**GRAND O'LEVEL CHEMISTRY SEMINAR 2023**

**LEAD KINDLY LIGHT**

1. (a)Draw a diagram for the set-up of apparatus that can be used to prepare a dry sample of hydrogen in the laboratory

   (b) Write the equation leading to the formation of hydrogen in the apparatus you have drawn

   (c) Explain why hydrogen is not usually prepared by reacting

   (i) Calcium and dilute sulphuric acid (ii) Lead and dilute sulphuric acid

   (d) Draw a set-up of apparatus that can be used to show the hydrogen can reduce copper (II) oxide.

   (e) State what is observed and write equation for the reaction that takes place during the reduction of copper (II) oxide and hydrogen

   (f) Hydrogen is a light gas, which is less dense than air. State the application of hydrogen as a result of this property.

2. The atomic numbers and the positions of the elements A, B, C, D, E, F, G, H and I in the periodic table are shown below. The letters are not normal symbols of the elements.

| I | II | | | | | | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| $A^3$ | | | | | | | | $E^6$ | | | $G^9$ | $H^{10}$ |
| | | | | | | | | | | | U | |
| | | | | $C^{29}$ | | | $D^{13}$ | | | $F^{34}$ | W | $I^{36}$ |
| $B^{37}$ | | | | | | | | | | | | |

   (a) Which one of the elements is a noble (an inert) gas?

   (b) What name is given to the elements in the group to which G belongs

   (c) Which element is likely to:

   (i) React more violently with chlorine?

   (ii) Form colored compound?

   (d) Write the formula of the:

   (i) Oxide of element **D**.

   (ii) Compound formed between element **F** and hydrogen.

   (e) State the type of bond that would exist in the chloride of element E.

   (f) Write the electronic configuration of element B and ion of **D**

3. (a) (i) Name the three fundamental particles in an atom.

   (ii) With the aid of a labelled diagram, describe how the three particles are located in an atom.

   (b) The full symbol of the atom of an element is $^{32}_{16}Q$ . State what the numbers 16 and 32 stand for.

   (c) If the full symbol of another atom is $^{34}_{16}R$ , state the

   (i) Similarity and the difference between the atoms **Q** and **R**.

   (ii) Name given to the atoms **Q** and **R**.

(d) The atomic numbers of elements **W, X** and **Y** are 6, 12 and 17 respectively.

(i) Write the electronic configurations of **W, X** and **Y**.

(ii) Using the outermost shell electrons only, draw a diagram to show how W and Y form a compound

(iii) State the type of bond formed between **X** and **Y**; **W** and **Y**.

(iv) Identify the element that exists as a diatomic molecule.

4. The number of protons, electrons and neutrons in some particles (ions and atoms) **A, B, E, G, H** and **F** are shown in the table below

| | Particles | | | | | |
|---|---|---|---|---|---|---|
| | A | B | E | G | H | F |
| Protons | 6 | 8 | 13 | 11 | 8 | 17 |
| Electrons | 6 | 8 | 10 | 11 | 8 | 18 |
| Neutrons | 6 | 8 | 14 | 12 | 10 | 18 |

(i) Identify which one of the particles is

(i) An anion (ii) A cation

(ii) State two particles, which are atoms of the same element

(iii) State the type of bond formed when particle **A** combines with particle **H**

(d) Write the formula of the ion formed from particle **G**.

5.(a) Describe how the following salts can be prepared in the laboratory

(i) Lead(II) sulphate from lead(II) oxide

(ii) Zinc sulphate crystals from zinc granules

(iii) Copper (II) sulphate-5-sulphate from copper (II) carbonate

(iv) Anhydrous iron(II) chloride

(v) Anhydrous iron (III) chloride

(b) State and explain what is observed when aqueous solutions of the following salts is tested with litmus paper

(i) potassium carbonate (ii) sodium chloride (iii) Ammonium sulphate

(c) Explain the following observations:

(i) 2M nitric acid reacts with magnesium more vigorously than a 2M ethanoic acid does.

(ii) A brown precipitate is observed when a magnesium ribbon is added to a copper (II) sulphate solution.

(iii) An aqueous solution of hydrogen chloride reacts with sodium carbonate whereas a solution of hydrogen chloride in methylbenzene does not.

6. (a)State what would be observed if dilute ammonia was added drop-wise until in excess to the aqueous solution of;

(i) Zinc sulphate (ii) Aluminium nitrate (iii) Magnesium sulphate
(iv) İron (II) chloride (v) Copper(II) sulphate (vi) İron(III)sulphate
(vi) lead (II) nitrate

(b)Write an ionic equation for the reactions in (a)

(c) For each of the above salts in aqueous solution state what would be observed and write ionic equations if dilute sodium hydroxide solution was added dropwise until in excess.

(d) Name a reagent(s) used to confirm for the presence of each of the following ions. In each case state what was observed and write an ionic equation where possible.

(i) Chloride ion (ii) carbonate ion (iii) hydrogen carbonate ion

(iv) Sulphate ion (v) Nitrate ion (vi) lead (II) ion (vii) ammonium ion

7. (a)(i) Give the difference between allotropy and allotrope.

(ii) Name one element that shows allotropy apart from carbon and state its allotropes

(b) (i) Mention the crystalline allotropes of carbon

(ii) State two properties of each of the allotropes of carbon

(iii) Explain two uses of each allotrope based on its properties you have named

(c) Name the element present in pure charcoal

(i) Explain why it is dangerous to use a charcoal stove in a poorly ventilated room

(ii) Write equation for the reaction between charcoal and heated iron (III) oxide

(d) (i) Draw and name the structure adapted by diamond and graphite

(ii) State the physical properties of diamond

(iii) What use is made of diamond due to the properties you have named?

(e)Give a reason why

(i) Graphite conducts electricity whereas diamond does not

(ii) Diamond is used as a cutting tool whereas graphite is used to mark paper

(f) (i) Describe the proof for allotropy

(ii) State conditions and write equations for the reaction between carbon and oxygen

(iii) Graphite was heated in excess air and the gas given off passed through aqueous sodium hydroxide for a long time. State what was observed and write equations for the reaction

8.(a) Beer or crude ethanol is manufactured by a process called fermentation

(i) Explain what is meant by the term fermentation

(ii) Write equation for the reaction that takes place during fermentation

(iii) Is the process of fermentation endothermic or exothermic? Give a reason for your answer

(b) Describe briefly how in the homes, alcoholic drinks can be prepared from either ripe bananas or millet flour

(c) Draw a diagram of apparatus that can be used to concentrate the alcohol produced in the laboratory.

(d) Write equation to show how ethanol can be converted to Ethene and indicate the conditions for the reaction.

9. (a) Chlorine can be prepared in the laboratory using potassium manganate (VII).

(i) Name one substance that reacts with potassium manganate (VII) to produce chlorine and briefly describe without a diagram how a dry sample of the gas is prepared.

(ii) State the conditions for the reaction

(iii) Write the equation for the reaction

(b) Damp litmus paper was dropped in a gas jar containing chlorine. State what was observed and explain your observation.

(c) A boiling tube filled with chlorine water was inverted into a beaker containing chlorine water and the mixture exposed to sunlight for some time

(i) State what was observed

(ii) Explain with the aid of equation(s) your observation(s) in c(i)

(d) Write an equation to show how chlorine can react with

(i) Dilute potassium hydroxide solution

(ii) Turpentine $C_{10}H_{16}$.

(iii) Hydrogen sulphide

(iv) Concentrated sodium hydroxide solution.

(v) Iron (II) chloride solution.

(e) Briefly describe a test you would carry out to confirm the presence of a chloride ion in solution. State what would be observed and write an ionic equation for the reaction that would take place.

10. (a) Carbon dioxide was passed through a saturated solution of calcium hydroxide until there was no further change

(i) State what was observed

(ii) Write equations for the reactions that took place

(b) Soap solution was added to the resultant mixture in (a).

(i) State what was observed

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

(c) Gas **P** was passed over heated lead (II) oxide. The gaseous product turned lime water milky

(i) Identify **P**

(ii) State what was observed and write equation of reaction when **P** was passed over heated lead (II) oxide

(iii) Write equation for the reaction between **P** and lead (II) oxide

(iv) Explain what would be observed if the gaseous product continued to pass through lime water for a long. Illustrate your answer using an equation(s)

(c) State one commercial use of carbon dioxide

(d) Charcoal was burnt in a charcoal stove as shown in the figure 1 below

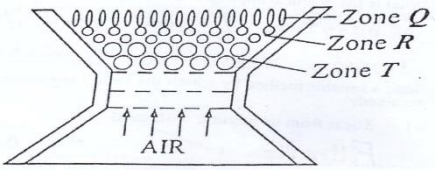



Fig. 1

Name the substance that was produced at zone **Q, R, T.**

11. (a) State the difference between the following pairs of terms

(i) Synthetic polymer and natural polymer

(ii) Thermosetting polymer and thermo softening polymer

(b) (i) State the conditions under which sulphuric acid can react with ethanol to produce ethene

(ii) Write equation for the reaction leading to the formation of ethene

(c) When reacted together, ethene molecules can form a polymer

(i) Name the polymer

(ii) Write equation leading to the formation of the polymer

(iii) State one use of the polymer

(d) Name one

(i) Synthetic polymer other than the one you named in (c) (i)

(ii) Natural polymer other than rubber

(e) State one

(i) Use of each polymer you have named in (d) (i)

(ii) Disadvantage of the polymer formed in (c) (ii)

12. (a) (i) With aid of a labelled diagram, explain how a pure sample of sulphur dioxide can be prepared in the laboratory using sodium sulphite and sulphuric acid

(i) Write equation for the reaction

(b) Name one reagent that can 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 an equation to show how sulphur dioxide reacts with

(i) Water (ii) Hydrogen sulphide

(iii) Oxygen in the presence of hot platinum

(d) The product of the reaction in c(i) was reacted with water

(i) Write equation for the reaction that took place

(ii) To the resultant mixture above, was added barium chloride solution, state what was observed, write equation for the reaction and explain your observation

13. (a) Sulphur (iv) oxide can react with excess oxygen in the presence of a catalyst which is finely divided to form sulphurtrioxide in the contact process

(i)Name the source of sulphur (iv) oxide

(ii)Name the catalyst used in the contact process

(iii) Explain why the catalysis finely divided

(iv) Write an equation for the reaction leading to the formation of sulphurtrioxide

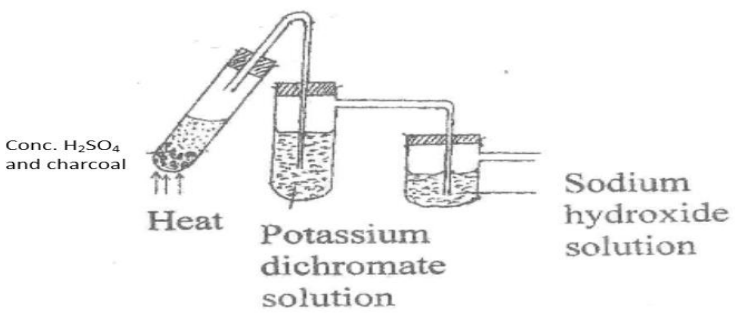
(v) State two other factors which can affect the yield of sulphurtrioxide in the contact process

(b) Describe how sulphurtrioxide formed in (a) can be converted to sulphuric acid

(c) Write equation for the reaction to show that sulphur (iv) oxide act as

(i) Oxidizing agent (ii) Reducing agent

(d) Concentrated sulphuric acid was heated with charcoal in the apparatus shown in the figure below




(i) Name the gas(es)produced during a reaction between concentrated sulphuric acid charcoal

(ii) State what would be observed in the tube containing acidified potassium dichromate solution.

(e) Sulphur dioxide (iv) was passed into a beaker containing a red flower and water

(i) State what was observed
(ii) Give a reason for your answer in (c)(i)

14. (a) Nitrogen can react with hydrogen in the presence of a catalyst which is finely divided to form ammonia in the Haber process
    (i) State the source of nitrogen
    (ii) Name the catalyst used in the reaction
    (iii) Explain why the catalyst is impregnated with aluminium oxide.
    (iv) Write equation for the reaction leading to the formation of ammonia
    (v) State two factors that can affect the yield of ammonia in the Haber process
    (vi) Explain how the factors named in (a)(v) affect the formation of ammonia

    (b) Write equation for the reaction to show that ammonia can
    (i) Act as a reducing agent (ii) Burn in oxygen

    (c) Ammonia obtained by Haber process can be converted to nitrogen (II) oxide
    (i) Write equation for the reaction leading to the formation of nitrogen (II) oxide
    (ii) State the conditions for the reaction

    (d) Write equation to show how nitrogen (II) oxide can be converted to nitric acid.

    (e) When aqueous ammonia was added drop wise until in excess to a solution of copper (II) nitrate, a blue precipitate **P** which dissolved in excess ammonia to give a deep blue solution was formed
    (i) Identify **P**
    (ii) Write the formula and name of the cation in the blue solution

15. (a) (i) State the conditions under which sulphuric acid can react with sodium nitrate to form nitric acid
    (ii) Write equation for the reaction in (a)(i)

    (iii) Draw a diagram for the preparation of nitric in (a)(i)

    (b) Sulphur was warmed with concentrated nitric acid
    (i) State what was observed (ii) Write equation for the reaction

    (c) Barium nitrate solution was added to the resulting mixture in (b).
    (i) State what was observed (ii) Write ionic equation for the reaction

(d) Ammonium nitrate dissolves in water according to the equation

$$NH_4NO_3(aq) + H_2O(l) \leftrightharpoons NH_4OH(aq) + HNO_3(aq)$$

Explain using equations why extensive use of ammonium nitrate fertilizer can make the soil become acidic.

(e) Write equation for the reaction to show the effect of heat on the following

(i) Sodium nitrite (ii) Silver nitrate

(f) Concentrated nitric acid was added to copper metal and the mixture heated.

(i) State what was observed (ii) Write equation for the reaction

16. Although nitrogen is generally unreactive, it readily reacts with burning magnesium ribbon

(a) State why nitrogen is generally inert

(b) Burning magnesium reacts with nitrogen

(i) Give a reason for the reaction

(ii) State what was observed

(iii) Write equation for the reaction

(c) Water was added to the product in (b) and a colourless gas **T** was evolved.

(i) Name **T**

(ii) Write equation for the reaction leading to the formation of **T**

(iii) Name a laboratory reagent that can be used to dry **T**

(iv) Describe how **T** can be identified in the laboratory. Write equation to illustrate your answer.

(d) State one industrial use of nitrogen

17. (a) Describe how a dry sample of ammonia can be prepared.

(b) (i) Draw a diagram of apparatus that can be used to show that ammonia can burn in oxygen

(ii) Write equation for the reaction

(c) Dry ammonia was passed over heated copper (II) oxide

(i) State what was observed

(ii) Write equation for the reaction

(d) Dry ammonia gas was passed over heated zinc oxide

(i) State what was observed

(ii) Write equation for the reaction

(iii) Explain your observation in d (i) above

18. (a). Explain how a dry sample of hydrogen chloride can be prepared from sodium chloride (no diagram is diagram is required)

(b). State what would be observed and write equation for the reaction that would take place if hydrogen chloride was passed.

(i) Over strongly heated magnesium ribbon

(ii) Through aqueous silver nitrate

(iii) copper (II) carbonate solution

(c). Aqueous hydrogen chloride reacts sodium carbonate solution to produce carbon dioxide according to the following equation

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$

Calculate the volume of carbon dioxide that would be produced at room temperature if excess sodium carbonate solution was added to 50.0cm$^3$ of a solution containing 0.2 moldm$^{-3}$ of hydrogen chloride.
(1 mole of gas occupies 24.0 dm$^3$ at room temperature)

(d) Hydrogen chloride react with iron fillings to form solid **X**

(i) Name solid **X**
(ii) Write equation for the reaction
(iii) Draw a diagram to show how the reaction can be carried out

(e) Solid X in (d) was dissolved in water to form an aqueous solution. To the solution was added aqueous ammonia drop wise until in excess

(i) State what was observed
(ii) Write ionic equation for the reaction that took place
(iii) State what would be observed and write an equation of the reaction that takes place when lead (II) nitrate solution was added to aqueous solution of **X**.

(f) Explain why an aqueous solution of hydrogen chloride is an electrolyte whereas a solution of the gas in methylbenzene is a non - electrolyte

19. Soap solution was run into three different A , B , and C water samples before boiling and after boiling until a stable bubble (lather) were formed .The amount of soap used was noted and recorded in the table below:

| ***Type of water*** | | ***Amount of water used (cm$^3$)*** | ***Amount of soap used (cm$^3$)*** |
|---|---|---|---|
| A | Boiled | 10 | 12 |
| | Un boiled | 10 | 12 |
| B | Boiled | 10 | 3 |
| | Un boiled | 10 | 8 |
| C | Boiled | 10 | 2 |
| | Un boiled | 10 | 2 |

(a) State and explain which one of the following water samples is

(i) soft water (ii) temporary hardwater (iii) permanent hard water

(b) State a method used to remove the hardness from water sample **B**

(c) (i) Name one reagent used to confirm the anion in sample ***A***

(ii) State what would be observed and write an ionic equation if the reagent in c(i) was added to water sample ***A***

(d) Explain why when tap water is boiled for some seconds a white precipitate if formed.

(e) For each of the following reactions state what would be observed and write an equation of reaction

(i) Lime water was added to hard water

(ii) Soap solution was added to hard water

(iii) Detergent was added to hard water

20. (a) A synthetic detergent can be obtained from petroleum products.

Explain why it is not good to pour synthetic detergents into water bodies.

(b) A water sample was boiled and on cooling, was tested by shaking with a known volume of soap solution. A cloudy solution and white precipitate was formed.

(i) State the name given to the white precipitate.

(ii)Write an ionic equation for the reaction leading to the formation of the white precipitate.

(c) (i) Name one compound that can be used to stop the formation of the white precipitate.

(ii) Write an equation for the reaction that would take place when the compound named in c (i) is used.

(d) Describe how

(i) soap is prepared

(ii) soap can remove grease from fabrics when washed.

(e) State one advantage of using detergents over soap.

21. (a) Name a reagent that can be used to distinguish between following pair of ions/substances and in each case state what would be observed and write when each ions/substances is treated with the named reagent

(i) $Zn^{2+} and\ Pb^{2+}$ $(ii)$ $Fe^{2+} and\ Cu^{2+}$ $(iii) Pb^{2+} and Al^{3+}$

$(iv)$ ${NH_4}^{+} and Al^{3+}$ $(v)$ ${SO_4}^{2-} and Cl^{-}$ (vi) ${SO_3}^{2-} and {SO_4}^{2-}$

$(vi)$ $C_2H_4 and C_2H_6$ (vii) $CO_2 and\ SO_2$ (viii) $HNO_3 and H_2SO_4$

(ix) $HCO_3^-$(aq) and $CO_3^{2-}$

(b) When aqueous ammonia was added drop wise until in excess to a solution of zinc nitrate, a white precipitate **P** which dissolved in excess ammonia to give a colourless solution was formed;

(i)Identify **P**

(ii)Write equation of reaction leading to the formation of **P**

(iii)Write an equation of reaction leading to the formation of a colourless solution

(iv) Name the cation in the colourless solution

22.The positions of the elements **A, B, C, D, E** and **F** are shown in the Periodic Table below. These are not the usual symbols for the elements.

| I | II | | | | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| A | B | | | | | | | D | | |
| | | | | | C | | | | E | F |

(i) State the type of bonding in the compound formed between

(i) **B** and **D**. (ii) **E** and **C**.

(ii) (i) Which one of the elements **A** and **B** reacts vigorously with cold water?

(ii) Write equation for the reaction between water and the element you have named in (b) (i).

(iii) Write the formula of the compound formed when **B** reacts with **D**

(iii) Write the formula of the ion of **C**

(iv)Write the electronic configuration of **B**, $E^-$ and **F**

(v) Which two elements represented in the table can react as reducing agents?

23.(a)(i) Distinguish between a physical change and chemical change

(ii) Outline four differences between physical change and chemical change

(b) State what would be observed if the following substances were heated until no further change

(i) Zinc oxide (ii) Lead (II) oxide (iii) Copper (II) carbonate

(iv) sodium carbonate

(c) State whether the change in b(iii) is a physical change or chemical change and explain your answer

(d) Solid iodine was gently heated in a test tube

(i) State what was observed

(ii) Name the type of change that took place

24. (a) Describe an experiment to show diffusion in gases using ammonia gas and hydrogen chloride gas. Your answer should include a diagram of set up of apparatus used

(b) Beetroot juice was placed in a cup of cold water and allowed to stand.
(i) State what was observed
(ii) Name the process that occurred
(iii) State what the process you have named demonstrated

25.(a) Draw a labelled diagram of the heating curve for water (melting point and boiling point of water on 0°C and 100°C respectively

(b) The table below shows variation in temperature with time when a solid **X**, was heated to boiling.

| Temperature (°C) | 25 | 47 | 80 | 80 | 162 | 218 | 218 |
|---|---|---|---|---|---|---|---|
| Time (minutes) | 0 | 1.0 | 2.5 | 4.5 | 7.0 | 8.7 | 9.5 |

(i) Draw a graph of temperature against time.
(ii) Explain the shape of the graph.

(c) Explain how a sample of sulphur can be obtained from a mixture of iron and sulphur

(b) A mixture of sulphur and iron was heated.
(i) State what was observed
(ii) Write equation for the reaction that takes place

(c) State what would be observed if a mixture of iron filings and sulphur is warmed with
(i) Carbon disulphide (ii) Dilute sulphuric acid

26.Sodium thiosulphate reacts with dilute acids according to the equation

$$S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow SO_2(g) + S(s) + H_2O(l)$$

(a) State what would be observed if dilute hydrochloric acid was added to sodium thiosulphate

(b) The rate of reaction is affected by concentration of thiosulphate
(i) State one factor other than concentration that can affect the rate of reaction
(ii) Briefly explain the effect of the factor on the rate of reaction you have named
(iii) Describe an experiment that can be carried out in the laboratory to show the effect of the factor you have named on the rate on the rate of the reaction

(c) The able below shows the variation in the concentration of sodium thiosulphate with time.

| Time (s) | 200 | 100 | 40 | 20 | 10 |
|---|---|---|---|---|---|
| Concentration of thiosulphate ($moldm^{-3}$) | 0.00 | 0.09 | 0.14 | 0.20 | 0.25 |
| $\frac{1}{concentration}$ ($mol^{-1}dm^3$) | | | | | |

(i) Complete the table by determining the values of $\frac{1}{concentration}$

(ii) Plot a graph of $\frac{1}{concentration}$ against time

(iii) State any conclusion you can draw from the shape from the graph

(c) State and explain the effect of each of the following conditions on the rate of a chemical reaction

(i)Temperature (ii) Particle size (iii) Concentration

27.Haematite is one of the ores from which iron can be extracted.

(a) Write the chemical formula of Haematite

(b) During the extraction of iron, roasted Haematite is mixed with coke and limestone. The mixture is fed into the blast furnace and a blast of hot air is blown into the furnace from the bottom

(i) Write equation(s) for the reaction(s) in the blast furnace that lead to the formation of iron

(ii) Explain the role of limestone

(c) Write equation and conditions for the reaction of iron with

(i) Sulphur (iii) hydrogen chloride

(ii) Hydrochloric acid (iv) chlorine (v) Oxygen.

(d) To the resultant mixture in reaction c(ii) was added dilute ammonia solution until the alkali was in excess.

(i) State what was observed

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

28.(a) Name the raw materials which are used in the extraction of iron in the blast furnace from spathic ore

(b) Briefly describe the reactions that lead to the formation of iron during the extraction using the blast furnace (*include equations for the reactions*)

(c) State what would be observed and write equation for the reaction that would take place when the following gases are passed over heated iron

(i) Dry hydrogen chloride (ii) Steam

(d) Dilute hydrochloric acid was added to iron filings and the mixture warmed

(i) State what was observed (ii) Write equation for the reaction.

29.(a) Name the ore from which sodium can be extracted and write its formula

(b) Sodium is extracted by electrolysis.

(i) Name the cathode and anode

(ii) Give a reason for the choice of the anode

(c) During the extraction of sodium by electrolysis, calcium chloride is added to the sodium ore. State why this is done

(d) Briefly describe how sodium is obtained from the ore you named in (a) by electrolysis method (*include equations for your answer*)

(e) Name any other substance obtained along with sodium in the process. Write equation to show how it is produced in the cell.

(f) State the conditions and write equations for the reactions between sodium and

(i) Chlorine (ii) Water (iii) Oxygen

(Include observations for each reaction)

30. Calcium carbonate reacts with dilute hydrochloric acid according to the following equation.

$$CaCO_{3\,(s)} + 2HCl_{\,(aq)} \longrightarrow CaCl_{2\,(aq)} + CO_{2\,(g)} + H_2O_{\,(l)}$$

(a) State what would be observed if dilute hydrochloric acid was added to calcium carbonate.

(b) The rate of the reaction is affected by the concentration of hydrochloric acid and the temperature of reaction mixture.

(i) State one factor other than temperature and concentration that can affect the rate of reaction between calcium carbonate and hydrochloric acid.

(ii) Briefly explain the effect of the factor you have stated in (b) (i) on the rate of the reaction.

(iii) Describe an experiment that can be carried out in the laboratory to show the effect of the factor you have stated in (b) (i) on the rate of reaction. (Diagram not required)

(c) The table below shows the variation in volume of carbon dioxide evolved with time when dilute hydrochloric acid was added excess calcium carbonate.

| Volume of carbon dioxide ($cm^3$) | 0 | 10 | 35 | 46 | 56 | 72 | 79 | 79 |
|---|---|---|---|---|---|---|---|---|
| Time (s) | 0 | 10 | 20 | 30 | 40 | 60 | 80 | 90 |

(i) Plot a graph of volume of carbon dioxide evolved against time.

(ii) Using the graph, determine the time taken to collect $60cm^3$ of carbon dioxide.

(iii) Draw tangents of your graph at points when time is 20 and 60 seconds and determine the gradual of each tangent

(iv) Compare the rate of reaction at 20 seconds and 60 seconds. Explain your answer.

31. (a) (i) State what is meant by enthalpy of combustion and write equation using methanol to illustrate your answer

(ii) Draw a well labelled diagram of a set up used to determine enthalpy of combustion of methanol

(b) In an experiment to determine enthalpy of combustion of methanol, 0.87g of methanol was burnt and the heat produced used to raise the temperature of 500cm$^3$ of water by 7.0$^0$C (C=12,O=16,H=1, Density of water =1gcm$^{-3}$, specific heat capacity of water =4.2Jg$^{-1}$K$^{-1}$)

(i) Calculate the experimental value of the enthalpy of combustion of methanol

(ii) The theoretical enthalpy of combustion of methanol is 726Kjmol$^{-1}$. Comment on the value you have obtained in (b)(i)

(c) The table below shows the enthalpies of combustion of some alcohols

| Alcohol | Formula mass | Enthalpy of combustion (KJmol$^{-1}$) |
|---|---|---|
| $CH_3OH$ | | 726.0 |
| $C_2H_5OH$ | | 1371.0 |
| $C_3H_7OH$ | | 2017.0 |
| $C_4H_9OH$ | | 2673 |

(i) Complete the table (C=12, H=1,O=16)

(ii) Calculate the heat liberated per gram of each alcohol

(iii) Comment on the suitability of an alcohol as a fuel.

32.(a) A gaseous hydro carbon **X** contains by mass , 83% carbon and the rest hydrogen

(i) Calculate the empirical formula of **X**

(ii) If 2.6g of **X** occupy a volume of 1.12dm$^3$at s.t.p, find the relative molecular mass of **X** hence determine its molecular formula.

(b) When 7.2g of sodium carbonate, $Na_2CO_3.$ n $H_2O$, was strongly heated, the mass of the residue was 2.7g . Calculate;

(i) The number of moles of water of crystallisation.

(ii) Percentage of water of crystallisation

(b) A hydrocarbon **Q** contains 82.5% carbon. The vapour density of **Q** is 29

(i) Define the term hydrocarbon

(ii) Determine the empirical and molecular formula of **Q**

(iii) Write the structural formula of **Q**

33.(a) A compound , Y , contains 52.17 % carbon, 13.04 % hydrogen and 34.78 % oxygen. The molecular mass of Y is 46. Determine the:

(i) empirical formula of Y.

(ii) molecular formula of Y.

(b) When **Y** was heated with excess concentrated sulpheric acid, a colourless gas , **Z** , which turned bromine water colourless was evolved. Identify:

(i) **Y** (ii) **Z**

34.(a) Oxygen produced from 200 cm$^3$ of a 0.5 M hydrogen peroxide solution reacted completely with magnesium. Calculate the mass of magnesium that reacted.

(b) 6.2g of impure sodium carbonate was dissolved in water to make 1litre of solution .25$cm^3$ of this solution required 24$cm^3$ of 0.1M hydrochloric acid for complete neutralization.

(i) Write equation of reaction
(ii) Determine the molar concentration of the metal carbonate
(iii) The mass of pure sodium carbonate that reacted
(iv)Percentage impurity of the sample.

35.Nitrogen forms a series of oxides

(a) Write the formula of the oxides of nitrogen and the class of oxides to why each one belongs

(b) Write equations for the reactions to show how each oxide can be obtained

(c) One of the oxide of nitrogen turns brown when exposed to air

(i) Name the oxide

(ii) Explain why the named oxide turns brown. Include an equation in your answer.

(d) One of the oxides of nitrogen reacts with water

(i) Name the products of the reaction of the oxide with water
(ii) Write equation for the reaction that takes place

(e) State what is observed and write equation for the reaction when the following are heated to a constant mass

(i) Lead(II) nitrate (ii) Zinc nitrate
(ii) Aluminium nitrate (iv) Copper(II) nitrate

36.(a) A mixture of iron and sulphur was heated

(i) State what was observed
(ii) Write equation

(b) Dilute sulphuric acid was added to the produce in (a)

(i) State what is observed
(ii) Write equation for the reaction

(c) The gaseous product was bubbled through lead(II) nitrate solution

(i) State what is observed
(ii) Write equation for the reaction
(iii) State the application of the reaction (c)

37.(a) State the conditions under which sulphuric acid can react with

(i). Sucrose ($C_{12}H_{22}O_{11}$) (ii). Zinc oxide (iii) Magnesium

(b) Write equation for the reaction of sulphuric acid with

(i) Sucrose (ii). Zinc oxide (iii). Magnesium

(c) State the property of sulphuric acid which is shown by its reaction with

(i) Sucrose (ii). Zinc oxide (iii). Magnesium

38.(a) (i) What is a pure substance

(ii) Name four properties that are used to determine the purity of a substance

(b)(i) Draw a well labelled diagram of a separating funnel to show how mixture of oil and water can be separated.

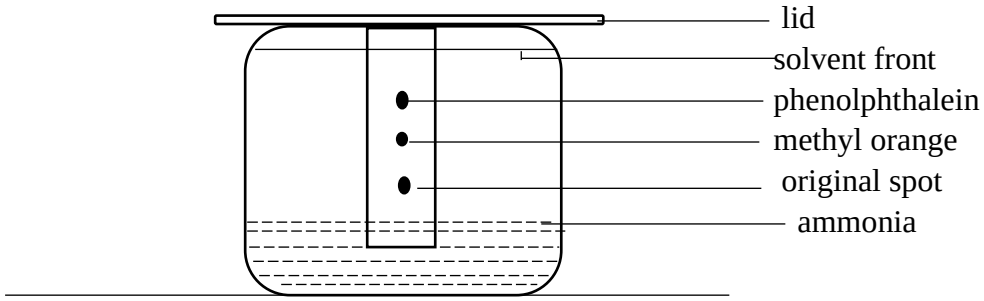
(ii) State why a separating funnel is the best method for separating oil and water

(iii) Draw a set of apparatus used to separate ethanol and water

(c) Distinguish between;

(i) Solute and solvent (ii) Miscible and immiscible liquids

(d) A mixture of phenolphthalein and methyl orange was separated as shown in the diagram below.




(i) Name the method of separation

(ii) State the colour of methyl orange in this experiment

(iii)Phenolphthalein is usually colorless. Explain why it is purple in this experiment

(iv) Which one of the indicators is more soluble in ammonia?

(v) Give any other two mixtures that can be separated using this method

39. (a)(i) Define the term alloy.

(ii) Give a reason why an alloy is not a compound.

(b) Complete the following table on the composition of alloys.

| ***Alloy*** | ***Composition*** | ***Use*** |
|---|---|---|
| Duralumin | | |
| Brass | | |
| Solder | | |
| Steel | | |

| | | |
|---|---|---|
| Stainless steel | | |
| Bronze | | |

(c) Give a reason why alloys are more useful than pure metals.

(d)The table below shows the melting and boiling points of some pure substances at atmospheric pressure. Study it and answer the questions that follow.

| ***Substance*** | ***Melting point ($^0C$)*** | ***Boiling point ($^0C$)*** |
|---|---|---|
| A | 0 | 100 |
| B | -117 | 78 |
| C | 115 | 444 |
| D | -219 | -183 |

(i) Which substance(s) is/are solid(s) at room temperature of $25^0C$?
(ii) Which substance(s) is/are liquid(s) at room temperature of $25^0C$?
(iii) Which substance(s) is/are gas (es) at room temperature of $25^0C$?
(iv) A sample of substance B was found to boil at $85^0C$ at atmospheric pressure. What deductions do make?

40. (a) Draw a labelled diagram to show how a dry sample of oxygen can be prepared in laboratory from sodium peroxide. Write the equation for the reaction that takes place.

(b) State and explain what happens when each of the following substances are lowered in a gas jar of oxygen and water added to the products.

(i) Burning sodium (ii) Ignited magnesium (iii) Hot iron.

(c) Name one natural process by which oxygen can be obtained

(d) State one medical and one commercial use of oxygen to society.

(e) Calculate the volume of oxygen liberated when 16 g of potassium chlorate (V) is heated.
(K=39; Cl=35.5; O=16; 1 mole of gas occupies 24000 ml at s.t.p.)

(f) Hydrogen peroxide produces gas bubbles slowly when exposed to air, but when aqueous iron (III) chloride is added, the production of gas bubbles becomes more rapid.

(i) Name the gas produced when hydrogen peroxide is exposed to air.

(ii) Write equation for the reaction that takes place.

(iii) Sate the role of iron (III) chloride in the reaction

(iv) Name another substance that can affect the production of the gas in the same way as iron (III) chloride.

41. The oxides of some elements are listed below.

• Lead (II) oxide • Sulphur dioxide • Copper (II) oxide • Aluminium oxide

(a). State the oxides(s) which will react with

(i). acid only. (ii). alkalis only. (iii). both acids and alkalis.

(b) A clean sample of steel wool was placed in a test tube containing some water and the test tube was inverted in a trough of water. After three days the volume of air in the test tube changed from 20 $cm^3$ to 16 $cm^3$ and a brown layer formed on the steel wool.

(i) Write the formula of the brown solid.

(ii) Calculate the percentage decrease in the volume of air in the tube.

(c) Draw a diagram of the setup of the apparatus that can be used to show that iron does not rust in the absence of moisture.

(d) State one other conditions necessary for rusting to take place.

(e) Name two methods for preventing rusting.

(d) (i) What is galvanized iron?

(ii) State one use of galvanized iron.

42.(a) With the aid of a well diagram describe briefly how you can prepare a pure and dry sample of carbon dioxide gas

(b) Burning magnesium was lowered in a gas jar of carbon dioxide

(i) State what was observed

(ii) Write equation for the reaction

(iii) Explain your observation

(c) Water was added to the product in (b) and the resultant mixture tested with litmus. State what was observed and explain your observation

(d) When a solution of sodium hydroxide was exposed to air for a long, a white solid was formed on the surface

(i) Name the white solid

(ii) Write equations leading to the formation of the white solid

43.(a) (i) Describe how you would obtain a sample of sugar crystals from sugar cane

(ii) State two uses of sugar in the world of the sick

(b) Concentrated sulphuric acid was added to sugar ($C_{12}H_{22}O_{11}$)

(i) State what was observed

(ii) What name is given to this process

(iii) Write equation for the reaction

(iv)Why is ethanol important to the society

44.(a) (i) State one word which means "formation of soap"

(ii) Name two sources of vegetable oils that can be used to make soap

(b) Briefly describe how soap can be prepared

(c) Explain the following

(i) Water containing calcium hydrogen carbonate will not lather easily with soap unless water has been boiled before using the soap

(ii) Water containing magnesium sulphate will not lather with soap even after boiling

(d) Soap forms scum when mixed with certain types of water.

(i) What is the chemical nature of scum?

(ii) Outline the physical method used to obtain water free from hardness

(iii) Give two advantages of hard water

(c) State why detergents are commonly used instead of soap in laundry

(d) Explain how soap works

(e) State what would be observed if soap solution was shaken with a solution of magnesium hydrogen carbonate. Explain your answer

(f) State what would be observed if a solution of soapless detergent was used instead of soap solution

(e) Give one disadvantage of using soapless detergents

45.(a)Alkenes and alkanes are hydrocarbons

(i) Define the term hydrocarbon

(ii) State the structural difference between alkanes and alkenes

(iii) Sate the difference between saturated and unsaturated hydrocarbon.

(b) The boiling point of straight chain alkanes having two to seven carbon atoms are shown in the table below.

| Number of carbon atoms | 2 | 3 | 5 | 6 | 7 |
|---|---|---|---|---|---|
| Boiling point (°C) | –79 | –42 | 37 | 69 | 98 |

(i) Plot a graph of boiling point against number of carbon atoms

(ii) From the graph, determine the boiling point of the alkane with four carbon atoms

(c) (i) What is the shape of the graph

(ii) State the relationship between the boiling point of the alkane and the number of carbon atoms in the alkane

46.(a) Describe how a dry sample of hydrogen sulphide can be prepared in the laboratory.

(b) Explain the use of a fume cardboard in the preparation of hydrogen sulphide

(c) Explain why

(i) Hydrogen sulphide is not dried using sulphuric acid

(ii) Is considered an air pollutant

(d) State what is observed and write equation for the reaction that takes place when hydrogen sulphide is mixed with

(i) Sulphur dioxide

(ii) Lead (II) nitrate solution

(iii) Concentrated sulphuric acid

(iv) Concentrated nitric acid

47.(a) Draw a labelled diagram of a simple cell consisting of zinc and copper electrodes dipped in dilute sulphuric acid solution. Indicate on the diagram the direction of flow of current.

(b) (i) Write equation of reaction that takes place at each electrode.

(ii) Give one example of a simple cell.

(c) Zinc and magnesium can form electro chemical cell.

(i) Draw a labelled diagram of the cell.

(ii) Identify the electrode which is cathode

(iii) Write equation of reaction at the cathode

(iv) Write the overall cell reaction

48. The set-up of the apparatus in figure 2 was used for electrolyzing silver nitrate solution.

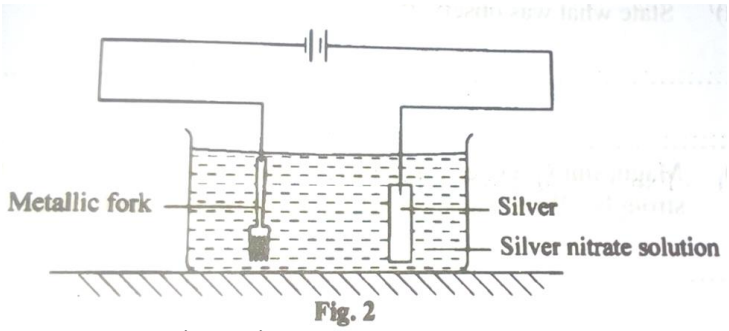



Fig. 2

(a) State what was observed on the;

(i) Metallic fork (ii) Silver.

(b) Write equation for the reaction that took place at the;

(i) Electrode with the fork. (ii) Electrode with silver

(c) (i) Name the process taking place at the electrode with the fork.

(ii) State **one** use of the process in (c) (i).

49. (a) Describe the reactions of magnesium with

(i) Water (ii) oxygen (iii) Chlorine

(b) Aqueous sodium hydroxide hydrogen carbonate solution was added to a solution containing magnesium ions, and the mixture heated. Explain what happened

(i) before the mixture was heated

(ii) after the mixture was heated

(c) Name one reagent that can be used to different magnesium ion from lead (II) ion. State what would be observed if magnesium ion and lead (II) ion are treated separately with the reagent you have named in (c) (i)

(d) Calcium, lead, potassium and zinc form part of the metal activity series.

(i) Arrange the metals in order of reactivity starting with the most reactive metal.

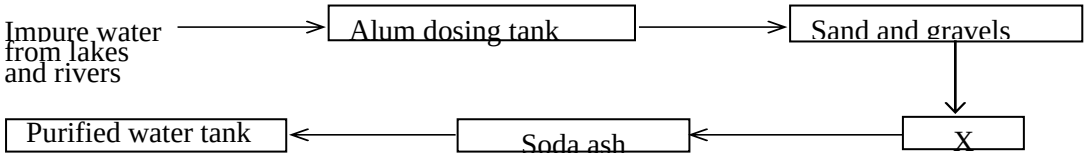
(ii) Describe how each metal reacts with cold water. Write equations for the reactions that take place.

50.(a). What is meant by the term water pollution?

(i) Name two substances that can cause water pollution

(ii) escribe how each of the substances you have named in b(i) above can cause water pollution.

(b) The flow diagram below shows the general scheme used in water purification




(i) State the purpose of the alum dosing tank and the sand and gravels

(ii) Identify **X** and state its purpose

(iii) State the role of soda ash

(iv)Write equations to show the role of soda ash

(c) Define each of the following terms

(i) Sewage (ii) Effluent (iii) Sludge

(d) Outline and explain the:

(i) Stages involve in the purification of water

(ii) Stages involved in sewage treatment

(e) Using one example in each case explain the following terms

(i) Efflorescent substance (ii) hygroscopic substance (iii) deliquescent substance

51. (a) What is solubility of a salt?

(b) The table below shows the solubilities of a salt P in water at different temperature

| Temperature (°C) | 10 | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|---|
| Solubility (g/100 g) of water | 18 | 20 | 24 | 30 | 38 | 50 |

(i) Plot a graph of solubility of **P** against temperature.

(ii) Use your graph to determine the solubility of **P** at 25°C.

(iii) Calculate the mass of **P** that would dissolve in 45 g of water at 25°C.

(c) Of what industrial application is the study of solubility of salts.

52. (a) Methanol undergoes combustion according to the following equation.

$2CH_3OH\ (l) + 3\ O_2\ (g) \longrightarrow 2CO_2\ (g) + 4\ H_2O\ (l); \triangle H = -726KJmol^{-1}$

What is meant by the expression; "$\triangle H = -726KJmol^{-1}$ "?

(b) When 0.87g of methanol was burnt, the heat evolved raised the temperature of 500$cm^3$ of water by 7.0$^0$C. Calculate the enthalpy of combustion of methanol.

( H=1 ; C=12 ; O=16; density of water = 1$gcm^{-3}$ ;specific heat capacity of water = 4.2Jg-1K-1)

(c) The standard Enthalpy of combustion of methanol is -726$KJmol^{-1}$ . Compare the experiment value obtained in (b) with the standard value. Explain your answer

(a) The enthalpy of some straight chain alcohols are shown in table 1.

Table 1.

| Alcohol | $CH_3OH$ | $C_2H_5OH$ | $C_3H_7OH$ | $C_4H_9OH$ | $C_5H_{11}OH$ | $C_6H_{13}OH$ |
|---|---|---|---|---|---|---|
| Formula mass | | | | | | |
| Enthalpy of combustion (KJmol-1) | 726 | 1371 | 2017 | 2673 | 3331 | 3984 |

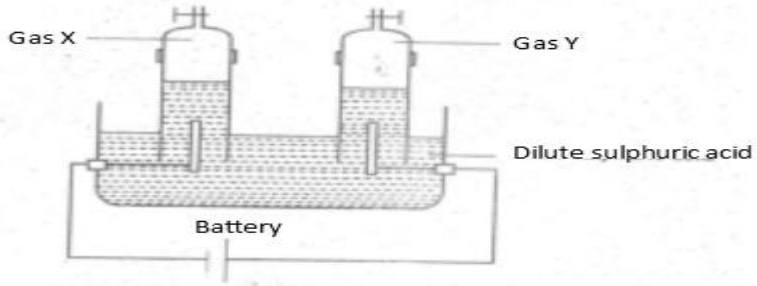
(i) Copy the table and fill in the values for the formula masses of the alcohols. (H=1; C=12; O=16)

(ii) Plot a graph of enthalpy of combustion against formula mass

(iii) State how the enthalpies of the straight chain alcohols vary with their formula masses

(iv) Use the graph to determine the enthalpy of a straight chain alcohol of formula mass 16

53. The diagram below is of electrolytic cell of the electrolysis of dilute sulphuric acid




(a) Name the gases **X** and **Y**

(b) Write equation for the reaction taking place at the terminals

(c) State two industrial applications of electrolysis

(d) Describe the industrial manufacture of sodium hydroxide

(e) Draw a diagram for the electrolysis of copper (II) sulphate using copper electrode.

(f) Write equations for the reactions taking place at the terminals

(g) What is the application of the above cell drawn

54.(a) What is meant by the term enthalpy of combustion

(i) Ethanol burns in oxygen according to the following equation

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ ; $\Delta H = -1358kJ$

Calculate the mass of ethanol that is required to raise the temperature of 150cm$^3$ of water by 45°C.

(b) The molar heat of combustion of carbon is -393kJmol$^{-1}$. Calculate the

(i) Amount of heat evolved when 4.8g of carbon is completely burnt in oxygen (C=12)

(ii) Volume of oxygen at s.t.p that would be required to produce 49.3kJ of heat. (1 mole of gas occupies 22.4dm$^3$ at s.t.p)

55.(a) Lead (II) nitrate solution was added to an aqueous solution of sodium iodide .

(i) State what was observed.

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

(b) hen lead (II) nitrate is heated strongly, it decomposes according to the following equation: $2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_{2(g)}$

If 3.31g of lead II nitrate was heated strongly, calculate the total volume of gaseous products at room temperature.

(b) 12g of hydrogen peroxide decomposed to produce oxygen according to the equation

$2H_2O_{2(aq)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$

Calculate the maximum volume of oxygen produced at s.t.p.

(H = 1, O = 16, 1 mole of gas occupies 22.4dm$^3$).

(c) 2.24dm$^3$ of ammonia gas was passed over heated copper (II) oxide

(i) State what was observed

(ii) Write equation of reaction.

(iii) Calculate the mass of solid product formed.

**END**