PANGANI GIRLS SCHOOL
CHEMISTRY DEPARTMENT
FORM 4 EXAM
TIME : 2 HOURS

NAME: ..... CLS: ..... CLS NO.....

1. A hydro carbon P contains 85.71% by mass of carbon and 14.29% by mass of hydrogen. The relative formula mass of P is 42.

i. Determine the empirical formula of the hydrocarbon P. (2mk)

ii. Determine the molecular mass of P. (1mk)

2. The elements tin and lead have the following electronic arrangements.

Sn 2 . 8 . 18 . 18 . 4

Pb 2 . 8 . 18 . 32 . 18 . 4

These elements can form chlorides which do not conduct electricity and have the boiling points as shown below.

$SnCl_4$ - 33°C, $PbCl_4$ - 15°C

i. In which group of the periodic table would you place tin and lead? (1mk)

ii. What conclusion can you draw about the bonding in these chlorides? (1mk)

iii. Lead (II) chloride can be prepared by adding hydrochloric acid to a cold solution of Lead (II) Nitrate solution. Write an equation for the reaction. (1mk)

b.i. Why is cold solution of Lead (II) nitrate used? (1mk)

ii. Which physical process can be used to isolate Lead (II) chloride formed? (1mk)

3. Give TWO important reasons why you think air is a mixture.
(2mks)

4. State two observations made when calcium metal is dropped in a boiling tube containing cold water. (2mks)

5. A student investigated the action of heat on hydrated iron (II) sulphate $FeSO_4 . xH_2O$ and obtained the following results.

Mass of hydrated salt = 27.80g
Mass of anhydrous salt = 15.20g

i. Calculate the value of X in the compound
Fe = 56, S = 32, O = 16, H = 1 (3mks)

6.a. What is the name of the method suitable for the separation of iodine and calcium chloride? (1mk)

b. Give two reasons why a mixture of ethanol and water can be separated. (2mks)

7.i. The molecular mass of hydrogen sulphide is 34 while that of water is 18. Explain why the boiling point of water is higher than that of hydrogen sulphide. (2mks)

ii. Aluminium chloride exists as a dimer. In the space below show bonding in Al_2Cl_6, Al = 13, Cl = 17. (1mk)

8.a. Define mole. (1mk)

b. Calculate the number of chloride ions in 11.1g of calcium chloride Ca = 40, Cl = 35.5La = 6.0×10^{23} per mole. (2mks)

9. The table below gives the atomic and ionic radii of elements in one of the groups of periodic table. The elements are not arranged as they appear in the group and the letters are not the actual symbols.

Element	Atomic radii (nm)	Ionic radii (nm)
A	0.14	0.192
B	0.133	0.215
C	0.072	0.135
D	0.099	0.181

i. Is this a metallic or non-metallic group of elements? Explain. (2mks)

ii. Which of the elements would be at the bottom of the group?Explain. (2mks)

10. $12.5cm^3$ of 0.5m sulphuric acid neutralized $50cm^3$ of sodium hydroxide solution.

i. Write the equation for the reaction taking place. (1mk)

ii. Calculate the molarity of sodium hydroxide solution. (2mks)

11. $25.cm^3$ of a solution contains 2.45g of hydrated Ammonium Iron (II) sulphate $(NH_4)_2SO_4$. FeSO4. $6H_2O$. Calculate the concentration of this solution in mol dm^{-3}. (Fe = 56, S=32, O=16, H=1, N=14). (3mks)

12. Give chemical tests to distinguish between the following pairs of substances.

a. Nitrogen (I) oxide and oxygen. (2mks)

b. Zinc carbonate and magnesium carbonate. (2mks)

13. Elements W, X and Y and Z are all in the same period of the periodic table. An oxide W_2O exists and is strongly basic. X forms a liquid covalent chloride XCl_3. The oxide of Y is Y_2O_3 and Z forms the ion Z^{-1}.

a. In which group of the periodic table do the elements belong? (1mk)

b. Write the formula for the chloride of W. (1mk)

c. Write the formula for the chloride of Y. (1mk)

14. When burning magnesium ribbon is lowered into a gas jar full of carbon dioxide the ribbon continued to burn with more vigour.

a. State what is observed inside the gas jar at the end of the reaction? (1mk)

b. Write the equation for the reaction that takes place. (1mk)

15. A gas X reacts with water to form a mixture of two acids. When the moist blue litmus paper is placed in a gas jar containing gas X it immediately turns red and then bleached. A solution of gas X gives a white precipitate with lead (II) Nitrate solution.

a.i. Identify gas X.(1mk)

ii. Write equation to show the bleaching action of gas. (1mk)

iii. Write ionic equation for the formation of the white precipitate.(1mk)

16.a. Name the only waste product in the Solvay product. (1mk)

b. Why does the reaction between dilute sulphuric acid and lumps of limestone soon stop?

17. When concentrated nitric acid is added to copper metal the reaction below takes place.

$$Cu_{(s)} + HNO_3(aq) \longrightarrow Cu(NO_3)_{2\,(aq)} + NO_{2(g)} + H_2O_{(l)}$$

a. Balance the equation above. (1mk)

b. State two observations which will be made in the flask when the reaction below takes place. (1mk)

1.

2.

c.i. Determine the oxidation state of nitrogen (N) in HNO_3 and NO_2. Show your working. (2mks)

(i) HNO_3 ii. NO_2

ii. Name the type of reaction which occurs when HNO_3 changes to NO_2.

18. When NO_2 gas is dissolved in water a colourless solution P is formed which is strongly acidic. When oxygen gas is bubbled through solution P solution Q is obtained.

i. Write an equation to show the reaction that takes place when NO_2 is dissolved in water. (1mk)

ii. Name solution Q. (1mk)

iii. Describe the role of oxygen above.

19. In each case below, state what property of concentrated sulphuric acid is illustrated and described what is observed when concentrated sulphuric acid acts on:

i. Sugar: Property: (1mk)

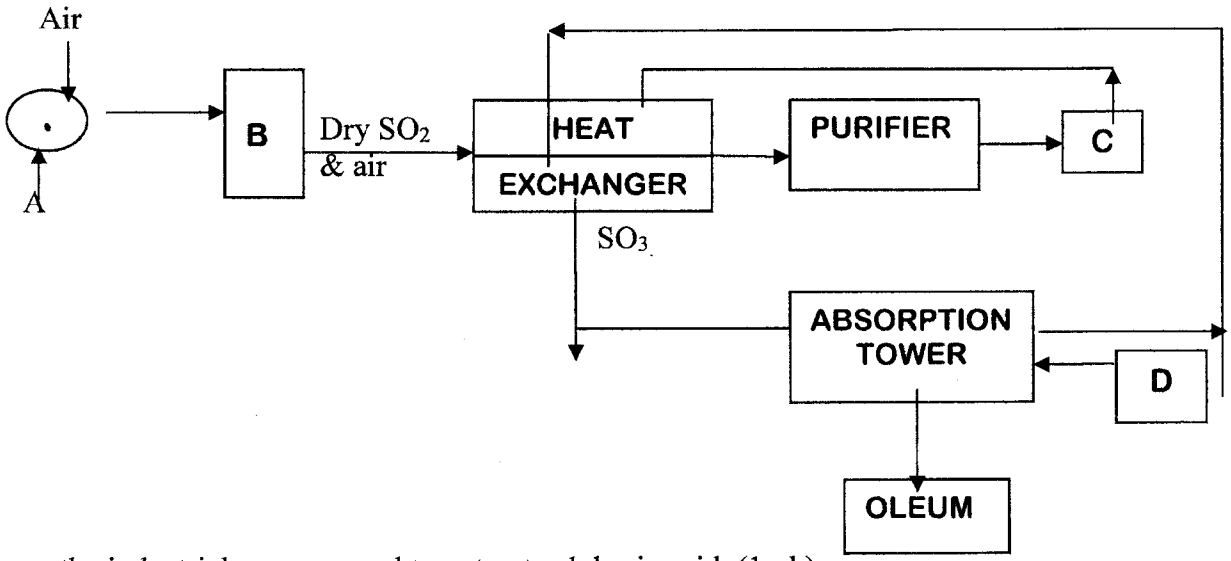
Observation:

ii. Copper metal: Property (1mk)

Observation:

iii. Concentrated sulphuric acid, left in an unstopped bottle, increased in volume. Explain. (1mk)

21. The flow chart below shows how sulphuric acid is manufactured by the contact process. Study it carefully and answer the questions that follow:



Name the industrial process used to extract sulphuric acid. (1mk)

a.i. What is the raw material in A? (1mk)

ii. What reagent is used in D? (1mk)

iii. What happens in 'C'? (1mk)

iv. What are the two uses of the heat exchanger? (2mks)

v. What is coming into the absorption tower through Z? (1mk)

vi. What is being taken from the absorption tower to the heat exchanger? (1mk)

23. 0.1 mol of XSO_4 combines with 5.4g of water to form the hydrate $XSO_4.nH_2O$. Find the value of n. (2mks)