High Demand Questions QUESTIONSHEET 1

A food scientist checked the quality of a bottle of vinegar.
He took 50 cm^3 of the vinegar and found out how much sodium hydroxide was needed to neutralise it.

(a) (i) Explain what is meant by 'neutralise'.

..... [1]

(ii) What apparatus could the scientist have used to measure the amount of sodium hydroxide needed?

..... [1]

He also tested some ethanoic acid solution. Ethanoic acid is the acid which is found in vinegar.
His results are shown below.

	vinegar	ethanoic acid
volume used/cm^3	50	10
volume of NaOH needed to neutralise/cm^3	30	10

The ethanoic acid solution contained 10 g of acid in every 100 cm^3 of solution.

(b) (i) How many grams of ethanoic acid are there in 10 cm^3 of solution?

..... [1]

(ii) Work out how many grams of ethanoic acid are in 50 cm^3 of the vinegar.

.....

..... [2]

(iii) What must you assume is kept constant to allow you to work out the answer to (ii) ?

..... [1]

A label on the bottle of vinegar states that it contains 8 g of ethanoic acid in 100 cm^3 of vinegar.

(c) Using your answer to (b)(ii) work out whether the answer on the bottle is correct.

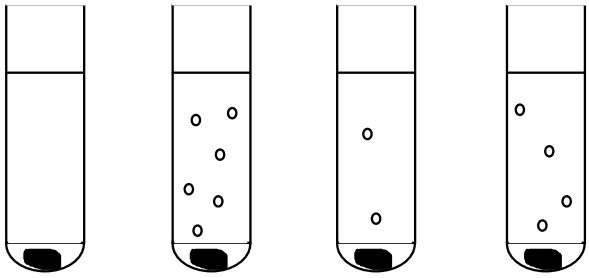
.....

..... [2]

TOTAL / 8

High Demand Questions QUESTIONSHEET 2

Small pieces of the metals copper, magnesium, nickel and zinc were placed in test tubes containing small quantities of hydrochloric acid. The following results were observed.



copper magnesium nickel zinc

(a) Use the observations from above to complete the following reactivity series.

1. ..... most reactive
2. .....
3. .....
4. .....least reactive

[2]

(b) (i) What is the name of the gas produced in the above reactions?

..... [1]

(ii) Describe the test and result you would use to identify this gas.

.....

..... [2]

(c) The reaction between the metals and the hydrochloric acid also produces a chemical compound known as a salt.

(i) What is the name of the salt formed in the reaction between magnesium and hydrochloric acid?

..... [1]

(ii) What type of bonding is present in this salt?

..... [1]

(iii) This salt is a solid at room temperature. Explain why a salt has a high melting and boiling point.

.....

..... [2]

TOTAL / 9

High Demand Questions QUESTIONSHEET 3

(a) The metal sodium burns in limited oxygen with a bright yellow flame to form sodium oxide.

(i) Write a word equation for the reaction between sodium and oxygen.

..... [1]

(ii) What is the formula of sodium oxide?
(A sodium ion is Na^+ and an oxide ion is O^{2-})

..... [1]

(iii) Predict whether sodium oxide is a solid, liquid or gas at room temperature.

..... [1]

(iv) Sodium oxide dissolves readily in water. What colour would the resulting solution turn pH paper?

..... [1]

(b) Sulphur dioxide is produced when coal is burnt and is responsible for the formation of acid rain.

(i) Complete the following equation and put in the missing state symbol.

$$S\ (s) + \_\_\_\_\ (g) \rightarrow SO_2\_\_\_\_$$ [2]

(ii) Acid rain is a weak acid. Predict what pH it would have if it was tested with pH paper.

..... [1]

(iii) Write down two problems which acid rain can cause.

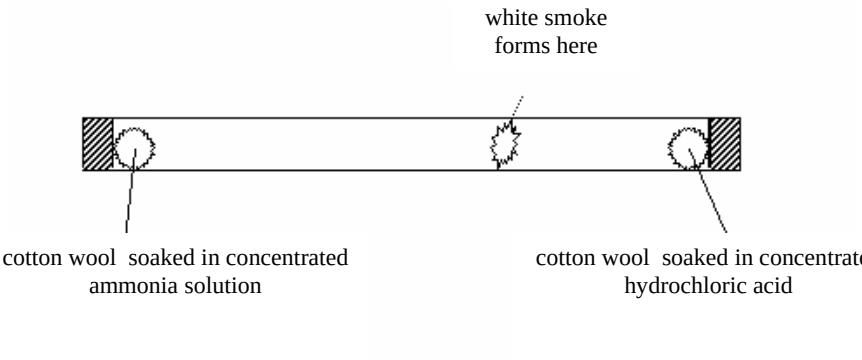
1. .....

2. .....

[2]

High Demand Questions QUESTIONSHEET 4

The following experiment was carried out using concentrated ammonia solution and concentrated hydrochloric acid.



(a) Ammonia contains the elements hydrogen and nitrogen and has the chemical formula NH_3.

(i) Name the type of bonding that exists in ammonia

..... [1]

(ii) Use the Periodic Table to draw a 'dot and cross' diagram to show the bonding in a molecule of ammonia. You need only show the electrons in the outer energy level.

[2]

(iii) Explain why ammonia has a low boiling point.

.....

..... [2]

(b) The ammonia and hydrogen chloride gases meet and react to form the ring of white smoke which is shown in the diagram.

(i) Explain, in terms of the particles of the gases, why the gases meet.

.....

..... [2]

(ii) Explain why the ring of white smoke forms nearer to the concentrated hydrochloric acid.

..... [1]

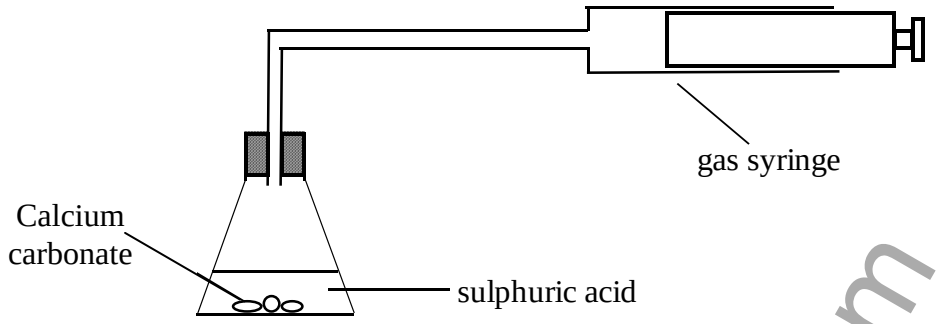
(iii) What is the name of the chemical formed when ammonia and hydrogen chloride react?

..... [1]

TOTAL / 9

High Demand Questions QUESTIONSHEET 5

The diagram below shows an experiment to measure the rate of reaction between calcium carbonate and sulphuric acid.



(a) The reaction between calcium carbonate and sulphuric acid produces a chemical compound called a salt, a gas and water.

(i) The gas produced can be identified using limewater. Name the gas and the result of this test.

Name of gas .....

Result of test ..... [2]

(ii) What is the name of the salt produced?

..... [1]

(b) The experiment was repeated with exactly the same volume of sulphuric acid and the same mass of calcium carbonate. This time the calcium carbonate used was a powder.

(i) What happens to the rate of the reaction?

..... [1]

(ii) Use the idea of particles to explain your answer to (b) (i).

.....

.....

..... [2]

(c) The experiment was repeated but with magnesium metal instead of calcium carbonate and a different salt and a different gas were produced.

(i) What gas is produced in the reaction between magnesium and sulphuric acid?

..... [1]

(ii) Describe the test you would use to identify this gas and the result that you would obtain.

.....

.....

..... [2]

(iii) Write down one use in industry of this gas.

..... [1]

TOTAL / 10

High Demand Questions QUESTIONSHEET 6

The table below shows the colours of various indicators at different pH values.

indicator	**colour 1**	**pH**	**colour 2**	**pH**
bromophenol blue	yellow	3	blue	4.5
phenolphthalein	colourless	8	pink	10
methyl orange	red	3	yellow	4.5
thymol blue	yellow	6	blue	7.5

Hydrochloric acid has a pH of 1.0 and ethanoic acid has a pH of 5.0
Ammonia solution has a pH of 10.0 and sodium hydroxide has a pH of 12.5

(a) Complete the table below to show colours of the indicators in the solutions.

indicator	**solution**	**colour**
bromophenol blue	hydrochloric acid	
phenolphthalein	ethanoic acid	
methyl orange	ammonia solution	
thymol blue	sodium hydroxide	

[4]

(b) (i) Name one indicator which turns the same colour in both ethanoic acid and sodium hydroxide

..... [1]

(ii) Which two indicators turn the same colour in hydrochloric acid?

.....

..... [2]

TOTAL / 7

High Demand Questions QUESTIONSHEET 7

Slaked lime is used raise the pH of soil.

(a) What is the chemical name for slaked lime?

..... [1]

(b) The recommended amount to use is 125 g per square metre of soil.
How much slaked lime would you need to apply to a rectangular garden which measured 10 metres by 8 metres?

.....

.....

..... [2]

(c) Less calcium oxide than slaked lime is needed to treat the same garden.
Why would the gardener prefer to use slaked lime?

..... [1]

(d)(i) Write an equation for the reaction of slaked lime with nitric acid.

..... [2]

(ii) How much slaked lime is needed to neutralise 63 g of nitric acid? (A_r: H=1; N=14; O=16 Ca=40)

.....

.....

..... [3]

TOTAL / 9

High Demand Questions QUESTIONSHEET 8

Sulphur dioxide reacts with chlorine, in the presence of water, to produce a mixture of hydrochloric and sulphuric acids.

(a) Complete the equation for the reaction.

SO_2 + Cl_2 + __H_2O → _____ + _____ [2]

(b) This reaction can be used to reduce the amount of chlorine in water.
If a bottle of tap water contained 2 mg of chlorine, how much sulphur dioxide must be added to reduce this to 1 mg? (A_r: O=16; S=32; Cl=35·5)

.....

.....

.....

..... [3]

The concentration of a solution can be expressed in grams per cubic decimetre (g/dm^3).
To calculate this you must divide the amount of substance dissolved (g) by the volume of the solution (dm^3).

(c) Which of the following has the greater concentration? Show your working.

A 10 g of potassium hydroxide in 2 dm^3 of solution.
B 50 g of potassium hydroxide in 5 dm^3 of solution

.....

.....

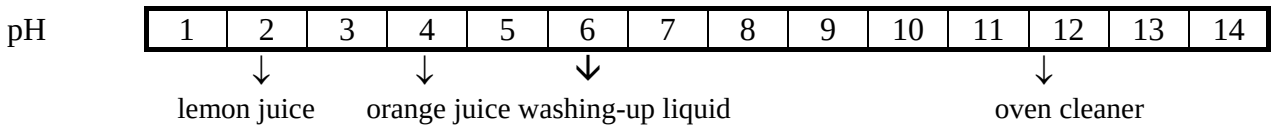
.....

..... [2]

TOTAL / 7

Medium Demand Questions QUESTIONSHEET 9

The pH of chemicals found around the home may be tested using pH paper. Some typical results are shown below.



(a) Answer the following questions using the above information.

(i) What is the pH of oven cleaner?

..... [1]

(ii) Which is the most acidic solution?

..... [1]

(iii) What would be the pH of a neutral solution?

..... [1]

(b) Vinegar was also tested using pH paper and found to have a pH of 4.1. What colour did the pH paper become?

..... [1]

(c) When a wasp stings someone its injects a liquid in the person's skin. An old fashioned remedy for wasp stings is to rub vinegar on them.

(i) Suggest the pH of the liquid which wasps inject into the skin.

..... [1]

(ii) What name is given to the reaction which happens between this liquid and the vinegar?

..... [1]

(iii) Name the colourless, tasteless liquid that is produced in this reaction.

..... [1]

TOTAL / 7

Medium Demand Questions QUESTIONSHEET 10

Some people suffer from acid indigestion when their stomach produces excess stomach acid. The label on a household brand of indigestion tablets says that it contains magnesium carbonate.

(a) Magnesium carbonate is insoluble in water. When mixed with water, what colour would it turn pH paper?

..... [1]

(b) The instructions on the packet suggest that 1 or 2 tablets are chewed as required.

(i) What name is given to the reaction which happens between the excess acid and the indigestion tablet?

..... [1]

(ii) Explain why the instructions suggest that the tablets are chewed when taken.

.....

..... [2]

(c) The acid present in the stomach is called hydrochloric acid. Hydrochloric acid, HCl, reacts with magnesium carbonate, $MgCO_3$, to produce magnesium chloride, carbon dioxide and water.

(i) Complete and balance the equation for this reaction.

$$\_\_\_HCl\ (aq) + MgCO_3(s) \rightarrow MgCl_2\ (aq) + \_\_\_\ (g) + H_2O\ (l)$$ [2]

(ii) Limewater can be used to test for carbon dioxide. What is the result of this test?

..... [1]

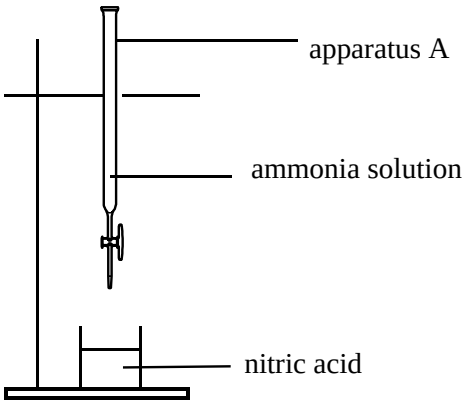
(iii) Use these relative atomic masses: C = 12; O = 16; Mg = 24
to calculate the relative formula mass of magnesium carbonate.

.....

..... [2]

TOTAL / 9

(a) In an experiment ammonia solution, an alkali, was added to nitric acid.



(i) What is the name of apparatus A?

..... [1]

(ii) What is the name of the reaction when the acid reacts with the alkali?

..... [1]

(iii) What is the pH when just enough ammonia solution is added to react with all the nitric acid?

..... [1]

(b) (i) What is the ion which is present in any solution of acid?

..... [1]

(ii) What is the ion which is present in any solution of alkali?

..... [1]

(iii) Write the simplest ionic equation which represents the above reaction.

..... [1]

(c) The following label is found on the bottle containing the nitric acid.

(i) What does the label tell you about the nitric acid?

..... [1]

(ii) Suggest two precautions which should be taken when using the nitric acid in the experiment.

1. ..... [1]

2. ..... [1]

TOTAL / 9

Medium Demand Questions QUESTIONSHEET 12

(a) Below are the chemical formulae of four acids.

HCl H_2SO_4 HNO_3 CH_3COOH

(i) What colour would they all turn a solution of litmus?

..... [1]

(ii) Write down the name of the ion present in solutions of all the acids.

..... [1]

(b) Below are the chemical formulae of four alkalis.

NaOH KOH $Mg(OH)_2$ NH_4OH

(i) What colour would they all turn a solution of litmus?

..... [1]

(ii) Write down the name of the ion present in solutions of all the alkalis.

..... [1]

(c) A solution of sulphuric acid can be used to neutralise a solution of sodium hydroxide.

(i) What is the pH of the solution when it is exactly neutral?

..... [1]

(ii) What is the name of the salt formed in the neutralisation reaction?

..... [1]

(iii) Balance the following symbol equation for the reaction.

H_2SO_4 (aq) + ____ NaOH (aq) $\rightarrow$ Na_2SO_4 (aq) + ____ H_2O (l) [2]

(d) When nitric acid neutralises ammonium hydroxide the salt formed is called ammonium nitrate.
Give one important use of ammonium nitrate.

..... [1]

TOTAL / 9

Medium Demand Questions QUESTIONSHEET 13

(a) Many power stations in the UK burn coal to produce electricity. Coal is a fossil fuel. Describe how the coal is formed.

.....

.....

.....

..... [3]

(b) Fossil fuels, such as coal, contain sulphur as an impurity. When the coal is burnt the sulphur is oxidised.

(i) Explain what is meant by the term 'oxidised'.

.....

..... [1]

(ii) What is the name of the gas formed when the sulphur is oxidised?

..... [1]

(c) Write a symbol equation for what happens when this gas reacts with rain water.

..... [2]

(d) Explain why acid rain can erode limestone.

.....

..... [2]

TOTAL / 9

Medium Demand Questions QUESTIONSHEET 14

Below is information about six chemicals.

chemical	state at 20 °C	pH in water	reaction with acid
A	gas	1	none
B	liquid	7	none
C	solid	4	none
D	solid	8	forms a salt, carbon dioxide and water
E	solid	14	forms a salt and water
F	solid	no reaction	fizzes

Use the table to write the letter of the chemical substance which:

(a) forms the most strongly acidic solution.

..... [1]

(b) forms a neutral solution.

..... [1]

(c) forms a solution which turns pH paper orange.

..... [1]

(d) is a metal.

..... [1]

(e) is a carbonate.

..... [1]

(f) is water.

..... [1]

(g) is sulphur dioxide.

..... [1]

TOTAL / 7

Medium Demand Questions QUESTIONSHEET 15

Antacid tablets are used to treat indigestion, which is caused by excess acid in the stomach.
Details of four solids, which are used to neutralise stomach acid, are shown in the table below.

Name of solid	**Formula**	**Reaction with acid**	**Cost per gram**
magnesium carbonate		fizzes	16.0 p
	$CaCO_3$		11.0 p
magnesium hydroxide	$Mg(OH)_2$	does not fizz	7.5 p
aluminium hydroxide	$Al(OH)_3$	does not fizz	22.0 p

(a) Complete the table. [3]

(b) Complete the equation for the reaction of magnesium hydroxide with hydrochloric acid.

$Mg(OH)_2 + 2HCl \rightarrow$ _____ $+ H_2O$ [1]

(c) An experiment was carried out to find out how much acid was needed to neutralise one gram of each of the solids. The solid was put into a flask with water and an indicator, then acid was added.

(i) Describe how you would find out the exact amount of acid needed.

.....

.....

..... [2]

(ii) Why is it important to use the same concentration of acid each time?

..... [1]

(d) Another way to compare the solids is to find out how much solid is needed to neutralise 20 cm^3 of acid. The results are shown below.

Solid	Mass of solid to neutralise 20 cm^3 of acid
Magnesium carbonate	0.7 g
$CaCO_3$	1.2 g
Magnesium hydroxide	0.6 g
Aluminium hydroxide	0.4 g

(i) Calculate the costs of each solid used.

.....

.....

.....

.....

.....

..... [4]

(Continued...)

QUESTIONSHEET 15 CONTINUED

(ii) Use all the information given to choose the best antacid.
Give a reason for your answer

.....

.....

..... [3]

TOTAL / 14

Medium Demand Questions QUESTIONSHEET 16

James spilt some acid on the floor. He looked at the possibility of treating it with one of four chemicals. Their properties are summarised in the table.

substance	**pH**	**reaction with acid**
A	13.0	produces a salt and water
B	8.5	produces a salt, water and carbon dioxide
C	8.0	produces a salt and water
D	1.0	no reaction

(a) (i) Why would substance D be useless for the purpose?

..... [1]

(ii) Which other substance would you advise him to avoid? (Give a reason)

.....

..... [2]

(iii) What type of substance is B?

..... [1]

(b) Sodium chloride is probably the best known salt. It is used in the food industry, spread on roads in winter and used to make a range of other chemicals.

(i) State two uses of sodium chloride in the food industry.

.....

..... [2]

(ii) Name two other chemicals made from sodium chloride.

.....

..... [2]

(iii) Why is sodium chloride spread on winter roads?

..... [1]

TOTAL / 9

Low Demand Questions QUESTIONSHEET 17

Nettles, bees and ants sting by injecting acid into your skin.
Wasp stings are alkaline.

(a) How could you test to prove that the liquid from an ant is acid?

.....

..... [2]

(b) Vinegar is used to treat a wasp sting and ammonia to treat a bee sting.
Explain why this works and what it tells you about vinegar and ammonia.

.....

.....

..... [3]

(c) Car batteries contain strong sulphuric acid.
To treat a spillage from a car battery, you must first add lots of water then put washing soda on it.
Explain this treatment.

.....

.....

..... [2]

TOTAL / 7

Low Demand Questions QUESTIONSHEET 18

The pH of soil is very important in deciding which crops grow best.
The table below shows the pH ranges which are best for some plants.

Plant	pH range
beans	6.0 to 7.5
potato	5.0 to 6.5
onion	6.0 to 7.0
leek	6.0 to 8.0

The soil in three fields was tested.
The results are shown below.

field	pH of soil
A	6.6
B	7.3
C	5.5

(a) In which field is the soil most acidic?

..... [1]

(b) For each field list the crops which would grow best in it.

Field A ..... [3]

Field B ..... [2]

Field C ..... [1]

(c) Lime can be added to raise the pH of the soil.
Which field would need lime before you could grow leeks in it?

..... [1]

TOTAL / 8

Low Demand Questions QUESTIONSHEET 19

Epsom salts was a favourite medicine of our grandparents.
Its chemical name is magnesium sulphate.

(a) Write down the formula of magnesium sulphate.

..... [1]

Salts can be made in a number of ways.
I adding a metal to an acid
II adding a carbonate to an acid
III adding a hydroxide to an acid

(b) For each of the methods above, give the correct chemical name of two substances which could be mixed to make magnesium sulphate.

method I ..... [2]

method II ..... [2]

method III ..... [2]

(c) In each case the magnesium sulphate is formed as a solution in water.
What would you need to do to produce solid magnesium sulphate?

..... [1]

TOTAL / 8

Low Demand Questions QUESTIONSHEET 20

Complete the following sentences about acids, bases and salts.

(i) Acids have a pH below _____. [1]

(ii) When acids are mixed with alkalis they become _____. [1]

(iii) All acids contain _____. [1]

(iv) Acids react with carbonates to produce _____ _____ gas. [1]

(v) The acid found in vinegar is called _____ _____. [1]

(vi) Acids are also found in _____. [1]

(vii) An example of an alkali is _____. [1]

(viii) Safety spectacles must be used when handling acids or alkalis, because they are _____. [1]

TOTAL / 8