **X**?

..... and

(1)

- (ii) Name the white solid that has formed at **Y**.

.....

(1)

- (iii) Why was the demonstration carried out in a fume cupboard?

.....

.....

(1)

- (iv) Complete the **four** spaces in the passage.

The chemical formula of ammonia is NH_3 . This shows that there is one atom of

..... and three atoms of in each
 of ammonia. These atoms are joined by bonds that
 are formed by sharing pairs of electrons. This type of bond is called
 a bond.

(4)

(b) Electrons, neutrons and protons are sub-atomic particles.

(i) Complete the **three** spaces in the table.

Name of sub-atomic particle	Relative mass	Relative charge
.....	1	+1
.....	1	0
.....	$\frac{1}{1840}$	-1

(2)

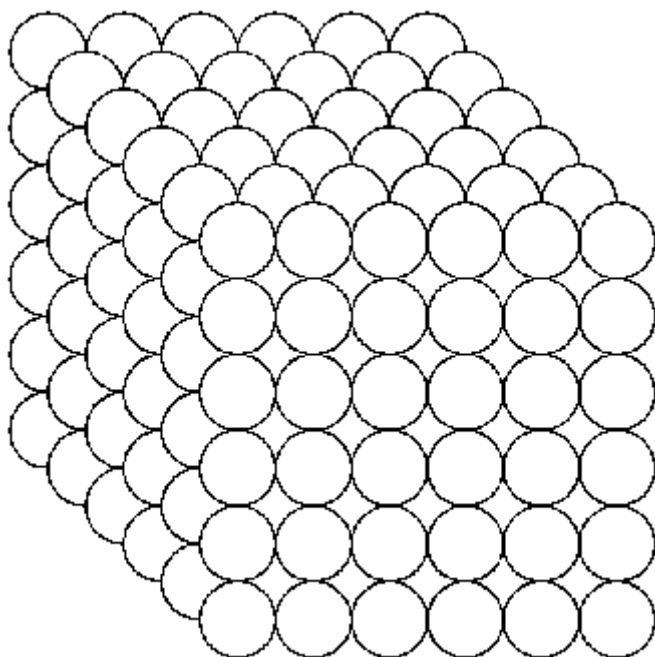
(ii) Which **two** sub-atomic particles are in the nucleus of an atom?

..... and

(1)

(Total 10 marks)

Q25. The diagram represents the particles in a piece of reactive metal.



The piece of reactive metal is added to dilute hydrochloric acid.

- (a) (i) Which particle will probably react first?

Choose from:

- a particle inside the piece;
- a particle at the centre of a face;
- a particle on one of the corners.

.....

(1)

- (ii) Explain the reason for your choice.

.....

.....

(1)

- (b) The reaction can be speeded up by making changes to the hydrochloric acid or the solid.

- (i) State **two** ways to speed up the reaction by changing the hydrochloric acid. In each case explain in terms of particles why the reaction is faster.

1.

.....
 (2)

2.

 (2)

(ii) What change can you make to the piece of solid to speed up the reaction?
 Explain in terms of the particles why the reaction is able to speed up.

.....
 (2)
(Total 8 marks)

Q26. Part of the Periodic Table showing the symbols for the first twenty elements is given below.

		H						He	
Li	Be			B	C	N	O	F	Ne
Na	Mg			Al	Si	P	S	Cl	Ar
K	Ca	Transition metals							

- (a) Draw diagrams showing the arrangement of electrons (electronic structures) in:
 (i) an aluminium atom;

(ii) a chlorine atom.

(2)

(b) (i) Use electronic structures to help you show why the formula of sodium oxide is Na_2O .

(3)

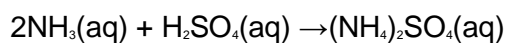
(ii) State why the formation of sodium ions is classified as an oxidation.

.....
.....

(1)

(Total 6 marks)

Q27. (a) Ammonium sulphate is made by the reaction:



(i) Complete the **three** answers in the table.

Question	Answer
How many hydrogens are there in the formula of ammonium sulphate?
What is the name of the substance with the formula NH ₃ ?
What is the name of the substance with the formula H ₂ SO ₄ ?

(3)

(ii) What is the main use for ammonium sulphate?

.....

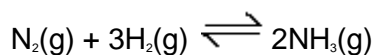
(1)

(iii) A similar reaction is used to make ammonium nitrate. What is the name of the acid which must be used?

.....

(1)

(b) NH₃ is made by the reversible reaction:



(i) Explain what the term *reversible reaction* means.

.....

(2)

(ii) What is the name of the raw material which is the source of nitrogen (N_2)?

.....

(1)

(iii) Nitrogen is an element. Explain what the term *element* means.

.....

.....

.....

(2)

(Total 10 marks)

Q28. Ammonium nitrate and ammonium sulphate are used as fertilisers.



(i) Which acid reacts with ammonia to form ammonium nitrate?

.....

(1)

(ii) Which acid reacts with ammonia to form ammonium sulphate?

.....

(1)

(iii) The reactions in (i) and (ii) are both exothermic. How can you tell that a reaction is exothermic?

.....

.....

(1)

(iv) The reactions in (i) and (ii) are both examples of acid + base reactions. What is the name of the chemical change which takes place in every acid + base reaction?

.....

(1)

(Total 4 marks)

Q29. (a) Atoms are made of sub-atomic particles. Complete the **six** spaces in the table.

Name of sub-atomic particle	Relative mass	Relative charge
.....	$\frac{1}{1840}$
Neutron
.....	1

(3)

(b) Complete the spaces in the sentences.

(i) The atomic number of an atom is the number of in its nucleus and is equal to the number of if the atom is not charged.

(1)

(ii) The mass number of an atom is the total number of and in its nucleus.

(1)

(c) The table gives information about the atoms of three elements.

Name of element	Chemical symbol	Number of electrons in:		
		1 st shell	2 nd shell	3 rd shell
Fluorine	F	2	7	0
Neon	Ne	2	8	0
Sodium	Na	2	8	1

Two of these elements can react together to form a chemical compound.

(i) What is the name and the formula of this compound?

Name Formula

(2)

(ii) What type of bonding holds this compound together?

.....

(1)

(iii) Explain, in terms of electron transfer, how the bonding occurs in this compound.

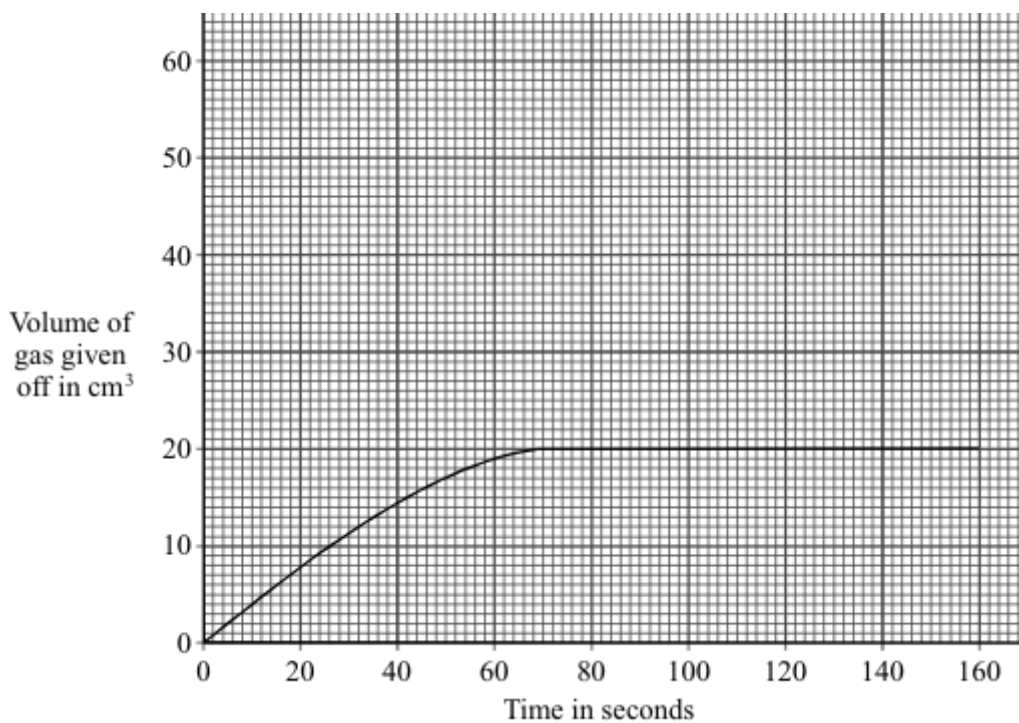
.....

.....

.....
.....
.....
.....

(2)
(Total 10 marks)

Q30. The graph shows the volume of gas given off during an experiment using hydrogen peroxide solution and manganese oxide.



Draw, on the axes above, a graph to show the result you would expect if the volume of hydrogen peroxide solution had been the same, but it was **twice** as concentrated.

(Total 3 marks)

Q31. Electrons, neutrons and protons are sub-atomic particles.

(a) Complete the **six** spaces in the following table.

Name of sub-atomic particle	Relative mass	Relative charge
.....	1
.....	0
.....	$\frac{1}{1840}$

(3)

(b) An aluminium atom has 13 electrons. How are these arranged in shells around the nucleus?

.....

(1)

(c) Chromium atoms have 24 protons and 28 neutrons.

(i) How many electrons does each neutral chromium atom have?

.....

(1)

(ii) What is the mass number of chromium?

.....

(1)

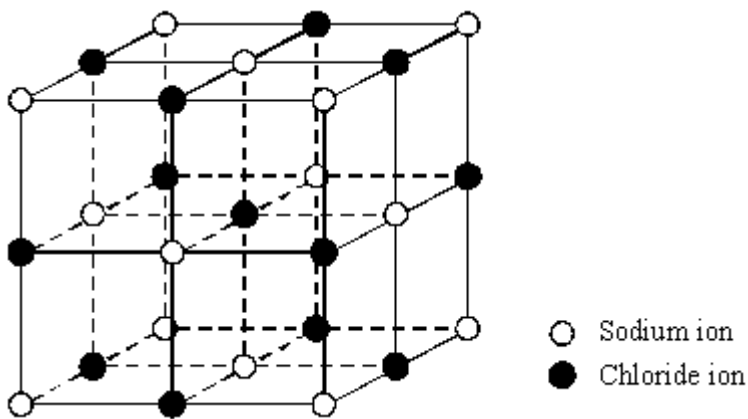
(d) What change occurs to an atom which undergoes the process of *reduction* in a chemical reaction?

.....

.....

(1)

(e) The diagram shows part of the ionic lattice of a sodium chloride crystal.



Explain why the ions in this lattice stay in place.

.....

.....

.....

.....

.....

.....

(3)
(Total 10 marks)

Q32. Sea water is a good source of bromine. To obtain the bromine from the bromide ions dissolved in sea water, it is displaced by reacting with chlorine. The bromine is removed by blowing air through the mixture to carry away the bromine. Bromine and chlorine are both in Group 7 of the Periodic Table.

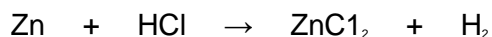
Write a balanced ionic equation for the reaction between chlorine molecules and bromide ions.

.....

(Total 3 marks)

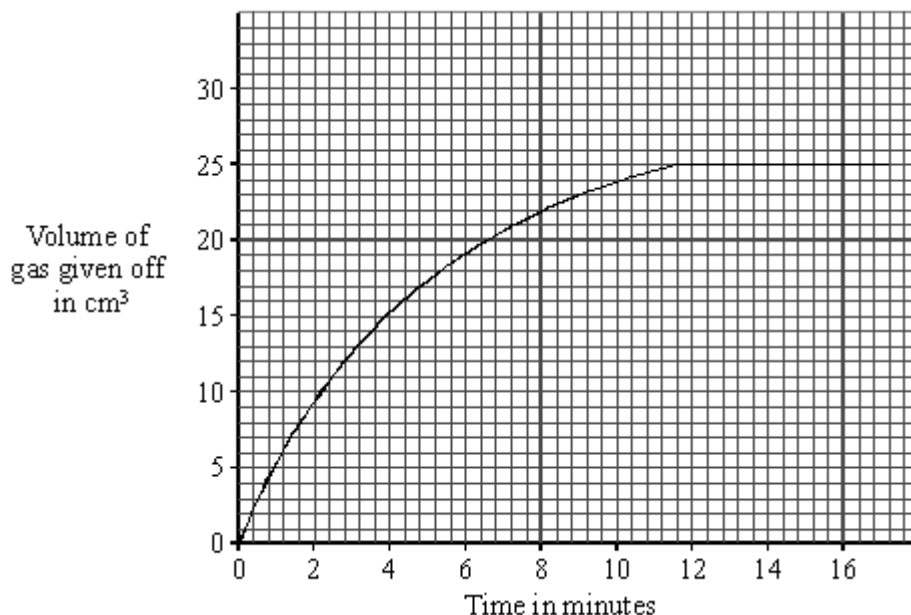
Q33. Zinc powder normally reacts slowly with hydrochloric acid.

(a) Balance the symbol equation for the reaction.



(1)

The graph shows the results from a reaction of 1.0 g of zinc powder with 20 cm³ of dilute hydrochloric acid. It gives off a gas and forms zinc chloride, ZnCl₂. Some unreacted zinc is left at the end.



(b) Copper powder is a good catalyst for the reaction of zinc with hydrochloric acid.

(i) A mixture of 10 cm³ of the same dilute hydrochloric acid and 1.0 g of copper powder was added to 1.0 g of zinc powder. What is the maximum volume of gas which could be given off?

..... cm³

(1)

(ii) Draw a graph, on the axes above, for an experiment where 20 cm³ of the same dilute hydrochloric acid was added to 1.0 g of copper powder mixed with 1.0 g of zinc powder.

(2)

(iii) Give **two** other ways the reaction described in part (i) could be made to go faster.

1.

2.

(2)

(c) Copper powder can be formed by adding copper sulphate solution to the mixture of zinc powder and acid.

(i) Why does zinc react with copper sulphate solution to produce copper?

.....
.....

(1)

(ii) Write the word equation for the reaction.

.....

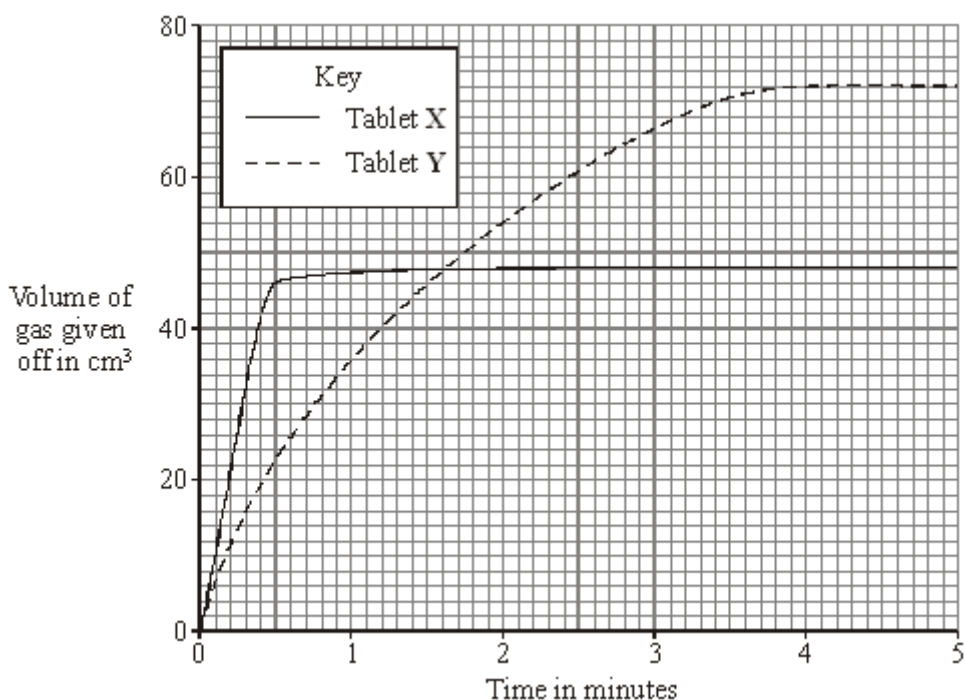
(1)

(Total 8 marks)

Q34. Many indigestion tablets contain calcium carbonate as their only active ingredient. Calcium carbonate neutralises some of the hydrochloric acid in the stomach.

Two different indigestion tablets, **X** and **Y**, were separately reacted with excess hydrochloric acid. The volume of gas given off in each reaction was measured every minute.

The results are shown in the graph.



(i) Which tablet, **X** or **Y**, contained most calcium carbonate?

Explain the reason for your answer.

.....
.....

(1)

(ii) Which tablet, **X** or **Y**, reacted faster with hydrochloric acid?.....

Explain the reason for your answer.

.....
.....

(1)

(iii) Explain the shape of the graph for tablet **X** between 3 and 5 minutes.

.....
.....
.....
.....

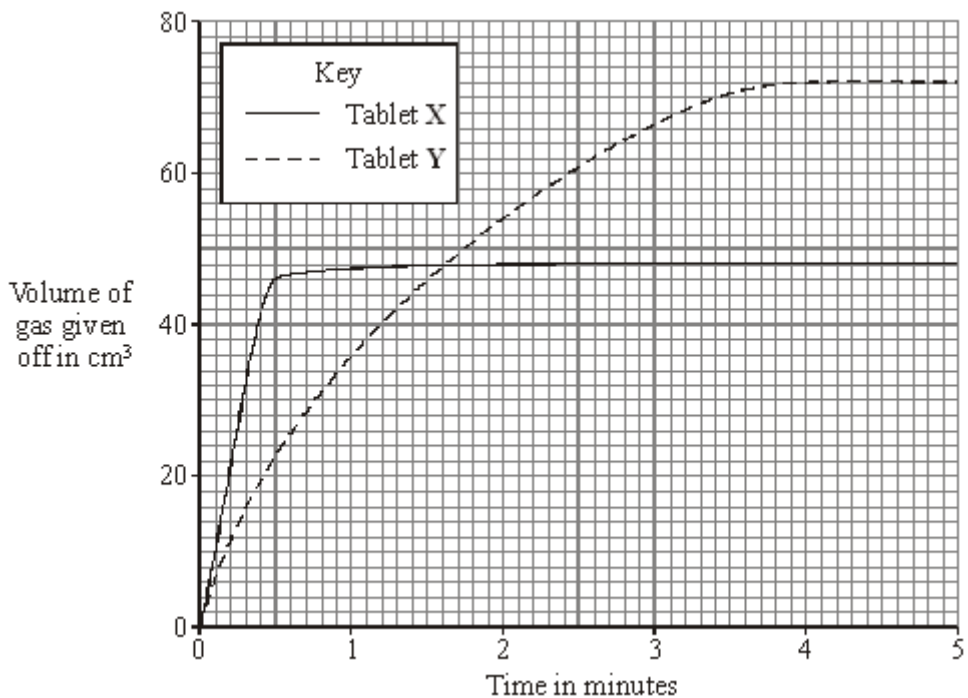
(1)

(Total 3 marks)

Q35. Many indigestion tablets contain calcium carbonate as their only active ingredient. Calcium carbonate neutralises some of the hydrochloric acid in the stomach.

Two different indigestion tablets, **X** and **Y**, were separately reacted with excess hydrochloric acid. The volume of gas given off in each reaction was measured every minute.

The results are shown in the graph.



(i) Which tablet, X or Y, contained most calcium carbonate?

Explain the reason for your answer.

.....

(1)

(ii) Which tablet, X or Y, reacted faster with hydrochloric acid?.....

Explain the reason for your answer.

.....

(1)

(iii) Explain the shape of the graph for tablet X between 3 and 5 minutes.

.....

(1)

(Total 3 marks)

