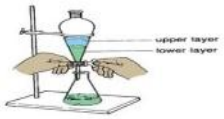
FACILITATION QUESTIONS

Chemistry department



CHEMISTRY 545/2

INSTRUCTIONS:

- **Attempt all questions**
- **Poor symbols and diagrams leads to loss of marks**
- **Avoid unnecessary crossing of work.**
- **Good presentation of work is an added advantage for better results.**

This paper consists of two sections **A** and **B** . Section A consists of 10 structured questions and candidates are required to answer all questions. Section B consists of **four** semi-structured questions and candidates are required to answer **two** questions.

SECTION A

1. Name one pair of substance in each case, which when mixed together can be separated by

(a) Use of separating funnel (1 mark)

_____

(b) Fractional crystallization (1 mark)

_____

(c) Chromatography (1 mark)

_____

(d) Fractional distillation (1 mark)

_____

(e) Simple distillation (1 mark)

_____

2. (a) Name the method used in separation of the following mixtures in each case and give a reason for your answer.

(i) Iron(III) chloride and Iron(II) chloride (1 mark)

_____

Reason_____

(ii) Sodium chloride and Sodium Carbonate (1 mark)

_____

Reason_____

(b) Steel is an alloy of iron and is widely used than iron itself. State two advantages of steel over iron. (2 marks)

_____

(c) State two alloys that contain copper and state one use of each.(3marks)

_____

3. (a)The table below shows some of the physical properties of solids and gases.

Property	Solid	Gas
Shape	Fixed	Not fixed
Volume	Fixed	Not fixed

(i) State one other difference between gases and solids. (1 mark)

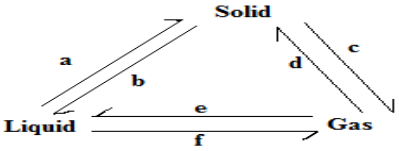
_____

(ii) Explain why a solid has a fixed shape while a gas has no fixed shape. (2 marks)

_____

_____

(b) Below is a diagrammatic representation of the changes of states of matter.



(i) Name the processes labeled a to f

A_____ b_____ c_____

d_____ e_____f_____

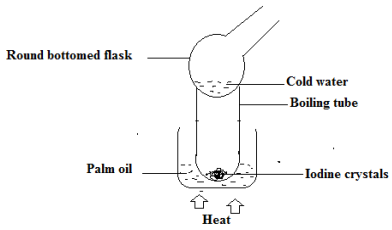
(ii) Give three examples of substances that undergo process c and d.

_____

_____

_____

(c) Below is a set up of an experiment which was performed by senior one students to find out the properties of Iodine crystals when heated.



State what was observed

(i) In the Boiling tube _____

(ii) On the round bottomed flask_____

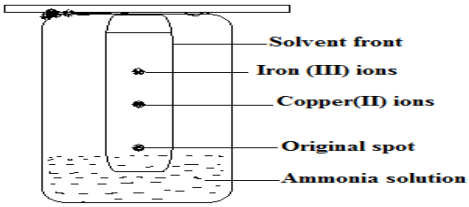
(iii) What change of state was demonstrated above _____

(iv) Explain why palm oil is used instead of water.

_____

_____

4. A mixture of copper(II) ions, Zinc(II) ions and Iron(III) ions was separated as shown below in figure 2.



(a) Name the method used to separate the mixture.

_____

(b) State the colors of copper(II) ions and iron(III) ions in the experiment.

_____

(c) Explain why zinc ions are not observed in the experiment.

_____

(d) Write an ionic equation for the reaction between iron(III) ion with ammonium solution.

_____

(e) State one other mixture that can be separated by the method you have named above

_____

5. (a) State the principle on which each of the following methods of separating mixtures works.
   (i) Chromatography

   _____

   (ii) Fractional crystallization.

   _____

   _____

   (b) State what would be observed and give a reason for your observation, if a mixture of water and the following substance was shaken, then allowed to stand for some time.
   (i) Ethanol

   Observation_____

   _____

   Reason.

   _____

   ii) Eddible oil
   Observation_____

   _____

   Reason

   _____

   (c) Name a piece of apparatus that can be used to separate components of mixture in (b).

   _____

6. (a) When exposed to sunlight, hydrogen peroxide produces gas bubbles,
   (i) Identify the gas that bubbles out from the hydrogen peroxide. (1 mark)

   _____

   (ii) Write an equation for the reaction leading to the formation of the gas you have identified in (i) from hydrogen peroxide

   _____

   (b) Manganese(IV) oxide was added to hydrogen peroxide and the mixture when exposed to sun light.
   (i) Sate how the rate of gas bubbling on this mixture would differ from that in (a) above.

   _____

   ii) Give a reason for your answer in b(i)

   _____

   (c) Other than the use of manganese(IV) oxide, suggest one other thing that could be done to enhance change in the rate of gas bubbling by the hydrogen peroxide.

   _____

   _____

7. (a)Under suitable conditions, hydrogen peroxide solution H_2O_2 can decompose rapidly to produce oxygen.
   (i) Write equation for the decomposition of hydrogen peroxide.

   _____

   (ii) State two ways in which the decomposition of hydrogen peroxide can be made to occur rapidly.

   _____

   _____

   b) Burning magnesium ribbon was lowered into a jar of oxygen.
   (i) State what was observed.

   _____

   ii) Write an equation for the reaction that took place.

   _____

8. The elements Aluminium, sulphur and calcium can each combine with oxygen to form oxides.
   (a) State the class of the oxide of
      (i) Aluminium _____
      (ii) Sulphur _____
      (iii) Calcium _____
   (b) (i) State what would be observed if a few drops of water were added to the oxide of calcium
9. (a) State the condition under which sodium can react with oxygen to form sodium peroxide. (1 marks)

   _____

   _____

   b) Write equations for the reaction
   (i) leading to the formation of sodium peroxide under the conditions which you have stated ($1^1/_2$ marks)

   _____

   ii) between sodium peroxide and water ($1^1/_2$ marks)

   _____

   c) State the practical application of the reaction in b(ii) (1 mark)

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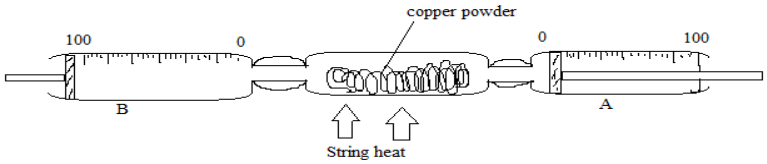
10. The diagram below shows an experiment to determine the percentage of one of the components of air.



Piston A is pulled to allow air over hot copper powder.
   (a) When the volume of air in B($100cm^3$) reduced to $0cm^3$, the volume of air in A increased from $0cm^3$ but does not reach $100cm^3$.
      (i) Name the component of air that has been removed by hot copper powder.

      _____

      (ii) Write equation for the reaction that took place in the combustion tube.

      _____

   (b) When burning magnesium is lowered in the residual air from the experiment above, the black particles are observed on the sides of the reaction vessel.
      (i) Name the black particles

      _____

      (ii) Write equation for the reaction that occurs in (b) (i) above.

      _____

11. (a) Name the fundamental particle of an atom which is
   (i) Positively charged _____
   (ii) Negatively charged_____
   (iii) Not charged _____

   (b) Name the

   (i) particle which is involved when an atom reacts with another atom.

   _____

   ii) particle(s) which determine(s) the mass of an atom. (1 mark)

   _____

(c) State what a charged atom is called, when it bears;

(i) a negative charge _____

(ii) a positive charge _____

12. (a) The full symbol of the atom of an element is $^{24}_{12}X$.

(i) Write the electronic configuration of the atom of X.

_____

(ii) Draw a diagram to show how X and hydrogen form a compound.

(b) The hydride of element X conducts electricity in the molten state. Write equation for the reaction occurring at the

(i) Anode _____

(ii) Cathode_____

13. The atomic number of elements W, chlorine and Y are 15, 17 and 20 respectively.

(a) Write the electronic configuration of an atom of elements

(i) W _____

(ii) Y _____

(b) State which one of the elements W or Y would form a chloride which is

(i) Solid with high melting point

_____

(ii) A volatile liquid at room temperature

_____

(c) Give reasons for your answers in (b) above.

_____

_____

(d) Show how chloride ions in aqueous solution can be identified.

_____

_____

14. A hydrocarbon Y contains 85.7% carbon.

(a) Calculate the simplest formula of Y (2 marks)

_____

_____

_____

_____

(b) 0.224g of Y occupied 96cm^3 at room temperature.

(i) Calculate the molecular mass and hence the molecular formula. (2 marks)

_____

_____

_____

_____

_____

_____

_____

(ii) State the homologous series to which Y belongs. ($^1/_2$ mark)

_____

(iii) Write down one structural formula of Y. ($^1/_2$ mark)

_____

15. A hydro carbon Z contains 82.76% carbon and the formula mass of Z is 58g

(a) Calculate the

(i) Simplest formula of Z. (2 marks)

(ii) The molecular formula of Z (1 mark)

(b) Write

(i) The structural formula of Z ($1^1/_2$ mark)

(ii) The equation for complete combustion of Z ($1^1/_2$ marks)

16. (a) Glucose can be converted to ethanol by fermentation process.

(i) Name one enzyme used to convert glucose into ethanol during fermentation. ($1^1/_2$mark)

(ii) Write equation for production of ethanol in (a) (i) (1 mark)

b) Ethanol can be converted to ethene by dehydration.

(i) State the conditions under which the reaction takes place. ($1^1/_2$Marks)

ii) Write equation for the reaction leading to the formation of ethene from ethanol. ($1^1/_2$marks)

(c) Write equation for the reaction between ethene and bromine. (01 mark)

17. Ethanol can be converted to ethene according to the following equation

$$C_2H_6O_{(l)} \xrightarrow{H_2SO_4} C_2H_{4(g)}$$

(a) State the necessary conditions for the conversion of ethanol to ethene ($1^1/_2$marks)

(b) (i) Name one reagent that can be used to distinguish between ethene and sulphur dioxide gas. ($^1/_2$mark)

ii) State what would be observed if the reagent you have named in b(i) was separately treated with each gas (2 marks)

(iii) Write equation to illustrate your observation in b(ii) between ethene and the reagent you have named in b(ii) (1 mark)

18. Concentrated sulphuric acid is used in the laboratory preparation of both ethene and sulphur dioxide.

(a) Name one substance that when treated with sulphuric acid can be used in the laboratory preparation of

(i) Ethene ($^1/_2$ mark)

(ii) Sulphur dioxide ($^1/_2$mark)

(b) State the property of sulphuric acid shown during the laboratory preparation of

(i) Ethene ($^1/_2$ mark)

(ii) Sulphur dioxide _____($1^1/_2$mark)

(c) Write an equation to show the reaction in which sulphuric acid together with the substance that you have named in (a) to produce

(i) Ethene ($1^1/_2$marks)

_____

(ii) Sulphur dioxide ($1^1/_2$ marks)

_____

19. (a) Butane, C_4H_{10}, is a fuel used in the Bunsen burner in the laboratory.

(i) Write the structural formula of Butane. (1 mark)

_____

(ii) State the homologous series to which the butane belongs. (1 mark)

_____

b)(i) Define the term fuel and give an example ($1^1/_2$ marks)

_____

_____

ii) Write the equation for the complete combustion of butane. ($1^1/_2$marks)

_____

20. Use hydro carbons CH_4, C_2H_4 and C_3H_8 to answer the following questions.

(a) Why are they referred to as hydro carbons (1 mark)

_____

(b) State the homologous series for the hydrocarbons below.

(i) CH_4 _____

(ii) C_2H_4_____

(c) Explain why ethene can decolorize bromine water yet ethane can not. (1 mark)

_____

_____

(d) Ethene undergoes the following reaction $_nH_2C=CH_2 \rightarrow -(CH_2CH_2)-n$

(i) Name the type of chemical reaction above._____

(ii) Name the product formed by the reaction. _____

21. (a) Write

(i) Structural formula of ethene? _____

(ii) The name of a compound W, having a molecular formula C_2H_6? (1 mark)

_____

(c) State what would be observed if bromine liquid was added separately to a sample of

(i) Ethene (1mark)

_____

(ii) Compound W (1 mark)

_____

(d) Briefly explain your observation in (b) above. (1 mark)

_____

_____

_____

22. Ethanol obtained from glucose can be converted to ethene as shown below.

$$C_6H_{12}O_6 \xrightarrow{\text{Step 1}} C_2H_5OH \xrightarrow{\text{Step 2}} C_2H_4$$

(a) Name the processes that take place in

(i) Step 1 _____

(ii) Step 2 _____

(b) State

(i) One other product formed together with ethanol in step 1

_____

(ii) The conditions for the conversion in step 2

_____

(c) Ethene can be converted to a polymer J of relative molecular mass 16,800.

(i) Write the structural formula of J

(ii) Calculate the number of moles of ethene that make up J

(iii) Give one disadvantage of the continued use of J.

23. When calcium turnings were added into water in a beaker, bubbles of a colourless gas X and a cloudy solution were formed.
    (a) State the identity of;
        (i) Gas X _____
        (ii) The cloudy solution _____
    (b) Write equation for the reaction leading to the formation of gas X
    (c) State
        (i) How gas X could be identified in the laboratory
        (ii) One laboratory use of the cloudy solution in the beaker.

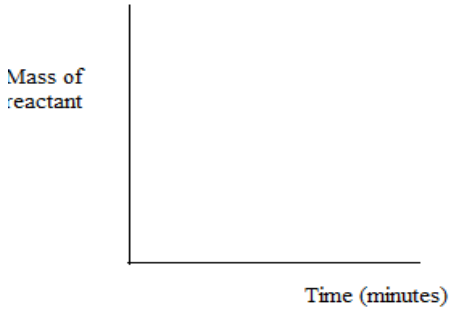
24. At room temperature, zinc granules react with dilute hydrochloric acid according to the following equation.

$$Zn_{(s)} + 2H^{+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + H_{2(g)}$$

    (a) State three ways by which the formation of hydrogen can be made faster.
    (b) Sketch a well labelled graph showing the variation of the volume of hydrogen collected with time.
    (c) Write equation for the reaction that would take place if dry hydrogen gas was passed over heated lead(II) oxide.

25. (a) Define the term rate of reaction. (1 mark)

b) On the axes below, sketch a graph to show variation of mass of reactant with time in a given reaction.



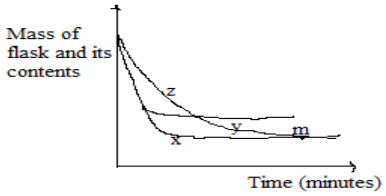
c) (i) State two factors that can affect rates of reactions (2 marks)

ii) Explain why the rate of a reaction increases in the presence of a catalyst.

_____

_____

26. The diagram below shows sketches of curves that were obtained in three experiments to study the rates of reactions of dilute sulphuric acid and iron metal.



(a) In the first experiment curve y was obtained. State three factors that could have been changed to obtain curve x. (3 marks)

_____

_____

_____

(b) State

(i) The significance of point M (1 mark)

_____

(ii) One factor that must have changed to obtain curve z from the conditions that produced curve x. (1 mark)

_____

27. When dry hydrogen was passed over heated lead(II) oxide, a colourless liquid is formed.

(a) State any other observation made (1 mark)

_____

(b) Name liquid Y (1 mark)

_____

(c) Write equation for the reaction leading to the formation of liquid Y.

_____

(d) Name

(i) A compound that is used to identify liquid Y in the laboratory. ($^{1}/_{2}$ mark)

_____

(ii) Any other substance that can lead to formation of Y from lead(II) oxide like hydrogen (1 mark)

_____

28. (a)(i) Name one substance which can react with ammonium sulphate to produce ammonia in the laboratory. (1 mark)

_____

ii) State the condition under which the reaction can take place ($^{1}/_{2}$ mark)

_____

(iii) Write an ionic equation for the reaction leading to the formation of ammonia from the named substance in (a)(i) ($1^{1}/_{2}$marks)

_____

(iv) Name a laboratory reagent that is used to detect ammonia. ($^{1}/_{2}$mark)

_____

(v) State what would be observed if ammonia was treated with the reagent you have named in (a) (iv) ($^{1}/_{2}$ mark)

_____

b) Ammonia can react with lead(II) oxide to produce lead according to the following equation.

$$3PbO_{(s)} + 2NH_{3(g)} \rightarrow 3Pb_{(s)} + N_{2(g)} + 3H_2O_{(l)}$$

State

(i) The condition(s) under which the reaction takes place ($^{1}/_{2}$ mark)

(ii) The property of ammonia shown in the reaction. ($^1/_2$mark)

c) 3.1g of lead was obtained when ammonia reacted with lead(II) oxide. Calculate the maximum volume of ammonia measured at s.t.p that reacted with lead(II) oxide. (1 mark)

29. Copper(II) oxide reacts with ammonia under certain conditions.
(a) State conditions for the reaction. (1 mark)

(b) Write an equation for the reaction that takes place. ($1^1/_2$ marks)

(c) State what is observed during this reaction. ($1^1/_2$marks)

(d) Give one use of the solid product formed in the above reaction. (1 mark)

30. A colourless gas Z was passed over heated lead(II) oxide in a combustion tube. A gaseous product formed has no effect on lime water.
(a) (i) Name gas Z_____
ii) State what is observed in the combustion tube upon passage of Z over hot heated lead(II) oxide.

(b) Write equation of the reaction between Z and
(i) Lead(II) oxide ($1^1/_2$ marks)

(ii) Identify he gaseous product ($^1/_2$ mark)

(iii) Name one other metal oxide that can be used in place of lead(II) oxide.

(iv) Write equation for reaction between gas Z and the metal oxide you have named in b(iii). ($1^1/_2$ marks)

31. (a) Name one crystalline and one amorphous allotropes of carbon and in each case state one use of the allotrope that you have named.
(i) Crystalline allotrope _____
Use _____
(ii) Amorphous allotrope _____
Use _____
b) Write equation for the reaction to show
(i) Combustion of carbon monoxide

ii) Reduction of iron(II,III) oxide by carbon monoxide.

c) State one practical application of the reaction in (b) (ii).

32. (a)Name one allotrope of carbon which is
(i) Amorphous ($^1/_2$ mark)

(ii) Crystalline ($^1/_2$ mark)

(c) State one use of each of the allotropes that you have named in (a) (2 marks)

(d) Name one element other than carbon which shows allotropy. (1 mark)

33. When excess dilute Hydrochloric acid was added to 7.8g of a mixture of calcium carbonate and calcium sulphate, 896cm^3 of carbon dioxide measured at s.t.p. was evolved.

(a) Write an equation for the reaction that took place (1 mark)

(b) Determine the

(i) Mass of calcium carbonate in the mixture (1 mark)

(ii) Percentage of calcium carbonate in the mixture. (1mark)

34. Car exhaust fumes contain gases including Carbon dioxide, carbon monoxide and nitrogen.

(i) Which of the gases above, contribute to acidic rain and how. ($1^1/_2$marks)

(ii) Describe how you would come to conclude that rain water is acidic (1 mark)

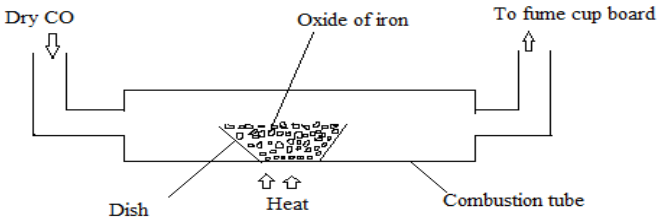
b)(i) Which **CO, N_2** and **CO, H_2** is hotter.

(Producer gas) (water gas)

ii) Explain your answer above. (1 mark)

c) Explain why it is necessary to keep containers of producer and water gas tightly sealed. (1 mark)

35. (a) Excess carbon monoxide gas was passed over a heated sample of an oxide of iron as shown in the diagram below. Study he diagram and the data below it to answer the questions that follow.



Mass of empty dish = 10.98g
Mass of empty dish + oxide of iron = 13.30g
Mass of empty dish + residue = 12.66g

(i) Determine the formula of the oxide of iron (Fe =56, O = 16) (3 marks)

_____

_____

_____

_____

_____

_____

(ii) Write an equation for the reaction which took place in the dish. ($1^1/_2$ marks)

_____

(c) Rusting is a destructive process in which iron is converted into hydrated iron(III) oxide.

(i) State two conditions necessary for rusting to occur. (1 mark)

_____

_____

(ii) One method used to protect iron from rusting ($^1/_2$ mark)

_____

36. (a) Phosphoric acid reacts with sodium hydroxide according to the following equation.

$$H_3PO_{4(aq)} + 2\ NaOH_{(aq)} \rightarrow Na_2HPO_{4(aq)} + H_2O_{(aq)}$$

(i) Define the term **basicity** of an acid (1 mark)

_____

_____

(ii) What is the basicity of phosphoric acid in the reaction above? (1 mark)

_____

(b) State what be observed and write an ionic equation for the reaction that would take place if to a solution of ammonium carbonate was added to

(i) Dilute phosphoric acid.

Observation (½ mark)

_____

Ionic equation (1 mark)

_____

(ii) aqueous copper(II) sulphate solution.

Observation (½ mark)

_____.

Ionic equation (1 mark)

_____

_____

37. (a) The PH of each of the dilute solution of potassium carbonate, lemon juice and ammonium nitrate was measured. Identify the substance which had a solution with a PH value that was

(i) Around 1 to 2 ($^1/_2$ mark)

_____

(ii) Well above 7 ($^1/_2$ mark)

_____

(iii) Around 4 to 5 ($^1/_2$mark)

_____

b) 15.0cm^3 of a 2M sodium sulphate solution was diluted with distilled water to make 200cm^3 of the resultant solution.
Calculate

(i) The moles of sodium ions in diluted solution (1 mark)

_____

_____

_____

(ii) Concentration of sodium ions in the diluted solution in $moldm^{-1}$ (1 mark)

_____

_____

_____

38. (a) Write an equation to show the hydrolysis of sodium carbonate in water.

_____

b) The resultant solution was tested with litmus paper.
(i) State what was observed.

_____

_____

ii) Give a reason for your answer

_____

c) Dilute sulphuric acid was added to sodium hydrogen carbonate solution.
(i) State what was observed.

_____

ii) Write an ionic equation for the reaction that took place.

_____

d) Name one reagent that can be used to distinguish between aqueous sodium carbonate and aqueous sodium hydrogen carbonate and in each case state what would be observed

_____

_____

_____

_____

39. (a) Write an equation for the ionization of Na_2CO_3 in water.

_____

b) Water was added to 250cm^3 of a 0.4M Na_2CO_3 solution to make one litre of dilute solution.
(i) Calculate the concentration of Na^+ in moles per litre of a dilute solution.

_____

_____

_____

_____

40. (a) 90cm^3 of 0.01M $Ca(OH)_2$ solution was added to a sample of water containing 0.001 moles of $Ca(HCO_3)_2$.

(i) State what was observed (1 mark)

_____

(ii) Write an equation for the reaction which took place ($1^1/_2$ mark)

_____

(iii) Calculate the number of moles of calcium ions in 90cm^3 of 0.01M calcium hydroxide. ($1^1/_2$ marks)

_____

_____

_____

_____

(iv) State what would be observed if soap solution was added drop wise to a sample of water after the addition of calcium hydroxide. Give a reason. (1 mark)

_____

_____

41. 1.9g of magnesium chloride were dissolved in distilled in water. Silver nitrate solution was added until in excess.

(a) Write equation for the reaction that took place ($1^1/_2$ marks)

_____

(b) Calculate the mass of silver nitrate that was used for complete reaction. (RFM of $MgCl_2$ = 95, N = 14, O= 16, Ag = 108) ($1^1/_2$ marks)

_____

_____

_____

_____

42. When some substances are exposed to air they under go changes.

(a) State what would be observed if each of the following substances were left exposed in air for some time.

(i) Sodium Carbonate -10-water (1 mark)

_____

(ii) Anhydrous calcium chloride (1 mark)

_____

(iii) Sodium hydroxide pellets (1 mark)

_____

(b) Name the process undergone by the substance when exposed to air

(i) Sodium Carbonate-10-water _____($^1/_2$mark)

(ii) Anhydrous calcium chloride _____($^1/_2$ mark)

(iii) Sodium hydroxide pellets _____ ($^1/_2$ mark)

(c) (i) State one practical application of fused calcium chloride that is as a result of property that you have stated in b(ii) above (1 mark)

_____

43. Sodium hydroxide pellets were left exposed in air for a long period of time. Using equations where necessary state what will be observed. (5 marks)

_____

_____

_____

_____

_____

_____

_____

44. The metals such as potassium, calcium, and copper can react with water under different conditions. State how the metals react with water.

(i) Potassium (2 marks)

_____

_____

_____

(ii) Calcium (2 marks)

_____

_____

_____

(iii) Copper (1 mark)

_____

_____

45. (a) When a concentrated solution of sodium chloride was electrolysed using graphite electrodes some products were obtained.

(i) Name the product(s) at the cathode (1mark)

(ii) Write the equation for the reaction for the reaction at the cathode. (1mark)

b) (i) State the effect of the remaining solution after the electrolysis of the above solution on litmus paper. (1 mark)

ii) Explain your answer in (i) above. (1 mark)

46. (a) A concentrated solution of sodium chloride was electrolysed between platinum electrodes.

(i) State what was observed at the cathode. (1 mark)

(ii) Write an equation for the reaction that took place at the cathode. ($1^{1/}_{2}$ mark)

b) The electrolyte in (a) was put in a mercury cell and moving mercury was allowed to flow at the bottom of the cell acting as the cathode.

(i) Name one substance that can be used as the anode in the reaction at the cathode. (½ mark)

ii) Write equation for the reaction at the cathode. ($1^{1}_{/2}$ mark)

iii) Which facto determined preferential discharge of the ion in b(i) above.

47. (a)(i) Define the term electrolyte.

ii) Water in which a small amount of acid has been added is an electrolyte while pure water is a non- electrolyte. Give a reason for this observation.

b) Molten lead(II) bromide conducts electricity whereas solid Lead(II) bromide does not. Explain briefly.

c) Name the particles by means of which electric current is conducted in

i) Carbon electrode _____

ii) Molten lead(II) bromide _____

48. (a) State what would be observed at each of the following electrodes of electricity is passed through a dilute solution of copper(II) sulphate solution using graphite electrode.

(i) Anode (1 mark)

(ii) Cathode (1 mark)

b) Write an equation for the reaction leading to the observation made at the anode. ($1^{1}_{/2}$ marks)

c) The resultant solution after electrolysis was tested with litmus paper.

i) State what was observed ($^{1}_{/2}$ mark)

ii) Give a reason for your answer in (a) above. (1 mark)

38. Chlorine is prepared in the laboratory by the action of hydrochloric acid on manganese(IV) oxide.

(a) (i) State the condition(s) for the reaction. (1 mk)

(ii) Write equation leading to the formation of chlorine. (1 mk)

(b) Using equations only state a reaction of chlorine in which it acts as

(i) a bleaching agent. (1½ mks)

(ii) an oxidising agent. (1½ mks)

49. (a) Chlorine gas is prepared by heating manganese (IV) oxide and substance T.

(i) Name substance T. ($^1/_2$ mark)

(ii) Other than heating, state any other condition for the reaction to take place. ($^1/_{2mk}$)

b) Write equation for the reaction that took place in (a) ($1^1/_2$ amrk)

c)(i) Turpentine was lowered in a gas jar of chlorine gas. State what was observed.

ii) Write equation for the reaction between turpentine and chlorine.

50. (a) Dry chlorine gas was passed over strongly heated iron fillings

(i) Write equation for the reaction which took place ($1^1/_2$ marks)

(ii) Calculate the volume of chlorine required to react with 28g of iron fillings at s.t.p. (2 marks)

b) State what was observed when sodium hydroxide solution was added drop wise until in excess to a solution of;

(i) $Fe^{3+}_{(aq)}$

-

ii) $Pb^{2+}_{(aq)}$ ($1^1/_2$ marks)

_____

_____

51. Hydrogen chloride gas was dissolved in two separate test tubes one containing methyl benzene and the other containing water. A little solid of sodium carbonate was added to each test tube mentioned above.
    (a) State what was observed in test tube containing
        (i) Methyl benzene (1 mark)

        _____

        (ii) Water (1 mark)

        _____

    (b) Explain the differences in the observation you have made in a(i) and a(ii) above. (3 marks)

_____

_____

_____

_____

_____

52. A mixture of sulphur and iron fillings is warmed separately in carbon disulphide and dilute sulphuric acid.
    (a) State what id observed
        (i) In carbon disulphide. (1 mark)

        _____

        _____

        (ii) In dilute sulphuric acid (2 marks)

        _____

        _____

    (b) If a mixture of iron fillings and sulphur is heated strongly
        (i) Identify the product formed. ($^1/_2$ mark)

        _____

        (ii) Write the possible equation for the reaction between the product identified in (b)(i) above and dilute hydrochloric acid. ($1^1/_2$ marks)

        _____

53. A mixture of iron fillings and sulphur was heated in a test tube and a red glow spread through the mixture.
    (a) (i) What did the red glow indicate (1 mark)

    _____

    ii) Write the equation for the reaction that took place ($1^1/_2$ marks)

    _____

    iii) State any other observation made as the reaction took place.

    _____

    (b) The residue from the reaction above was cooled and treated with dilute hydrochloric acid.
        (i) State what was observed.

        _____

        (ii) Write the equation for the reaction that occurred. (1 mark)

        _____

54. (a) Sulphur dioxide can be prepared by burning iron pyrites, FeS_2, in air according to the following equation.

$$4FeS_{2\,(s)} + 11O_{2(g)} \rightarrow 2Fe_2O_{3\,(s)} + 8\,SO_{2(g)}$$

    (i) Calculate the volume of sulphur dioxide evolved at room temperature when 9.60g of iron pyrite is reacted with excess oxygen.
    (Fe = 56, S=32, 1 mole of a gas occupies $24dm^3$ at room temperature)

_____

_____

_____

_____

_____

b) During the manufacture of sulphuric acid by the contact process sulphur dioxide is heated with oxygen in presence of a catalyst.

(i) Name the catalyst

_____

(ii) Write equation for the reaction between sulphur dioxide and oxygen.

_____

55. Name one reagent which could be used to distinguish between members of each of the following pairs of ions and in each case state what would be observed if the reagents you have named are treated separately with each of the members of the pairs of ions.

(a) I^- and Cl^-

(i) Reagent

_____

(ii) Observations

_____

_____

(b) CO_3^{2-} and HCO_3^-

(i) Reagent

_____

(ii) Observations

_____

_____

(c) Zn^{2+} and Pb^{2+}

(i) Reagent

_____

(ii) Observations

_____

_____

56. Dilute ammonia solution was added drop wise until in excess to a solution containing a mixture of lead(II) nitrate and zinc nitrate and filtered.

(a) Identify the cation in the

(i) Filtrate _____

(ii) Residue _____

(b) Write an equation for the reaction that led to the formation of the residue.

_____

(c) Write the formula of the cation that was in the filtrate.

_____

(d) The residue was dissolved in dilute nitric acid. Write an equation for the reaction that took place.

_____

57. (a)Briefly describe a simple chemical test or physical test that can be used to distinguish between the ions of each of the following pairs.

(i) $K^+_{(aq)}$ and $Na^+_{(aq)}$

_____

_____

_____

(ii) $NH_4^+{}_{(aq)}$ and $Mg^{2+}{}_{(aq)}$

_____

_____

_____

b) Ammonium hydroxide solution was added drop wise to an aqueous solution of aluminium nitrate solution until in excess.
(i) State what was observed.

_____

ii) Write the equation for the reaction that took place.

_____

c) If dilute sodium hydroxide solution was added drop wise until in excess to the product in (a) above.
i) State the likely observation.

_____

ii) Give a brief explanation for your observation in (c)(i) above.

_____

_____

_____

58. Name the reagent that can be used to distinguish between each of the following pairs of ions and in each case state what would be observed if each ion is treated with the reagent.
(a) Magnesium ion and calcium ions

_____

_____

_____

(b) Carbonate ions and hydrogen carbonate ions

_____

_____

_____

59. (a) When 4.0g of ammonium nitrate NH_4NO_3, was dissolved in $96cm^3$ of water, the temperature of water changed from 27^0c to 24.1^0c.
(i) Give a reason why there was a drop in the temperature of the water.

_____

(ii) Calculate the enthalpy of solution of ammonium nitrate, given that (H=1, N=14,O=16, density of water is $1gcm^{-3}$, and heat capacity of ammonium nitrate is 4.2 $j/g/^0C$.

_____

_____

_____

_____

_____

60. (a) 2.0g of ammonium nitrate was dissolved in $100cm^3$ of water, and the temperature of the water dropped from 25.0^0c to 21.0^0c.
(i) Give a reason for why there was a drop in the temperature of the water.

_____

(ii) Calculate the molar enthalpy of solution of ammonium nitrate. (H=1, N=14, O=16, density of water is $1gcm^{-3}$, and the heat capacity of water is $4.2j/g/^0c$)

_____

_____

_____

_____

_____

_____

SECTION B

1. a) Whatdo you understand by the term normal salt?

b) A student had dilute sulphuric acid as one of the materials to prepare a dry sample of calcium sulphate. Describe the steps that must have been taken to achieve the objective.

c) Water samples containing calcium sulphate were treated as follows before being used in washing clothes.

(i) Mixed with washing soda

(ii) Boiled

Explain what would be observed during the washing processes using the two water samples.

d) Describe how you would test for sulphate ions in water

2. (a) Describe how a pure sample of lead(II) nitrate crystals can be obtained in the laboratory starting from lead(II) oxide. Your answer should include the equation for the reaction that takes place. (*No diagram(s) is/are required*) (4 marks)

b) Lead(II) nitrate crystals were strongly heated in a hard glass tube.

(i) State what was observed. (1 mark)

(ii) Write equation for the reaction that took place. ($1^1/_2$marks)

c) The residue in (b) was warmed with dilute nitric acid

(i) State what was observed. (1 mark)

(ii) Write equation for the reaction that took place. ($1^1/_2$ marks)

(a) To the resultan mix ure in (c) was added dilute ammonia solution dropwise until in excess.

(i) State what was observed. (1 mark)

(ii) Write equation for the reaction that took place. ($1^1/_2$ marks)

(b) Dilute sodium hydroxide solution was added drop wise until in excess to the product in (d).

(i) State what was observed. (1 mark)

(ii) Explain your answer in (e)(i) above. (No equatio(s) is/are required) .(2 marks)

3. a) (i) Define the term "solubility of a solute" (2 marks)

ii) State how temperature and quatity of a solvent can affect the solubility of a solute. (2 marks)

b) The solubility of a salt X at varoius temperatures are shown in the table below.

Temperature (^{0}c)	0	20	40	60	80	100
Solubility(g/100g of water)	4.0	5.0	12.0	21.5	39.5	60.0

Plot a graph of solubility of x (vertical axis) against temperature. (5 marks)

c) Use the graph in (b) to determine

i) the solubility of x at 15^0c and 75^0c. (2 marks)

(ii) the mass of x which wolud crystallize if 39.5g of a substance of a saturated solution at 80^0c was cooled to 15^0c.

(a) State

(i) How you would distinguish between hard water and soft water.

(ii) One use of hard water

(b) Name one compound which when dissolved in water will cause.

(i) Permanent hardness of water.

(ii) Temperary hardness of water.

4. (a) Draw a labelled diagram to show the structure of an atom.

b)(i) State how the total number of electrons in atom compres with that of protons.

ii) Expain how positively and negatively charged ions are formed.

(c) The full symbol of two atoms of an element are $^{15}_{8}$A and $^{18}_{8}$B.

(i) State the group in the periodic table to which the elements belong.

(ii) Determine the number of neutrons in the atoms A and B respectively.

(iii) State what the term used to describe relationship between A and B.

(d) The atomic numbers of elements D, E and F are 17, 6 and 11 respectively. Write the electronic configuration of D, E and F.

(e) D can react with both E and F to form compounds. Using the outermost energy level electrons only, draw a diagram to show the formula of the compound that can be formed when D reacts with E and suggest a suitable solvent for the compound that is formed when D reacts with E and F respectively and give a reason for your choice of the solven in each case.

5. The atomic number of sodium and hydrogen was given as 11 and 1 respectively;

(a) (i) Write down the electronic configuration of sodium and hydrogen. *(01 mark)*

(ii) Using the outer most energy level electrons only, describe how sodium bonds with hydrogen. *(3½ marks)*

(b) Sodium metal can be extracted using electrolysis of molten sodium chloride onto which calcium chloride is added.

(i) State the purpose of adding calcium chloride. *(01 mark)*

(ii) Name the electrodes that are used. *(01 mark)*

(iii) Write an equation of the reaction at the electrode where sodium is produced. *(1½ marks)*

(c) Using equations, describe briefly how sodium reacts with;

(i) Chlorine *(02 marks)*

(ii) Oxygen *(03 marks)*

(iii) Water

6. a) (i) Name the raw material from which sulphuric acid can be manufactured by the contact process.

ii) with the help of equations, outline the reactions which take place during the contact process.

b) Explain why fuming sulphuric acid has no effect on litmus paper whereas dilute sulphuric acid readily turns blus litmus paper red.

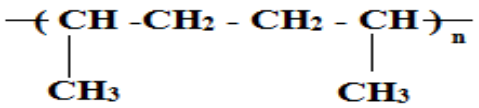
c) State what would be observed and and write equation for the reaction that would take place when concentrated sulphuric acid was added to;

(i) iron (II) sulphate -7- water

(ii) Potassium chloride.

7. (a) Define the term polymer.

b) Distinguish between a plastic and a fiber.



(c) The structure below shows a polymer

(i) Write the structural and name of the monomer from which the polymer was obtained.

(ii) Give two uses of the polymer above

d) Cotton is an important natural polymer; name two other natural polymers

(ii) State one advantage and one disadvantage of natural polymers over synthetic polymers.

8. Starch and polythene are generally categorized as polymers.

(a) What is a polymer? *(02 marks)*

(b) State the major difference between starch and polythene. *(½ mark)*

(c) Name the monomer(s) of;

(i) Starch *(½ mark)*
(ii) Polythene *(½ mark)*

(d) Give one other polymer in the category of;
(i) Starch *(½ mark)*
(ii) Polythene *(½ mark)*

(e) Briefly describe how the monomer of;
(i) Starch can be converted to an alcohol. *(3½ marks)*
(ii) Polythene can be prepared from an alcohol. *(04 marks)*
(No diagram is required in both cases)

(f) The monomer of polythene was reacted with bromine water.
(i) State what was observed. *(01 mark)*
(ii) Write equation of the reaction that took place. *(01 mark)*

9. (a) Ethene can undergo polymerization.
(i) What is meant by " polymerization" of ethene.
(ii) Name the product of polymerization of ethene and write an equation for the reaction leading to the formation of the product that you have named.
(iii) State one use of the product you have named in (a) (ii).

b) On polymerization of ethene formed a compound Y molecular mass 16,660.

i) Determine the number of moles of ethene molecules that combine to form Y. (C=12, H= 1)

ii) State the term which is used to describe a single unit of ethene molecule in Y.

c) Draw a digram of the set up used in the laboratory to prepare, ethene by dehydration of ethanol using a named acid.

d) A stream of ethene gas was bubbled through potassium manganate (VII) solution for some time.

i) State what was observed.

ii) Name one non organic gas that shows the same property as ethene in (d)(i) above.

10. Sewage consists of sludge and effluent.
(c) (i) Distinguish between sludge and effluent.
ii) State one use of sludge.
(iii) Explain how sewage can cause water pollution ($2^{1}/_{2}$ marks)
(d) Sedimentation, aeration and chlorination are some of the methods of sewage treatment. Describe what each of the methods involves and indicate how it results into treated water. (6 marks)
(e) During sedimentation a mixture of some gases is produced, which is recycled into the sewage works.
(i) Name one major component of the mixture. ($^{1}/_{2}$ mark)
(ii) Explain with the aid of equation(s) why the gas mixture is recycled into the sewage works. (3 marks)

11. Under suitable conditions, oils and fats can be used to make soap.
(a) (i) Define the term soap and write the chemical formula of soap.
ii) State the term which mean formation of soap.
iii) State one difference between oil and fat.
(b) Name one;
(i) Locally available in eac case which is a source of oil and fat.
(ii) Substance which when reacted with oil or fat can produce soap.
(c) Briefly describe how;

(i) Soap solution can be prepared in the laboratory using oil or fat from the source you have named in b(i) and substance named in b(ii).

(ii) A sample of solid soap can be obtaine from the solution you have prepared.

(d) Soap solution was shaken with a sample of water in which contain calcium hydrogen carbonate has been dissolved. State what would be observed, and write an equation for the reaction that took place.

(e) State two advantages and one disadvantage of using a synthetic detergents.

12. (a) (i) What do you understand by water pollution?
ii) State two causes of water pollution.
b) Drinking water is treated before it is used. However, calcium and nitrate ions are not removed by the treatment.
(i) Describe briefly how water from a river flowing through a forest area can be treated for drinking.
(ii) How would you test for nitrate ions in water.
iii) How is water rich in calcium ions important for a poultry farm.

13. (a) (i) Give the difference between exothermic and endothermic reactions.
ii) Give one example of exothermic and endothermic reactions.
b) Explain each of the following observations
(i) Some experiments are carried out in vaccun flasks
(ii) Some reactions need to be heated before they start
iii) A catalyst speeds up a reaction.
c) (i) Describe how you would determine the standard heat of neutralization of hydrochloric acid.
(ii) $50cm^3$ of 1M sodium hydroxide solution required $25cm^3$ of 1M sulphuric acid and the temperature changed from 30^0c t0 32.5^0c. (Given that S.H.C of solution is $4.18jcm^{-1}c^{0-1}$). Calculate the standard heat of neutralization.
d) Describe how you would test for chloride ions in solution.

14. (a) What is meant by heat of combustion?
b) Describe an experiment you can use to determine the heat of combustion of ethanol of ethanol C_2H_5OH. State any assumptions made during the experiment. ($8^1/_2$ marks)
(c) The molar heat of combustion of ethanol is $296jmol^{-1}$. Calculate the mass of ethanol that would be required to raise the temperature of $250cm^3$ from 25^0c to 65^0c.

15. (a) What do you understand by the term **Enthalpy of combustion?**
b) Briefly describe a simple experiment to determine the enthalpy of combustion of ethanol in the laboratory.(include a well labeled diagram) (9 marks)
c) 0.54grams of ethanol was burnt in a calorimeter and the heat energy released caused the temperature of $215cm^3$ of water to rise by 24.5^0c.
(Molar mass of ethanol = 46, Density of water = 1 gcm^3, S.H.C of water = $4.2j^{-1}k^{-1}$)
Using the values above determine the enthalpy of conbustion of ethanol.

16. (a) Define the term rate of reaction. *(01 mark)*

(b) State and explain how the rate of reaction between zinc granules and 1M dilute sulphuric acid would be altered if;

(i) Zinc powder was used instead of zinc granules. *(1½ marks)*

(ii) 2M sulphuric acid was used. *(02 marks)*

(c) The data below shows the time ,t, taken for the reaction of a certain substance, **Q,** to go to completion when solutions containing various concentrations of **Q** were used.

(i) Copy and complete the table by computing the values of $^1/_t$ (sec^{-1}). *(2½ marks)*

(ii) Plot a graph of $^{1}/_{t}$ (sec^{-1}) against concentration of **Q** ($moldm^{-3}$) on the graph paper provided. *(05 marks)*

(d) Use your graph to;

(i) Determine the time taken for the reaction to reach completion at a concentration of 0.5 $moldm^{-3}$. *(1½ marks)*

(ii) Deduce how the rate of reaction varies with concentration of **Q.** *(1½ marks)*

17. (a) Draw a labelled diagram for the set up of apparatus that can be used to electrolyse lead(II) bromide. (3 marks)

b) Describe the reactions that take place during the electrolysis of copper(II) sulphate solution using.

(i) Graphite electrodes ($6^{1}/_{2}$ marks)

(ii) Copper electrodes ($4^{1}/_{2}$ marks)

c) State one industrial application of electrolysis other than purification of copper. (1 mark)

18. (a) Distinguish between the terms anode and cathode.

b) Explain why copper(II) chloride in solid form does not conduct electricity where as in molten form it does.

(c) A dilute solution of copper(II) chloride was electrolysed using graphite as electrodes.

(i) State what was observed at the cathode.

(ii) Write equation for the reactions at the anode and cathode respectively.

d) Describe how the product at the anode can be identified.

(e) The electrolysis of dilute copper(II) chloride was repeated for some time using copper instead of graphite as electrodes.

(i) State what was observed at Anode and cathode respectively.

(ii) Write equation to support your observation at the anode.

(a) State one factor other than chnages of electrodes from graphite to copper that would affect the products of electrolysis of copper(II) chloride solution and indicate how it would affect the process.

19. (a) What is meant by each of the following terms;

(i) Ore

(ii) Alloy

b) (i) Name and write formulae of two ores of copper.

ii) Describe how pure copper can be obtained from one of the ores you have described in (i) above.

(iii) State two environmental effects of copper mining industry an area. *(02 marks)*

20. Explain the following observations.

(a) When zinc powder is added to a solution of copper(II) sulpate, the colour of the solution turns from blue to colourless and the temperature of the solution rises.

(b) Moist blue litmus dropped in a gas jar full of dry chlorine turns red and finally into white. $6^{1}/_{2}$ marks)

(c) Burning magnesium lowered into a gas jar full of dry carbon dioxide burns with a bright white flame and a mixture of black solid and white ash formed. (4marks)

21. Explain the following observations. (where necessary illustrate your answer with equations).

(a) When heated, a mixture of ethanol and concentrated sulphuric acid produces a gas that decolourises bromine water. (4 marks)

(b) Sodium chloride in the solid state does not conduct electricity but it will when molten and it is decomposed by electric current. (6 marks)
(c) When aqueous ammonia is added to a solution containing zinc ions, a white precipitate is formed followed by sa colourless solution. (5 marks)

22. a) Briefly explain how nitric acid can be prepared in the laboratory. (No diagram needed)
b) Concentrated nitric acid was added onto copper turnings in a boiling tube.
i) State what was observed.
ii) Write equation for the reaction that occurred in the boiling tube.
c) Write equations to show effect of heat on
(i) Potassium nitrate
(ii) Ammonium nitrate.

(d) Zinc(II) nitrate undergoes thermal decomposition according to the equation below.

$$2Zn(NO_3)_{2(s)} \rightarrow 2ZnO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

Determine the mass of zinc(II) nitrate that is heated to produce $1.4dm^3$ of the nitrogen dioxide gas at s.t.p? (Formula mass of $Zn(NO_3)_2 = 189$)

23. (a) (i) Explain briefly how a dry sample of oxygen can be prepared in the laboratory using hydrogen peroxide. (Diagram not required) (5 marks)
ii) State how oxygen produced in (i) can be identified. (1 mark)
b) Write equation for the reaction between excess oxygen and

(i) Burning sodium ($1^1/_2$ marks)
(ii) Red hot charcoal ($1^1/_2$ marks)

c) During large scale production of oxgen from air, both carbon dioxide and water are first removed before air is liquefied.

(i) Breifly explain why both water vapour and carbon dioxide are first removed.(1 mark)

(ii) Name one substance that can be used to remove water and carbon dioxide (1 mark)

(iii) Write equation to show how the named substance in c(ii) removes carbon dioxide.
(iv) Briefly describe how oxygen can be obtained from liquid air. (Diagram is/ are not required) (2 marks)
d) State one large scale use of oxygen. ($^1/_2$ mark)

24. (a) Describe how a dry sample of hydrogen chloride gas can be prepared from a named chloride.
b) Name the sustance that is formed when hydrogen chloride gas is passed through water.
c)(i) Name a reagent that can be used to test for chloride ions in solution.
ii) State what is observed and write an ionic equation for the reaction that would take place when the named reagent is treated with a chloride ion in solution.
d) $25.0cm^3$ of a 0.2M hydrochloric acid required $20.0cm^3$ of sodium hydroxide solution for complete neutralization. Calculate the molarity of sodium hydroxide solution.

25. Chlorine is prepared from Potassium manganate(VII) and substance X.
(a) Name substance X.
(b) State the conditions for the reaction
(c) Draw a labelled diagram of apparatus used to prepare and collect pure and dry sample of chlorine.
(d) Write equations to show how chlorine reacts with each of the following

(i) Water.
(ii) Iron

(e) (i) State what would be observed if chlorine is bubbled through potassium iodide solution for a long time.
ii) Explain your answer in e(i) above.

26. (a) (i) Draw a labeled diagram of the set up of apparatus that can be used to prepare a dry sample of ammonia in the laboratory. ($3^{1}/_{2}$ marks)
ii) Write equation for the formation of ammonia.
b) Write equation for the reaction between ammonia and
(i) Hydrogen chloride
(ii) Lead (II) oxide
iii) Aqueous solution of lead(II) nitrate.
c) State what woud be observed if ammonia solution was added to a solution of copper(II) chloride drop wise until in excess.
ii) Name one reagent that can be used distinguish between aluminium ion and lead (II) ions.
iii) State what would be observed and write equation for the reaction that takes place if any, when the reagent you named in (d) (ii) is treated separately with Aluminium ions and Lead(II) ions.(a) sulphur dioxide can be prepared in the laboratory using dilute hydrochloric acid and substance T.

(i) Identify T and write an equation for the reaction leading to the formation of sulphur dioxide. (2 marks)

(ii) With the aid of a labelled diagram describe the laboratory preparation of dry sample of sulphur dioxide. (06 marks)

b) When bubbled through barium sulphite solution, Sulphur dioxide reacted to form white precipitate of Barium sulphate according to the following equation.

$$BaSO_{3(aq)} + SO_{2(g)} \rightarrow BaSO_{4(s)}$$

(i) Calculate the mass of dry barium sulphate that would be obtained if $600cm^3$ of sulphur dioxide measured at room temperature was bubbled through barium sulphite. (Ba = 137, S =32, O=16, 1 mole of gas occupies $24.0dm^3$ at room temperature. (2 marks)

(ii) Dilute hydrochloric acid was added to the white precipitate. State what was observed and write an ionic equation for the reaction. (2 marks)

c) Burning magnesium was lowered into a gas jar of sulphur dioxide. State what was observed and write an equation for the reaction that took place. (2 marks).

27. Sulphuric acid is usually manufactured on a large scale by the contact process;
(a) Name the raw materials used in the contact process and state the necessary conditions.
(b) Using a flow diagram describe how sulphuric acid is obtained from the raw materials you have named in (i) above an write all equations.
(c) (i) State conditions under which hydrogen can be obtained from sulphuric acid and zinc.
ii) 13g of zinc metal was dropped in excess sulphuric acid. Calculate the volume hydrogen gas produced at room temperature. (1 mole of a gas at s.t.p occupies $22400cm^3$)

28. Copper (II) sulphate and vanadium (V) oxide are very useful catalysts.
(b) Which of the two catalysts is an industrial catalyst? *(½ mark)*
(c) Name the reactants that are catalyzed by;
(i) Copper (II) sulphate *(01 mark)*
(ii) Vana dium (V) oxide *(01 mark)*
(d) Write equation of the reaction for each of the reactants you have named in (b). *(03 marks)*

(e) One of the reactants you have named for the industrial catalyst, readily reacts with water.

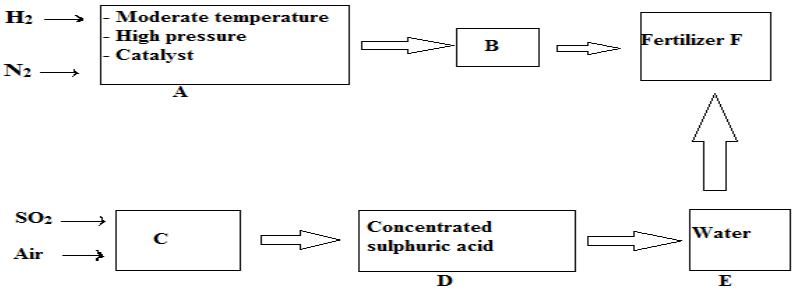
(i) Name the reactant that reacts with water

(ii) Write equation of the reaction of the reactant with water. *(1½ marks)*

(iii) Describe how a dry sample of the reactant you have named in (d) (i) can be prepared in the laboratory. *(6½ marks)*

(f) Give two uses of the gas obtained when copper (II) sulphate is used as a catalyst. *(01 mark)*

29.



The flow chart shows events leading to the manufacture of a fertilizer. The steps are represented by letters A, B, C, D, E and F.

(a) (i) Name the catalyst used in step A and state the status of the catalyst.

ii) Write an equation leading to the formation of product B?

(b) (i) State the 3 conditions for the reaction in step C.

ii) Identify the product at step C.

iii) Write equation of reaction leading to the formation of a product at step C?

iv) Write equation of the reaction leading to the formation of a product at step D.

v) Name the product at step D.

(c) (i) Write equation of reaction leading to formation of a product at step E.

ii) What is the role of water in step E?

iii) Name the product formed at step E.

(d) (i) Write equation leading to formation of a fertilizer at step F.

ii) Calculate the percentage of nitrogen content in fertilizer F and ammonium phosphate. (H=1, N= 14, O= 16, P= 31, S= 32)