

SENIOR FOUR HOLIDAY WORK

Question one

- (a) Under suitable condition(s), a dry pure sample of ammonia can be prepared in the laboratory using ammonium chloride mixed with calcium hydroxide according to the following equation.



- (i) State:
 I. the condition(s) for the reaction leading to the formation of ammonia.
 II. how ammonia is collected and give a reason for your ammonia.
 (ii) Briefly explain why ammonia is not dried using fused calcium chloride or concentrated sulphuric acid. (*No equation required*)
 (iii) Name the substance which is usually used as a drying agent for ammonia.
 (b) Calculate the volume of ammonia formed when at room temperature and pressure when 3.7 g of calcium hydroxide completely reacts with ammonium chloride. (1 mole of a gas at r.t.p occupies 24dm³; Ca=40; O=16; H=1)
 (c) Draw a labelled diagram of the setup of the apparatus to show that ammonia is very soluble in water.
 (d) By means of an equation only show how ammonia can act as reducing agent.
 (e) State the condition(s) under which dry ammonia can react with oxygen and write equation(s) for the reaction(s) that take(s) place.
 (f) One of the products formed in (e) can be used in the large scale manufacture of nitric acid.
 (i) Identify the product.
 (ii) Using equations only, show how the product identified in (d)(i) can be converted into nitric acid. (4½ mks)
 (iii) Write equation for the reaction between fuming nitric acid and copper.
 (g) When ammonium nitrate was warmed with sodium hydroxide, a gas P was evolved. Gas P turned aqueous copper(II) sulphate deep blue.
 (i) Identify gas P. (01 mk)
 (ii) Write
 I. the formula of the cation responsible for the deep blue.
 II. an ionic equation leading to the formation of gas P. (1½ mks)
 (iii) Determine the percentage of nitrogen in ammonium nitrate. (O = 16; N = 14; H = 1)
 (h) State **two** large scale uses of ammonia. (01 mks)

Question two

- (a) Copper(II) nitrate was strongly heated in a fume cupboard.
 State
 (i) why heating was done in a fume cupboard (01 mk)
 (ii) what was observed. (1½ mks)
 (b) (i) Write equation for the reaction that took place. (1½ mks)

- (ii) Calculate the mass of the residue formed when 5.0 g of copper(II) nitrate was strongly heated. (2½ mks)

- (c) The residue formed in (a) was mixed with warm dilute sulphuric acid (01 mk)
 (i) State what was observed. (1½ mks)
 (ii) Write equation for the reaction that took place. (1½ mk)
 (iii) Describe briefly how dry crystals of the product of the reaction in (c)(i) can be obtained in the laboratory. (3½ mks)
 (d) To the product in (c)(i), dilute sodium hydroxide was added drop wise until there was no further change. (01 mk)
 (i) State what was observed.
 (ii) Write equation(s) for the reaction(s) that took place. (1½ mks)
 (iii) Write equation for the reaction that took place. (1½ mk)
 (e) Dilute ammonia solution was added drop wise until in excess to the product in (d).
 (i) State what was observed. (01 mk)
 (ii) Explain your observation in (e)(i). (*Equation not required*) (02 mks)
 (iii) Write the formula of the cation in the resultant mixture in (e)(i).

Question three

- (a) (i) Name **two** substances which when reacted together in the laboratory produce sulphur dioxide.
 (ii) State the condition(s) required for the formation of sulphur dioxide from the named substances in (a)(i).
 (iii) Write an ionic equation for the reaction leading to the formation of sulphur dioxide from the named substances in (a)(i).
 (b) Name **one**
 (i) substance that can be used to dry sulphur dioxide.
 (ii) reagent that would be used to confirm the presence of sulphur dioxide, and state what would be observed if the reagent you have named was treated with sulphur dioxide.
 (c) Write equation for the reaction between sulphur dioxide and water.
 (d) State what would be observed and write an equation for the reaction that would take place when
 (i) hydrogen sulphide gas is mixed with moist sulphur dioxide. (2½ mks)
 (ii) red flowers are dropped in a jar of moist sulphur dioxide and the jar is left stand for a few minutes. (02 mks)
 (iii) hot magnesium ribbon is dipped in a jar of dry sulphur dioxide.
 (e) Sulphuric acid is one of the most important mineral acids with a wide range of uses. The acid is obtained on a large scale by Contact process using sulphur dioxide as one of the raw materials and a catalyst
 (i) Name
 I. a suitable catalyst which is used in the process. (01 mk)
 II. **two** other raw materials apart from sulphur dioxide used in the process.
 (ii) State **two**
 I. sources of sulphur dioxide used in the Contact process.
 II. useful products obtained from sulphuric acid.

- (iii) With the help of equations, outline how sulphur dioxide can be converted into sulphuric acid in the Contact process.
- (f) State the condition(s) under which sulphuric acid reacts as:
- an acid.
 - an oxidising agent.
 - a dehydrating agent.
- (g) State two
- classes of substances, other than carbonates or hydrogenocarbonates which sulphuric acid react with as an acid.
 - substances which sulphuric acid which reacts with as
 - an oxidising agent
 - a dehydrating agent
- (h) (i) When concentrated sulphuric acid was left in an open transparent glass beaker for some days, the level of the acid rose up. Give a reason for this observation. (*Equation not required*)
- (ii) State one
- word which means the process that took place in (h)(i).
 - practical application of the sulphuric acid as a result of the property observed in (h)(i).
- (i) Briefly describe a test you would carry out to confirm the presence of the anion in a dilute aqueous solution of sulphuric acid; state what would be observed and write an equation for the reaction that would take place.
- (j) Sulphur dioxide is an acidic gas and an industrial pollutant.
- What is meant by the terms **acidic gas** and **pollutant**?
 - Define the term **chemical pollution**.
 - Name any other **three** atmospheric pollutants.
 - Buildings made up of limestone (calcium carbonate) eventually start to crumble if sulphur dioxide is present in the atmosphere. Explain.

Question four

- (a) State the difference between the pairs of terms. In each case give an example.
- A base and an alkali.
 - An acid salt and a normal salt.
 - A strong acid and a weak acid.
- (b) Define the following terms
- An acid.
 - Basicity of an acid.
- (c) Outline how a pure dry sample of
- copper(II) sulphate crystals can be obtained starting with copper(II) oxide.
 - calcium carbonate or lead(II) carbonate can be prepared.
 - amorphous sodium carbonate can be prepared starting from sodium hydroxide.
- (d) State what would be observed and write equation(s) for the reaction(s) that would take place if
- the crystals in (c)(i) were heated strongly.
 - to the aqueous solution of the crystals in (c)(i) was added few drops of sodium hydroxide solution.

- (e) The product in (d)(ii) was treated with excess dilute ammonia solution. (01 mark)

- State what was observed.
 - Give a reason for your answer in (e)(i).
 - Write the formula of the species responsible present in the final mixture.
- (f) Briefly describe a test you would carry out to confirm the presence of sulphate ion in aqueous solution; state what would be observed and write equation for the reaction that would take place.

- (g) State one use of
- copper(II) sulphate in a laboratory.
 - sodium carbonate on a large scale.
- (h) Lead(II) nitrate solution reacts with copper(II) sulphate solution according to the following equation.
- $$Pb(NO_3)_2(aq) + CuSO_4(aq) \rightarrow PbSO_4(s) + 2NaNO_3(aq)$$
- (i) State what is observed when lead(II) nitrate solution is added to copper(II) sulphate solution.
- (ii) Calculate the mass of lead(II) sulphate that would be formed if lead(II) nitrate solution was added to a solution containing 1.6 g of copper(II) sulphate (*Relative formula mass of copper(II) sulphate = 160*)

Question five

A compound Q of formula mass 286, contains sodium, 16.08%, carbon, 4.20%, oxygen 16.78% and the rest being water.

- Calculate the empirical formula of Q.
- Determine the molecular formula of Q.
- Q was left exposed to the atmosphere for some time.
 - State what was observed.
 - Write equation for the reaction that took place.
 - What name is given to the process that occurred when Q was exposed for some time to the atmosphere?
- To an aqueous solution of Q was added magnesium chloride solution.
 - State what was observed.
 - Write ionic equation for the reaction that took place.
- State one large scale use of compound Q in water treatment.

Question six

- Calcium oxide is a hygroscopic white solid.
 - State what is meant by the term **hygroscopic substance**.
 - Write equation to illustrate the hygroscopic nature of calcium oxide.
 - State one practical application of calcium oxide as a result of hygroscopic nature.
- Name one other oxide which is hygroscopic.
- Explain why the reaction of between calcium oxide and dilute sulphuric acid stops after a short period of time.
- Write equation for the reaction that can take place when a mixture of calcium oxide and silicon(IV) oxide is heated strongly.
- State one large scale uses of the product in (c)(i).