

## High Demand Questions

## QUESTIONSHEET 1

Look at the following section of the periodic table.

1	2											3	4	5	6	7	0	
																		He
Li	Be											B	C	N	O	F		Ne
Na	Mg											Al	Si	P	S	Cl		Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br		Kr

Use **only the elements shown** to answer the following questions.

(a) When metals react with non-metals they form ionic compounds.

(i) How do metal atoms form ions?

..... [1]

(ii) Write the symbol of a metal that forms +1 ions.

..... [1]

(b) Write down the formulae of:

(i) an aluminium ion.

..... [1]

(ii) a chloride ion.

..... [1]

(iii) aluminium chloride.

..... [1]

(c) When non-metals react with non-metals they form molecules.

(i) What type of bonding is found in molecules?

..... [1]

(ii) Tetrachlormethane is a compound of carbon and chlorine. Write down the formula of tetrachlormethane.

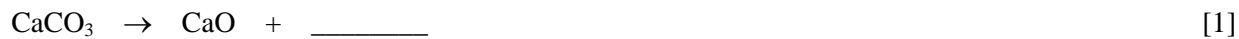
..... [1]

(iii) Ammonia exists as molecules.

Draw a dot and cross diagram to show the bonding in ammonia.

When calcium carbonate (limestone) is heated it produces calcium oxide and carbon dioxide.

- (i) Complete the following equation



- (ii) What name is given to this type of reaction?

..... [1]

- (b)(i) Calculate the relative molecular mass of calcium carbonate.  
(relative atomic masses: C=12, O=16, Ca=40)

..... [1]

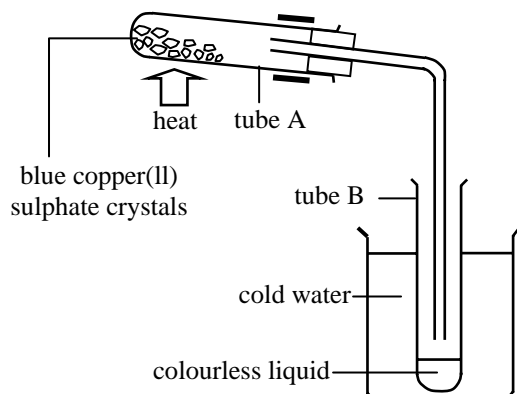
- (ii) How many tonnes of calcium carbonate are needed to produce 280 tonnes of calcium oxide?

.....  
.....  
.....  
..... [3]

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The diagram shows an experiment to investigate the effect of heat on copper(II) sulphate crystals.



(a)(i) Why is cold water used in the beaker?

..... [1]

(ii) How could you identify the colourless liquid in tube B as water?

.....  
 ..... [1]

(b) When 2.5 g of blue copper(II) sulphate crystals were heated, 1.6 g of white solid were left in tube A.

(i) Calculate the mass of water driven off in the experiment.

..... [1]

(ii) Calculate the percentage of water driven off.

.....  
 ..... [2]

(c) The equation represents the change taking place on heating blue copper(II) sulphate crystals.



(i) What type of change is taking place?

..... [1]

(ii) Write an equation to represent what happens when water is added to white copper(II) sulphate.

..... [1]

(ii) What symbol should be used instead of the arrow in the first equation?

..... [1]

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Nitrogen is an important element to help plants to grow.

Artificial fertilisers contain compounds of nitrogen.

Two such compounds are sodium nitrate ( $\text{NaNO}_3$ ), ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ).

- (a) Calculate the relative molecular masses of each of these compounds.

(Relative atomic masses: H = 1, C = 12, N = 14, O = 16, Na = 23)

- (i) sodium nitrate.

.....  
.....  
..... [1]

- (ii) ammonium nitrate.

.....  
.....  
..... [1]

- (b) Calculate the percentage of nitrogen in:

- (i) sodium nitrate.

.....  
.....  
..... [2]

- (ii) ammonium nitrate.

.....  
.....  
..... [2]

- (c) Which of them would be best for a farmer to use?

..... [1]

- (d) Ammonia,  $\text{NH}_3$  has 82.4% of nitrogen in it.

Give **two** reasons why it would be unsuitable for use as a fertiliser.

.....  
..... [2]

## High Demand Questions

## QUESTIONSHEET 6

- (a) Calculate the empirical formulae of the following compounds.  
(Relative atomic masses: H=1, C=12, N=14, O=16, S=32, K=39, Fe=56)

(i) a compound of 3.5 g nitrogen and 4 g oxygen.

.....  
.....  
..... [2]

(ii) a compound of 50% oxygen and 50% sulphur.

.....  
.....  
..... [2]

(iii) a compound of 39% potassium, 1% hydrogen, 12% carbon and 48% oxygen.

.....  
.....  
..... [2]

(iv) 16.0 g of an oxide of iron formed from 11.2 g iron.

.....  
.....  
..... [3]

- (b) Find (i) the empirical formula and (ii) the molecular formula of a compound containing 4.04% hydrogen, 24.24% carbon and 71.72% chlorine, given the following information:  
relative atomic masses: H=1, C=12, Cl=35.5  
relative molecular mass of the compound = 99

(i)

.....  
.....  
..... [3]

(ii)

.....  
..... [2]

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## High Demand Questions

## QUESTIONSHEET 7

A chemist finds a compound in an unlabelled bottle.  
He carries out a number of experiments on it.  
Here are his results.

colour	black
heat	no change
add dilute hydrochloric acid	solution of green salt
heat and pass hydrogen over it	brown solid, gas which condenses to colourless liquid

(a) Identify the black solid.

..... [1]

(b)(i) Identify the green salt.

..... [1]

(ii) What products would be formed when a solution of the green salt is electrolysed?

.....  
..... [2]

(iii) How can the gas produced during electrolysis be identified by a chemical test?

.....  
..... [2]

(c)(i) Name the brown solid produced in the fourth test.

..... [1]

(ii) Name the liquid which condenses in the fourth test.

..... [1]

(iii) Write an equation for the reaction.

..... [1]

(iv) What is the role of hydrogen in this reaction?

..... [1]

## High Demand Questions

## QUESTIONSHEET 8

Barium chloride contains water of crystallisation ( $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$ ).

Some barium chloride was heated in a basin.

The results are shown below.

mass of empty basin	= 117.8 g
mass of basin plus $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$	= 125.9 g
mass of basin plus $\text{BaCl}_2$ after heating	= 124.7 g

(a)(i) Why was the empty basin weighed?

..... [1]

(ii) Calculate the mass of  $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$ .

..... [1]

(iii) Calculate the mass of  $\text{BaCl}_2$  after heating.

..... [1]

(iv) Calculate the mass of water lost.

..... [1]

(v) Calculate the percentage of water in the  $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$ .

..... [2]

(b) What could be done to ensure that all the water had been lost?

..... [3]

(c) Calculate the relative molecular masses of:

(i)  $\text{BaCl}_2$

..... [1]

(ii)  $\text{H}_2\text{O}$

..... [1]

(Relative atomic masses: H = 1, O = 16, Cl = 35.5, Ba = 137)

(d) Use your previous answers to determine the value of x in  $\text{BaCl}_2 \cdot x\text{H}_2\text{O}$ .

..... [3]



The following words describe ten different types of chemical reaction.

decomposition	precipitation	combustion	
oxidation	reduction	reversible	neutralisation
exothermic	endothermic	displacement	

Write the correct word after each of the following descriptions of chemical reactions.

- (a) two solutions are mixed together and form an insoluble product  
..... [1]
- (b) a reaction in which oxygen is removed from one of the reactants  
..... [1]
- (c) a reaction which takes in heat from the surroundings  
..... [1]
- (d) a reaction where products can form the original reactants  
..... [1]
- (e) a single substance breaks down into two or more simpler ones  
..... [1]
- (f) a substance loses electrons  
..... [1]
- (g) one element takes the place of another in a compound  
..... [1]
- (h) a substance burns in oxygen  
..... [1]

## Medium Demand Questions

## QUESTIONSHEET 10

When calcium oxide reacts with water it forms calcium hydroxide (slaked lime).  
The reaction is exothermic.

- (a) Explain what is meant by an 'exothermic reaction'.

..... [1]

- (b) The formula for a calcium ion is  $\text{Ca}^{2+}$  and that of a hydroxide ion is  $\text{OH}^-$ .  
Write down the formula for calcium hydroxide.

..... [1]

- (c) Write down one use of slaked lime.

..... [1]

- (d) When slaked lime is dissolved in water, it produces a solution known as limewater.  
It is possible to make a small amount of calcium carbonate from limewater.  
Explain how this can be done.

..... [1]

- (e) How can calcium carbonate be converted into quicklime?

..... [1]

- (f) The reactions described above are often put together in a diagram called the calcium cycle.  
Explain the word "cycle" in this context.

.....

..... [2]

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## Medium Demand Questions

## QUESTIONSHEET 11

Solutions of different halogens were mixed with solutions of halide salts. The mixtures were shaken with some organic solvent. Halogens dissolve better in the solvent than in water and give distinctive colours. (chlorine - green, bromine - orange, iodine - violet)

Here are the results of some experiments.

experiment	halogen added	halide salt	colour after shaking
A	chlorine	potassium bromide	orange
B	chlorine	potassium iodide	violet
C	bromine	potassium chloride	orange
D	bromine	potassium iodide	violet
E	iodine	potassium chloride	violet
F	iodine	potassium bromide	violet

(a) What type of reaction is taking place?

..... [1]

(b) In which experiments are no reactions taking place?

..... [3]

(c) Write a word equation for experiment A.

..... [1]

(d) Write a symbol equation for experiment A.

[2]

(e) What do the experiments tell you about the relative reactivities of chlorine, bromine and iodide?

.....  
..... [1]

(f) How would you expect fluorine to react with potassium chloride?

..... [1]

(g) How would you expect chlorine to react with potassium fluoride?

..... [1]

The table below gives information about the solubilities of a number of salts.

	<b>sodium</b>	<b>potassium</b>	<b>lead</b>	<b>barium</b>	<b>calcium</b>
<b>chloride</b>	soluble	soluble	insoluble	soluble	soluble
<b>sulphate</b>	soluble	soluble	insoluble	insoluble	slightly soluble
<b>nitrate</b>	soluble	soluble	soluble	soluble	soluble
<b>carbonate</b>	soluble	soluble	insoluble	insoluble	insoluble

- (a) What can you say about the solubility of sodium and potassium salts?  
..... [1]
- (b) What can you say about the solubility of nitrates?  
..... [1]
- (c) What can you say about the solubility of lead salts?  
..... [2]
- (d) Predict the products of the following reactions, underlining any precipitates.
- (i) sodium carbonate solution with lead nitrate solution  
.....  
..... [2]
- (ii) calcium chloride solution with potassium nitrate solution  
.....  
..... [1]
- (iii) barium chloride solution with sodium sulphate solution  
.....  
..... [2]
- (e) Barium salts are poisonous, yet some X-ray patients have to drink barium sulphate. Explain why they can do this without harming themselves.  
.....  
.....  
..... [2]

## Medium Demand Questions

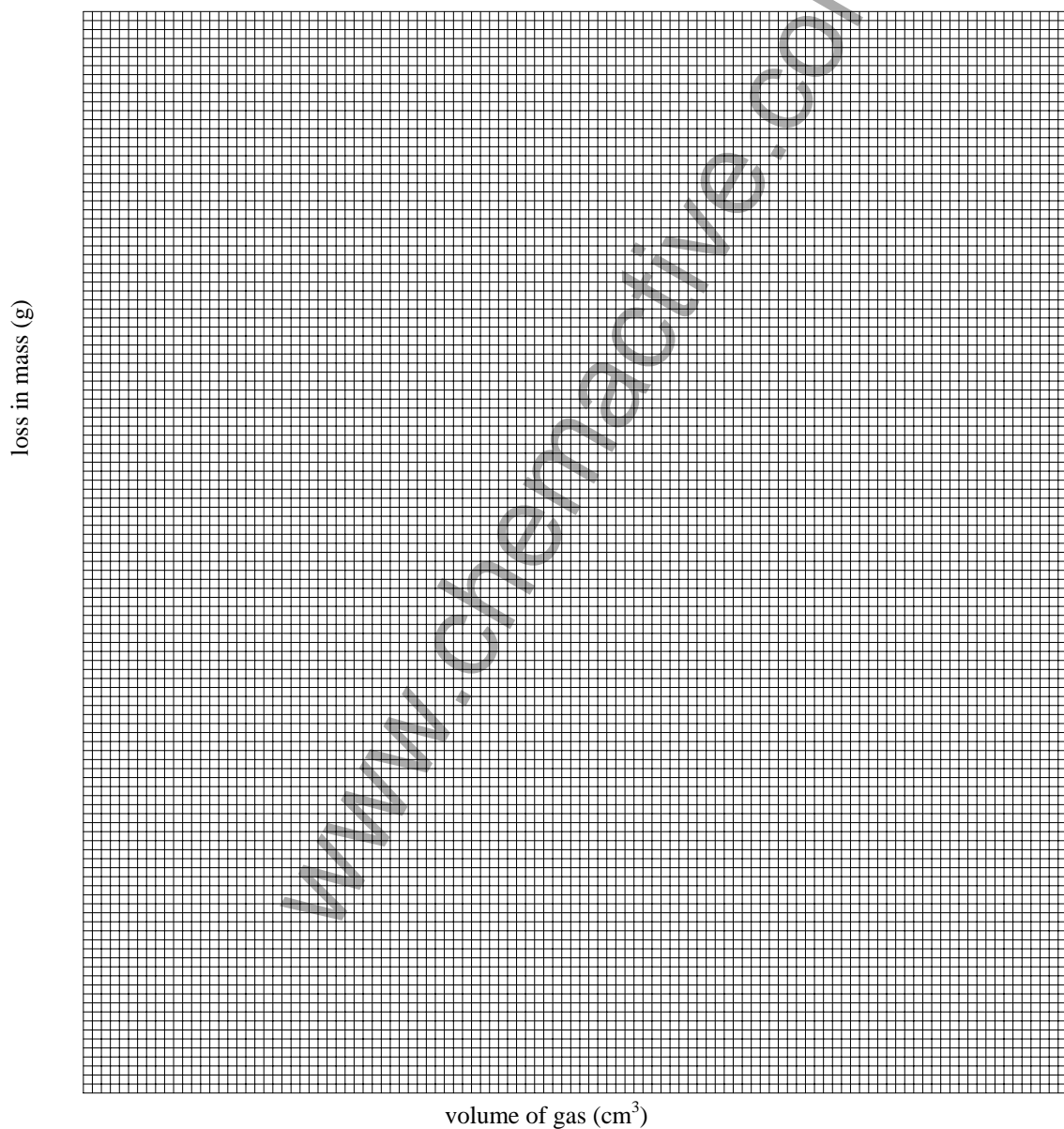
## QUESTIONSHEET 13

Five students wanted to find out what would happen when a certain compound was heated. They found that a gas was given off, so they measured the mass of the gas lost. Their results are shown below.

student	1	2	3	4	5
loss in mass (g)	0.032	0.06	0.083	0.09	0.107
volume of gas (cm <sup>3</sup> )	24	45	62	75	80

- (a) Plot the results on the graph.

[4]



(Continued...)

## QUESTIONSHEET 13 CONTINUED

(b) Which student's result is incorrect?

..... [1]

(c) Use your graph to estimate:

(i) the volume of 0.05 g of the gas.

..... [1]

(ii) the mass of 15 cm<sup>3</sup> of the gas.

[1]

(d) The gas given off is oxygen.

(i) How can the results of the experiment be used to confirm this?

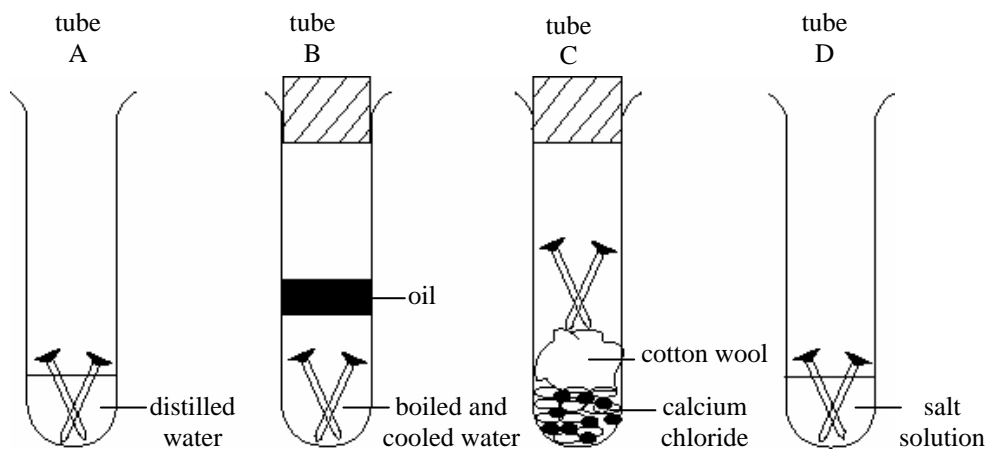
.....  
..... [2]

(ii) Describe a chemical test that can confirm the identity of the gas.

.....  
..... [2]

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Study the diagram below.



- (a) (i) In which two tubes will the steel go rusty?

..... [1]

- (ii) Why does the steel not rust in the other two tubes?

.....  
 ..... [2]

- (b) In which tube will the rusting occur fastest?  
 Explain your answer.

.....  
 ..... [2]

- (c) Explain how ships and piers are prevented from rusting.

.....  
 ..... [3]

- (d) State how each of the following is prevented from rusting.

- (i) cutlery

..... [1]

- (ii) car bodies

..... [1]

## Medium Demand Questions

## QUESTIONSHEET 15

Zinc metal can be extracted from the mineral zinc blende (zinc sulphide)

Stage 1 - zinc blende heated in air to produce zinc oxide.

Stage 2 - zinc oxide reacted with sulphuric acid to make a solution containing zinc ions.

Stage 3 - zinc metal is obtained by electrolysis of the solution.

The zinc extracted is used to coat other metals and in alloys.

- (a) Suggest **two** advantages of alloys over pure metals.

.....  
..... [2]

- (b)(i) Name the metal that zinc is often used to protect.

..... [1]

- (ii) What is the process of covering a metal with zinc called?

..... [1]

- (c)(i) Apart from zinc oxide, what other product is formed when zinc blende is heated in air?

..... [1]

- (ii) The formula of zinc oxide is ZnO.

The formula of an oxide ion is  $O^{2-}$ .

What is the formula of a zinc ion?

..... [1]

- (d) What type of reaction occurs when zinc oxide reacts with sulphuric acid?

..... [1]

- (e) Zinc can also be extracted from zinc oxide by heating it with coke.

- (i) What is the main element in coke?

..... [1]

- (ii) Write an equation for the reaction between zinc oxide and coke.

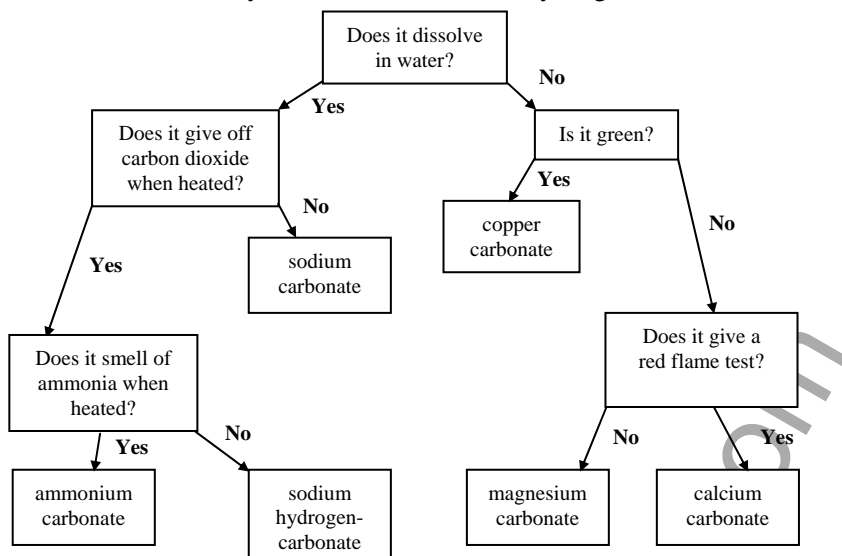
..... [1]

- (iii) What type of reaction involves the removal of oxygen?

..... [1]



The key below is used to identify five carbonates and a hydrogencarbonate.



- (a) (i) Which soluble compound gives off carbon dioxide, but gives no smell?

..... [1]

- (ii) What type of substance will react with any carbonate or hydrogencarbonate to produce carbon dioxide?

..... [1]

- (iii) Only one carbonate in the key produces no carbon dioxide when heated.  
Which one?

..... [1]

- (b) Tablets for upset stomachs often contain citric acid and magnesium carbonate.  
Describe and explain what happens when these tablets are added to water.

..... [2]

- (c) A teaspoon of sodium hydrogencarbonate is added when making gingerbread.

- (i) What is the purpose of the sodium hydrogencarbonate?

..... [2]

- (ii) Why would sodium carbonate be unsuitable for this purpose?

..... [1]

## Low Demand Questions

## QUESTIONSHEET 17

Quicklime, CaO, is made by heating limestone, CaCO<sub>3</sub>, in a rotating kiln.

Limestone is added at the top of the kiln. Turning the kiln lets the limestone move slowly to the bottom as it is heated. Quicklime is formed and is taken from the bottom.

(a) Give the chemical name for:

(i) quicklime

..... [1]

(ii) limestone

..... [1]

(b) Heat is required for the reaction to take place.  
What name is given to reactions which take in heat?

..... [1]

(c) James investigated this reaction. He heated a piece of limestone on the edge of a gauze.  
Describe what he saw.

.....  
.....  
..... [2]

(d) Before the rotating kiln was invented, each batch of limestone had to be heated separately.  
Suggest **one** advantage that the rotating kiln has over the older method.

.....  
..... [1]

(e) There are proposals to extend a limestone quarry.

(i) Give **two** arguments that the quarry owners could use in favour of the proposed extension.

.....  
.....  
..... [2]

(ii) Give **two** arguments that those against the extension could use.

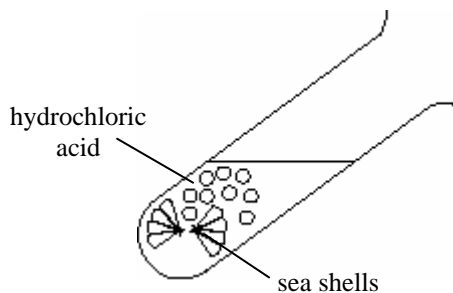
.....  
.....  
..... [2]

TOTAL / 10

## Low Demand Questions

## QUESTIONSHEET 18

- (a) Some students decided to investigate the chemistry of seashells. They started by adding hydrochloric acid to some pieces of seashell. The mixture fizzed. They decided to find out if the gas was carbon dioxide.
- (i) Complete the diagram below to show how they could do this.



[3]

- (ii) What result would they see if the gas was carbon dioxide?

[2]

- (b) They then heated a small piece of shell in a flame. Different substances give different colours when put in a flame.

substance	colour of flame
sodium chloride	yellow
potassium chloride	pink
calcium chloride	red
copper chloride	green

- (i) Why is copper wire not used for the test?

[1]

- (ii) How is the test wire cleaned between each test?

[1]

The shells turned the flame a red colour.

- (iii) Which metal is in the seashells?

[1]

- (c) Use the results of the two tests to select the chemical name of the substance from which seashells are made from the list below.

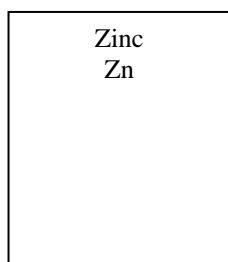
sodium chloride      sodium carbonate      calcium carbonate      calcium chloride

[1]

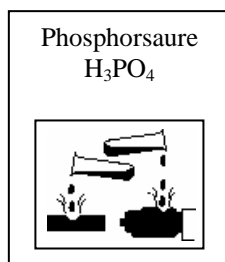
## Low Demand Questions

## QUESTIONSHEET 19

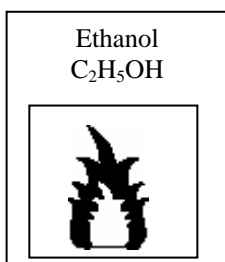
Some bottles of chemicals were imported from Germany.  
Their labels are in German.



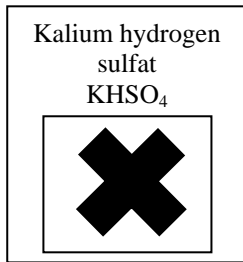
A



B



C



D

- (a) Which bottle contains a potassium compound?

..... [1]

- (b)(i) Which bottle contains an element?

..... [1]

- (ii) What gas is formed when this element is added to dilute sulphuric acid?

..... [1]

- (c) Which bottle contains a flammable substance?

..... [1]

- (d)(i) Which bottle contains a compound of four elements?

..... [1]

- (ii) What does the hazard label on this bottle mean?

..... [1]

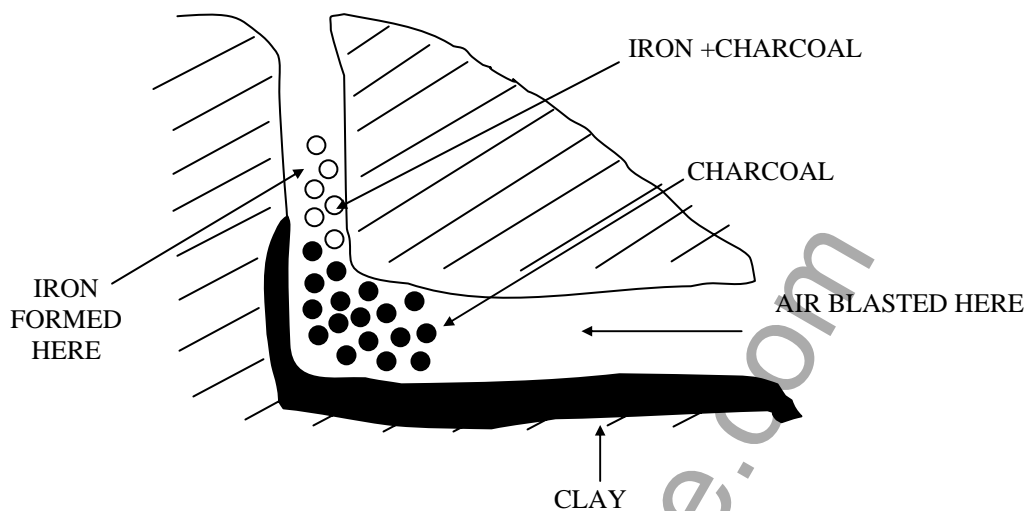
- (e) The gas, hydrogen, is known in German as "Wasserstoff".  
Wasser means water.  
Suggest an explanation for the name.

.....

..... [2]

TOTAL / 8

- (a) The diagram shows a cross section through a type of blast furnace, which was used in the Iron Age.



- (i) The charcoal is the fuel for the furnace. Charcoal is mainly carbon.  
Write an equation for the burning of charcoal in a plentiful supply of air.  
..... [1]
- (ii) Some carbon monoxide may also be formed.  
Why is this undesirable?  
..... [1]
- (b) The iron ore is reduced to iron when the furnace gets hot enough.
- (i) What is meant by 'reduced' in this reaction?  
..... [1]
- (ii) Name a substance that is oxidised in the process.  
..... [1]
- (c) When the furnace was opened, the clay had changed.  
List three of the changes to the clay.  
.....  
.....  
..... [3]