**Note: All middle years left out intentionally.**

**PAPER 1 1987**

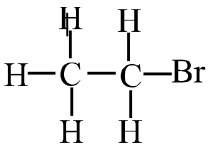
**SECTION A**

1. Which one of the following elements reacts with nitrogen when heated?
A. Copper. B. Zinc
C. Sulphur. D. Magnesium.

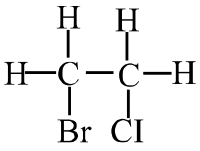
2. The reaction in which vegetable oil is changed to margarine is called
A. dehydration B. hydrogenation.
C. hydration. D. saponification.

3. Ethene was bubbled through a solution of bromine in tetrachloromethane. The structure of the compound formed is

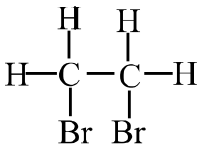
**A**



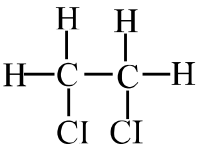
**B**



**C**



**D**



4. Element *X* belongs to group II in the Periodic Table. The formula of the oxide of *X* is
A. XO B. $X_2O$
C. $X_2O_3$ D. $XO_2$.

5. The mass of potassium hydroxide, KOH, contained in 250cm$^3$ of 0.01 M of potassium hydroxide solution is (K = 39, H = 1, O = 16)
A. 0.056g B. 0.140g
C. 0.280g D. 0.560g.

6. Which one of the substances underlined in the equations below is being reduced.
A. $PbO(s) + H_{2(g)} \rightarrow Pb_{(s)} + H_2O_{(l)}$
B. $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$
C. $H_2S_{(g)} + Cl_{2(g)} \rightarrow S_{(s)} + 2HCl_{(g)}$
D. $2NH_{3(g)} + 3CuO_{(s)} \rightarrow 3Cu_{(s)} + 3H_2O_{(l)} + N_{2(g)}$

7. The number of particles in the nuclei of atoms Q, R, S and T are shown in the table below.

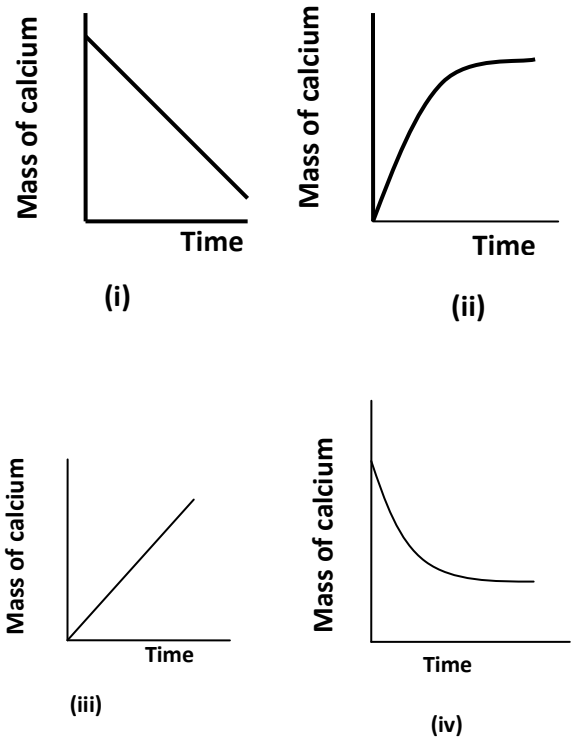
| Atom | Number of particles | |
|---|---|---|
| | protons + neutrons | neutrons |
| *Q* | 40 | 20 |
| *R* | 40 | 22 |
| *S* | 45 | 24 |
| *T* | 45 | 25 |

Which of the atoms are isotopes?
A. Q, and R. B. Q and T.
C. R and S. D. S and T.

8. A salt P reacted with concentrated sulphuric acid to give a colourless gas which fumed in moist air. The anion in P is likely to be a
A. nitrate. B. chloride.
C. sulphite. D. carbonate.

9. The breakdown of starch into Glucose when heated in solution with dilute acid is known as
A. dehydration B. fermentation
C. hydrolysis D. hydrogenation

10. Which one of the graphs below shows the change in mass of calcium carbonate with time when it is reacted with hydrochloric acid?




A. (i) B. (ii)
C. (iii) D. (iv).

11. The reaction in which ethanol is changed to ethene when ethanol is reacted with excess concentrated sulphuric acid is called
A. hydrogenation. B. neutralisation.

C. hydration. D. dehydration.

12. Ethane burns in oxygen according to the following equation
$2C_2H_6 + xO_2 \rightarrow yCO_2 + 6H_2O$
The values of x and y in the equation are
A. x = 2 and y = 2, B. x = 7 and y = 6,
C. x = 7 and y = 4, D. x = 4 and y = 6.

13. Which one of the following anions will react with silver nitrate solution to give a white precipitate soluble in excess aqueous ammonia?
A. $Cl^-$ B. $NO_3^-$
C. $SO_4^{2-}$ D. $CO_3^{2-}$

14. Which one of the following oxides would dissolve in excess aqueous ammonia and excess dilute sodium hydroxide solution?
A. FeO B. ZnO
C. CuO D. PbO.

15. 10g of a saturated sodium chloride solution was evaporated and 6g of solid sodium chloride was left. The solubility of sodium chloride is
A. $\left(\frac{6\times100}{10}\right)$g B. $\left(\frac{6\times100}{4}\right)$g
C. $\left(\frac{6\times100}{16}\right)$g D. $\left(\frac{10\times100}{16}\right)$g

16. Which one of the following hydroxides can be prepared by reacting a soluble salt of the metal with excess sodium hydroxide solution?
A. $Pb(OH)_2$ B. $Zn(OH)_2$
C. $Al(OH)_2$ D. $Fe(OH)_3$.

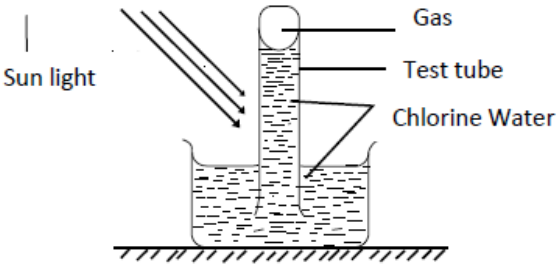
17. A compound X contains Fe, 72.4% and O, 27.6%. (Fe = 56; O = 16). The empirical formula of X is given by the ratio.
A. $\left(\frac{72.4}{72}\right) : \left(\frac{27.6}{72}\right)$
B. $\left(\frac{72.4}{56}\right) : \left(\frac{27.6}{16}\right)$
C. $\left(\frac{72.4\times56}{100}\right) : \left(\frac{27.6\times16}{100}\right)$
D. $\left(\frac{56}{72.4}\right) : \left(\frac{16}{27.6}\right)$

18. Which of the following salts is normally prepared by precipitation?
A. Calcium carbonate. B.Sodium sulphate.
C. Zinc chloride.
D.Ammonium chloride.

19. Spring water decomposes on boiling to produce white solid particles. The solid particles are
A. Calcium carbonate.
B. Calcium hydrogen carbonate
C. Calcium sulphate
D. Calcium hydrogen sulphate.

20. Excess lead powder was shaken with an aqueous solution containing a mixture of copper (II) nitrate and magnesium nitrate. The cations present in the solution after the reaction were
A. $Pb^{2+}$, $Cu^{2+}$ and $Mg^{2+}$
B. $Pb^{2+}$, and $Cu^{2+}$ only.
C. $Mg^{2+}$ and $Cu^{2+}$ only.
D. $Pb^{2+}$ and $Mg^{2+}$ only.

21. Chlorine was exposed to sunlight as shown in the diagram below.




The gas collected in the test tube was
A. chlorine. B. hydrogen chloride.
C. oxygen. D. hydrogen.

22. A separating funnel is used in the laboratory to separate
A. sand from water.
B. sulphur from iron.
C. water from ethanol.
D. water from paraffin.

23. In the laboratory preparation of chlorine, concentrated hydrochloric acid is heated with
A.Manganese(iv)oxide
C. sodium chloride crystals
B. copper (ii)chloride crystals
D. lead(ii)oxide

24. Which one of the following gases turns moist potassium dichromate paper green?
A. Hydrogen.
B. Sulphur dioxide.
C.Hydrogen chloride.
D. Carbon dioxide.

25. Which one of the following is not a property of ethene?
A. Ethene turns potassium permanganate colourless.
B. Ethene has a double bond between carbon atoms.
C. Ethene undergoes addition reaction with bromine.
D. Ethene dissolves in water to form a basic solution.

26. When heated strongly, potassium nitrate decomposes according to the following equation
$2KNO_{3(s)} \rightarrow 2KNO_{2(s)} + O_{2(g)}$
The volume of oxygen at s.t.p. that can be obtained by heating 5g of potassium nitrate is
(K = 39, O = 16, N = 14; 1mole of gas occupies 22.4 1 at s.t.p.)

A. $\left(\frac{22.4\times5}{202}\right)$ litres. B. $\left(\frac{5\times202}{22.4}\right)$ litres.

C. $\left(\frac{22.4\times5}{101}\right)$ litres. D. $\left(\frac{5\times101}{22.4}\right)$ litres.

27. Which one of the following pairs of substances will react to form hydrogen?
A. Copper and dilute sulphuric acid.
B. Magnesium and dilute hydrochloric acid.
C. Copper (II) carbonate and dilute sulphuric acid.
D. Sodium sulphite and dilute hydrochloric acid.

28. Which one of the following cations would form a yellow precipitate when reacted with aqueous potassium iodide?
A. $Ca^{2+}$ (aq) B. $Zn^{2+}$ (aq)
C.$Fe^{2+}$ (aq) D. $Pb^{2+}$ (aq)

29. Sodium ethanoate. $CH_3COONa$, was dissolved in water. The resultant solution
A. bleached litmus paper.
C. changed red litmus paper blue.
B. had no effect on litmus paper
D. changed blue litmus paper red.

30. Carbon burns in oxygen according to the following equation $C + O_2 \rightarrow CO_2$.
The heat energy obtained when 480g of carbon is burnt completely is (The molar heat of combustion of carbon is $2.2 \times 10^{-7}$ kJ $mol^{-1}$; C = 12)
A. $8.8 \times 10^{-5}$ kJ. B. $8.8 \times 10^{-6}$ kJ C. $8.8 \times 10^{-7}$ kJ D. $4.4 \times 10^{-6}$ kJ

31. Metal M was dissolved in dilute nitric acid and the solution was evaporated to dryness and then heated strongly until there was no further change. The residue was yellow when hot and white on cooling. M is
A. Zinc. B. Lead.
C. aluminium. D. Iron.

**32.** Air contains mainly
A. carbon dioxide. B. oxygen
C. nitrogen. D.water vapour.

**33.** Two gases which are evolved on heating copper (II) nitrate are
A. oxygen and nitrogen.
B. oxygen and nitrogen dioxide.
C. oxygern and ammonia.
D. ammonia and nitrogen dioxide.

**34.** When concentrated hydrochloric acid is reacted with potassium permanganate, the gas given off is
A. chlorine.
B. hydrogen chloride.
C. hydrogen.
D. oxygen.

**35.** Which one of the following properties is shown by carbon monoxide?
A. it burns with a blue flame.
B. it turns lime water milky.
C. it turns blue litmus red.
D. it is very soluble in water.

**36.** What would be observed if copper turnings were added to zinc sulphate solution?
A. A white precipitate is formed.
B. solution turns blue.
C. copper is coated with zinc.
D. solution remains colourless.

**37.** Which of the following solutions would give the maximum volume of carbon dioxide within the shortest time when reacted with 10g of calcium carbonate at room temperature?
A. $30cm^3$ of 2M HCl
B. $60cm^3$ of 1M HCl
C. $40cm^3$ of 2M HCl
D. $50cm^3$ of 1M HCl

38. Excess hydrochloric acid was reacted with 1.95g of zinc powder. The reaction proceded according to the equation.
$Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$
The maximum volume of hydrogen in $cm^3$ which was evolved at s.t.p. was
A. 672 B. 224
C. 448 D. 892
***(Zn = 65: molar volume = 22400cm at s.t.p)***

39. When element X and Y are heated together they form a compound with the formula $X_3Y_2$.

Elements X and Y have the following electronic structures respectively.
A.2.8.1 and 2.5 B. 2.8.2 and 2.4
C. 2.8.1 and 2.6 D. 2.8.2 and 2.5

*Each of the questions 40 to 43 consists of an assertion (statement) on the left hand side and a reason on the right hand side. Select.*
***A.*** *if both assertion and reason re true statements and the reason is a correct explanation of the assertion.*
***B.*** *if both assertion and reason are true statements but the reason is not a correct explanation of the assertion.*
***C.*** *if the assertion is true but the reason is an incorrect statement.*
***D.*** *if the assertion is incorrect but the reason is a true statement*
.

| | | *Instructions Summarised* |
|---|---|---|
| | *Assertion* | *Reason* |
| A. | True | True(Reason is a correct explanation) |
| B. | True | True(Reason is not a correct explanation) |
| C. | True | Incorrect |
| D. | True | True statement |

| | | |
|---|---|---|
| 40. When liquid air is distilled oxygen comes off before nitrogen. | because | nitrogen boils at a lower temperature than oxygen. |
| 41. When hydrogen is passed over heated copper(II) oxide there is no chemical change. | because | hydrogen is higher than copper in the activity series. |
| 42. During formation of chloride ion the chlorine atom attains the electronic configuration of a noble gas. | because | noble gases have stable configurations. |
| 43. Solid lead (II) bromide conducts electricity | because | the ions of solid lead (II) bromide are not able to move. |

*In each of the questions 44 to 50 one or more of the Answers given may be correct. Read each question carefully and then indicate on your Answer sheet according to the following.*
*A. if 1, 2, 3 only are correct.*
*B. if 1, 3 only are correct.*
*C. if 2, 4 only are correct.*
*D. if 4 only is correct*

| *Instructions summarised* | | | |
|---|---|---|---|
| A | B | C | D |
| 1,2,3 Only correct | 1,3 Only correct | 2,4 Only correct | 4 Only correct |

.

44. Which of the following substances will sublime when heated?
1. ammonium chloride.
2. iron (III) chloride.
3. iodine
4. sulphur.

45. Which of the following gases will bleach moist litmus paper?
1. oxygen
2. chlorine
3. carbon dioxide.
4. sulphur dioxide.

46. During electrolysis f copper (II) sulphate solution using copper electrodes.
1. copper is deposited at the cathode.
2. oxygen is evolved at the anode.
3. the anode dissolves.
4. the cathode dissolves.

47. Which of the following substances will dissolve in water to give a solution that will change blue litmus paper red?
1. sodium ethanoate.
2. ammonium chloride.
3. magnesium oxide.
4, carbon dioxide.

48. Which of the following substances is / are decomposed by electric current?
1. solution of urea
2. aqueous sodium chloride.
3. molten wax.
4. molten lead (II) bromide.

49. Which one of the following when in aqueous solution can e reduced by aluminium metal?
1. $Fe^{2+}$ 2. $Ca^{2+}$ 3. $Cu^{2+}$ 4. $Mg^{2+}$

50. Which of the following substances would undergo permanent changes when strongly heated?
1. Iodine
2. Sugar.
3. Potassium carbonate.
4. Potassium chlorate.

## PAPER 2 1987
## SECTION A

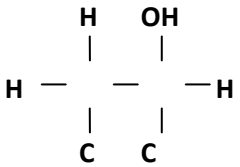
1. (a) 5.0g of calcium carbonate was heated strongly until there was no further change.
(i) Write equation for the reaction.

……
(ii) Calculate the mass of solid left.
……
……
……
(b) The residue in (a) was shaken with water and the product tested with blue litmus paper.
State what was observed.
……
……
……
(Ca = 40, C = 12, O = 16)

2. Hydrogen chloride reacts with silver ions according to the equation
$HCl(g) + Ag^{+}(aq) \rightarrow AgCl(s) + H^{+}(aq)$
1.2 litres of hydrogen chloride was carefully bubbled through $500cm^3$ of 1.0 M solution of silver ions at room temperature.
Calculate
(a) the number of moles of silver ions that reacted.
……
……
……
(b) the number of moles of hydrogen chloride bubbled. (1 mole of gas occupies 24 litres at room temperature).
……
……
(c) the mass in grams of silver chloride formed (Cl = 35.5, Ag = 108).

……
……

3. The structure of an organic substance A is shown below.




(a) Name A.

……

(b) A reacts with excess concentrated sulphuric acid at 170$^{o}$C to form an organic product B.

(i) Name B.

……

(ii) Write the structure of B.

……

……

(iii) Name one reagent that could be used to detect the presence of B.

……

……

(iv) State what would be observed if the reagent named in (iii) was used.

……

……

4. A concentrated solution of sodium chloride was electrolyzed using platinum electrodes.

(a) (i) State what was observed.

……

(ii) at the cathode.

……

(b) Explain your observation in (a) (i).

……

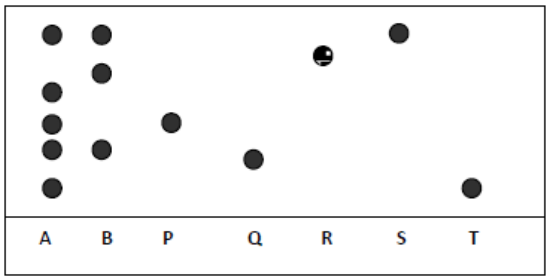
……

(c) Litmus paper was dipped into solution after the electrolysis. State what was observed.

……

……

5. The result of paper chromatography experiment is shown in the diagram below.




A and B are different mixtures of some of the pure substances, P, Q, R, S and T.

(a) Identify the substances in the

(i) mixture A.

……

……

(ii) mixture B.

……

……

(b) Which substances are present in both mixtures?

……

……

(c) Which substances are present in mixture A only?

……

……

6. (a) Explain what is meant by the terms

(i) 'mass number'?

……

(ii) 'atomic number'?

……

(b) An atom of an element is represented by the symbol $^{80}_{35}X$

(i) State the mass number of the atom.

……

(ii) What is the atomic number of the atom?

……

……

(iii) How many neutrons are present in the atom?

……

7. (a) A given mass of magnesium strips was reacted with dilute hydrochloric acid at room temperature. The volume of the gas produced was measured at various intervals.

(i) Write equation for the reaction.

……

……

(ii) Sketch a graph to show variations of the volume of the gas produced with time.

……

……

(b) State what would be observed if the same mass of magnesium powder was used instead of the strips. Give one reason for your Answer.

……

……

8. Nitric acid is manufactured by catalytic oxidation of ammonia.

(a) Name

(i) two raw materials, other than ammonia that are used in the manufacture of nitric acid.

……

……

(ii) the catalyst used.

……

……

(b) Write equation for the reason between nitric acid and ammonia.

……

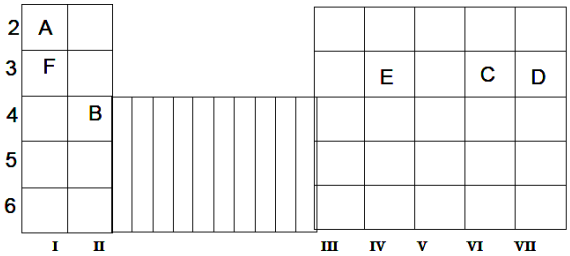
……

(c ) State one use of the product in (b).

……

……

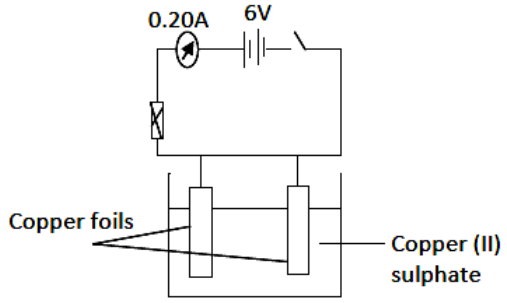
9. The positions of the elements A, B, C,D, E and F are shown in the periodic table below. These letters are not the usual symbols for the elements.




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

(i) B and D.

……
……
(ii) E and C.
……
……
(b) (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)
……
……
(c) From the table select two elements that can oxide F.
……
……
10. A circuit was connected as shown in the diagram below and a steady current of 0.20 amperes was passed for 20 minutes. (1 faraday = 96 500, C $mol^{-1}$; Cu = 64)




(a) Write equation for the reaction that took place at the cathode.
……
……
……
(b) Calculate
(i) the number of coloumbs of electricity used.
……
(ii) the number of moles of electricity.
……
(iii) the mass of substance formed at the cathode.
……
……

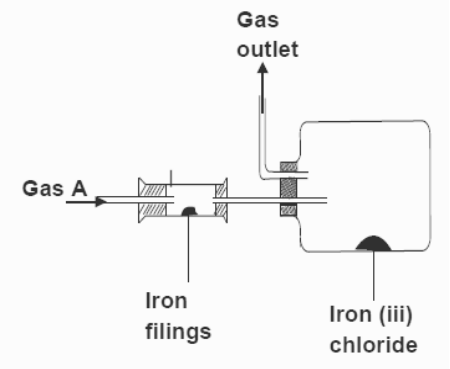
**SECTION B**

***Attempt all questions in this section.***

11. (a) Define 'allotropy'
(b) Give one example on an element other than carbon which shows allotropy and name its allotropes
Allotropes of sulphur are Rhombic, Monoclinic.
(c) (i) Describe briefly the structure of graphite.
(ii) State the properties of graphite.
(d) Describe how you would show by a chemical test that graphite is made up of carbon atoms.

12. (a) In sewage treatment, the sewage is brought into contact with appropriate bacteria under controlled conditions.
(i) Explain what is meant by the term 'sewage'.
(ii) Explain the role of bacteria in sewage treatment.
(iii) State the conditions under which bacteria will be active during the treatment of sewage.
(b) Distinguish between a 'sludge' and an 'effluent' in relation to sewage treatment.
(c ) State two uses of sewage sludge.

13. The diagram below shows the apparatus which can be used to prepare anhydrous iron (III) chloride.




(a) (i) Name the gas A.
(ii) State the conditions for the reaction between iron fillings and gas A.
(iii) Describe what would be observed during the reaction.
(iv) Write equation for the reaction.
(b) Describe how you would prepare pure crystals of iron (II) chloride in the laboratory.

14. Carbon dioxide gas can be prepared in the laboratory by reacting an acid with a carbonate.
(a) Write an ionic equation for the reaction.
(b) Draw a labeled diagram of the apparatus that can be used in the laboratory to prepare and collect a sample of carbon dioxide.
(c) Write equations to show how carbon dioxide reacts with each of the following and state what would be observed in each case;
(i) sodium hydroxide solution.
(ii) calcium hydroxide solution.
(iii) Magnesium metal.
(d) Name one process in each case by which the concentration of carbon dioxide in the atmosphere is
(i) increased.
(ii) decreased.

## PAPER 1 1988
## SECTION A

1. Which one of the following mixtures can be separated by filtration?
A. sugar and water. B. ink and water.
C. sulphur and iron D. sand and kerosene.

2. A solution of hydrogen chloride in dry methyl benzene will
A. form sodium chloride and water with sodium hydroxide.
B. liberate carbon dioxide with sodium hydrogen carbonate.
C. liberate hydrogen with magnesium

D. not conduct an electric current.

3. A compound Z when strongly heated leaves a residue which is yellow when hot and white when cold. Z contains
A. $Pb^{2+}$ B. $Cu^{2+}$
C. $Zn^{2+}$ D. $Fe^{2+}$

4. When a solid was heated it changed to gas without passing through the liquid state. This change of state is called
A. vaporization B. sublimation.
C. distillation D. condensation.

5. Ionic compounds have high melting points because
A. ions strongly attract each other.
B. ions strongly repel each other.
C. they combine by transfer of electrons.
D. ions are arranged in a crystal lattice.

6. Sodium sulphite reacts with hydrochloric acid according to the equation:
$SO_3^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \rightarrow H_2O_{(l)} + SO_{2(g)}$
$20.0cm^3$ of sodium sulphite was neutralized exactly by $25.0cm^3$ of 0.05M hydrochloric acid. The molarity of the sulphite was
A. $\frac{2\times 20.0\times 0.05}{25.0}$ B. $\frac{20.0\times 0.05}{2\times 25.0}$
C. $\frac{2\times 25.0\times 0.05}{20.0}$ D. $\frac{25.0\times 0.05}{2\times 20.0}$

7. Which of the following are the raw materials used to manufacture hydrogen gas on a large scale?
A. Zinc and dilute sulphuric acid.
B. Iron and water.
C. Carbon and water
D. Sodium and water.

**8.** Which one of the following methods is suitable for preparing anhydrous iron **(III)** chloride in the laboratory?
A. pass dry chlorine over heated iron.
B. pass dry hydrogen chloride over heated iron.
C. react iron with dilute hydrochloric acid and heat to dryness.
D. react iron **(III)** oxide with dilute hydrochloric acid and heat to dryness.

**9.** How many grams of pure sodium sulphate crystals, $Na_2SO_4.10H_2O$ (relative molecular mass = 322) would be required to make $250cm^3$ of 0.01 M sodium sulphate solution?
A. 0.40g B. 0.81g
C. 1.60g D. 3.22g

10. Which one of the following is normally used to catalyse the oxidation of ammonia during the manufacture of nitric acid?
A. platinised asbestos.B. finely divided iron.C. vanadium (V) oxide.D. Iron (III) oxide.

11. Which one of the following substances will undergo a physical change when heated strongly?
A. calcium nitrate.
B. calcium hydroxide.
C. sodium nitrate.
D. sodium hydroxide.

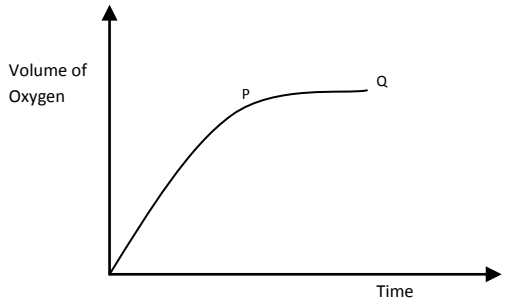
12. When a solution X was reacted with aqueous sodium iodide, a yellow precipitate was formed. With ammonium hydroxide, solution X formed a white precipitate insoluble in excess alkali. X contained
A. $Ca^{2+}$ B. $Fe^{2+}$
C. $Zn^{2+}$ D. $Pb^{2+}$

13. Which one of the following substances is deliquescent?
A. Calcium hydroxide.
C. Magnesium hydroxide.
B. Sodium hydroxide. D. Zinc hydroxide.

14. The mass of copper deposited from a solution of copper (II) chloride when a current of 1.2 A s passed for 3000 s is
A. $\frac{63.5\times 1.2\times 3000}{2\times 96500}$g
C. $\frac{3000\times 1.2\times 96\ 500}{2\times 63.5}$g
B. $\frac{63.5\times 2\times 96\ 500}{1.2\times 3000}$g
D. $\frac{96\ 500\times 2}{63.5\times 1.2\times 300}$g
***(Cu = 63.5, 1 F = 96 500 coulombs)***

15. The formula of an oxide ion is $O^{2-}$. This shows that
A. the number of protons exceeds the number of electrons by two.
B. the number of electrons exceeds the number of protons by two.
C. oxygen atom loses two electrons to form $O^{2-}$.
D. the oxide ion has two electrons in its outermost shell.

16. The graph below represents the variation of the volume of oxygen with time when hydrogen peroxide decomposes in the presence of a catalyst.




PQ show that
A. oxygen is being evolved at a constant rate.
B. decomposition is at its maximum.
C. decomposition has stopped.
D. the catalyst has all been used up.

17. Which one of the following methods would be suitable for preparing magnesium sulphate?
A. Direct combination.
B. Double decomposition.
C. Neutralization.
D. Displacement of hydrogen by a metal.

18. Which one of the following metals combines directly with nitrogen?
A. Potassium. B. Copper.
C. Calcium. D. Zinc.

19. When calcium hydrogen carbonate is heated it decomposes according to the equation.
$Ca(HCO_3)_{2(s)} \rightarrow CaO_{(s)} + H_2O_{(l)} + 2CO_{2(g)}$
270g of the hydrogen carbonate was decomposed. The volume in litres of carbon dioxide evolved at s.t.p. was
A. $\frac{27 \times 22.4}{162}$ B. $\frac{162}{27 \times 22.4}$
C. $\frac{2 \times 27 \times 22.4}{162}$ D. $\frac{162}{2 \times 27 \times 22.4}$
(H = 1; C = 12; O = 16; Ca = 40; 1 mole of gas occupies 22.4l at s.t.p).

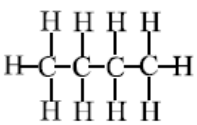
20. The reaction in which soap is manufactured from oils and fats is known as
A. fermentation. B. hydrogenation.
C. polymerization. D. saponification.

21. A compound contains 92.3% carbon and 7.7% hydrogen by mass. What is the empirical formula of the compound?
(C = 12 , H = 1)
A. $C_2H$ B. $CH_2$
C. $C_2H_2$ D. CH

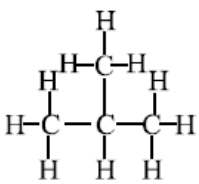
22. A solution of salt Y formed a white precipitate when dilute nitric acid was added followed by silver nitrate solution. Y contained
A. $CO_3^{2-}$ B. $SO_4^{2-}$
C. CI D. $NO_3^-$

23. Which one of the following is the structural formula of butane?

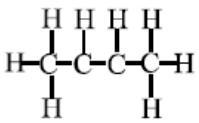
A



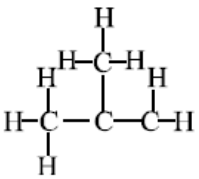
B



C



D



24. What is the percentage of nitrogen in calcium nitrate, $Ca(NO_3)_2$ ?
(N = 4; O = 16; Ca = 40)
A. $\frac{14 \times 100}{164}$ B. $\frac{62 \times 100}{164}$
C. $\frac{28 \times 100}{164}$ D. $\frac{124 \times 100}{164}$

25. When pollen grains are placed in water in a trough and observed under a microscope, the grain particles will be seen to
A. all remain stationary.
C. stick together in a cluster.
B. all move randomly.
D. all move in one direction.

26.Which one of the following is an electrovalent compound?
A. Calcium oxide.
B. Sulphur dioxide.
C. Hydrogen chloride.
D. Phosphorus (III) chloride.

27. Which one of the following substances will dissolve in water to give a solution with pH greater than?
A. Sodium hydrogen carbonate.
C. Sulphur dioxide.
B. Ammonium sulphate.
D. Carbon dioxide.

28. The atomic number of element Y is 19. The formula of its chloride is
A. $YCl_2$ B. $Y_2Cl$
C. YCl D. $Y_2Cl_2$.

29. Which one of the following mixtures can be separated by shaking with excess water and filtering ?
A. Sodium sulphate and sodium carbonate.
B. Copper (II) oxide and copper (II) chloride.
C. Calcium nitrate and calcium chloride.
D. Potassium permanganate and potassium sulphate.

30. Which one of the following nitrates dose not give off oxygen when strongly heated?
A. $Ca(NO_3)_2$ B. $Zn(NO_3)_2$
C. $KNO_3$ D. $NH_4NO_3$

**31.** Which one of the following does not involve a change in mass when heated in air?
A. Potassium permanganate.
B. Copper (II) hydroxide.
C. Zinc oxide.
D. Copper.

32. Methane burns in oxygen according to the equation
$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$.
The volume of oxygen required for complete combustion of 20cm3 of methane is (all volumes measured at constant temperature and pressure).
A. $10cm^3$ B. $20cm^3$
C. $30cm^3$ D. $40cm^3$

33. The number of neutrons in the nucleus of the atom $^{70}_{29}X$ is

A. 99. B. 70.
C. 41. D. 29.

34. Which one of the following is observed when aqueous barium chloride is added to iron **(II)** sulphate solution?
A. A green precipitate.
B. A white precipitate.
C. A blue precipitate.
D. A brown precipitate.

35. Which one of the following pairs of compounds can cause temporary hardness of water?
A Sodium hydrogen carbonate and potassium hydrogen carbonate.
B. Sodium hydrogen carbonate and magnesium hydrogen carbonate.
C. Potassium hydrogen carbonate and calcium hydrogen carbonate.
D. Magnesium hydrogen carbonate and calcium hydrogen carbonate.

36. Which one of the following is not an equation for an oxidation reduction reaction?
A. $3CuO(s)\ 2NH_{3(g)} \rightarrow 3Cu_{(s)} + 3H_2O_{(l)} + N_{2(g)}$
B. $MgO(s) + H_2SO_{4(aq)} \rightarrow MgSO_{4(aq)} + H_2O_{(l)}$
C. $MnO_2(s) + 4HCl_{(aq)} \rightarrow MnCl_{2(aq)} + 2H_2O_{(l)} + Cl_{2(g)}$
D. $2Mg_{(s)} + CO_{2(g)} \rightarrow 2MgO_{(s)} + C_{(s)}$

37. Which one of the following hydroxides is soluble in aqueous ammonia but not in sodium hydroxide solution?
A. $Zn(OH)_2$ B. $Cu(OH)_2$
C. $Pb(OH)_2$ D. $Ca(OH)_2$

38. Calcium hydroxide with ammonium chloride according to the equation
$Ca(OH)_{2(s)} + 2NH_4Cl_{(s)} \rightarrow CaCl_{2(s)} + 2H_2O_{(l)} + 2NH_{(g)}$.
If 14.8g of calcium hydroxide was reacted completely with ammonium chloride, what mass of ammonia gas would be evolved?
(H = 1; N = 14; O = 16; Ca = 40)
A. 1.7g B. 3.4g
C. 6.8g D. 9.0

39. Which one of the following equations represents a neutralization reaction between an acid and alkali?
A. $2H_4^+{}_{(aq)} + CO_3^{2-}{}_{(s)} \rightarrow CO_{2(g)} + H_2O_{(l)}$
B. $2NH_4^+{}_{(aq)} + CO_3^{2}{}_{(aq)} \rightarrow (NH_4)_2 + CO_{3(aq)}$
C. $NH_4^+{}_{(aq)} + OH_{(aq)} \rightarrow NH_{3(g)} + H_2O_{(l)}$
D. $H^+{}_{(aq)} + OH^-{}_{(aq)} \rightarrow H_2O_{(l)}$

40. Which one of the following properties is not true about carbon monoxide?
A. it is colourless. B. it is acidic.
C. it is poisonous. D. it is a reducing agent.

*Each of the questions 41 to 42 consists of an assertion (statement) on the left hand side and a reason on the right hand side. Select.*
*A. if both assertion and reason are true statements and the reason is a correct explanation of the assertion.*
*B. if both assertion and reason are true statements but the reason is not a correct explanation of the assertion.*
*C. if the assertion is true but the reason is an incorrect statement.*
*D. if the assertion is incorrect but the reason is a true statement*

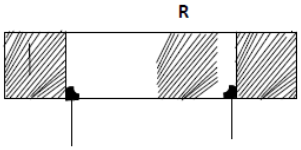
| | | |
|---|---|---|
| 41. Ethene does not react with bromine. | **because** | ethene contains a double bond between two carbon atoms |
| 42. During industrial conversion of sulphur dioxide to sulphur trioxide platinised asbestos is used. | **because** | platinised asbestos increase rate of formation of sulphur trioxide.. |

***In each of the questions 43 to 50 one or more of the Answers given may be correct. Read each question carefully and then indicate on your Answer sheet according to the following.***
***A. if 1, 2, 3 only are correct.***
***B. if 1, 3 only are correct.***
***C. if 2, 4 only are correct.***
***D. if 4 only is correct.***

| *Instructions summarised* | | | |
|---|---|---|---|
| A | B | C | D |
| 1,2,3 Only correct | 1,3 Only correct | 2,4 Only correct | 4 Only correct |

.

43. In an experiment an apparatus was set up as shown in the diagram below. After sometime a white ring appeared at point R.




Cotton wool soaked in concentrated ammonia

Cotton wool soaked in concentrated hydrochloric acid

This experiment shows that
1. ammonia is lighter than hydrogen chloride.
2. ammonia is basic and hydrogen chloride is acidic.
3. ammonia and hydrogen chloride particles are volatile.
4. Hydrogen chloride is lighter than ammonia.

44. When copper (II) nitrate crystals are heated strongly the following substance(s) is/ are produced.
1. Oxygen gas. 2. Water vapour. 3. Copper (II) oxide.
4. Copper metal.

45. Which of the following is (are) true about a solution of sodium carbonate in water?
1. it produces carbon dioxide when heated.
2. it reacts with acids with effervescence.
3. it can be used in the purification of water.
4. it turns red litmus blue.

46. The following is (are) characteristics of metals.

1. conduct electricity.
3. their atoms form cations.
2. conduct heat.
4. their atoms form anions.

47. When sugar is warmed with concentrated sulphuric acid.
1. carbon is formed.
2. sulphur dioxide is formed.
3. sugar is dehydrated.
4. sugar is oxidised.

48. An element belongs to the halogen group in the periodic table but below iodine. The element is likely to be
1. coloured.
2. diatomic.
3. a solid at room temperature.
4. a liquid at room temperature.

49. Which of the following solutions contain(s) the same number of hydrogen ions?
1. 1 l of 1 M $H_2SO_4$
2. 1 l of 2 M HCI
3. 2 l of 1 M $HNMO_3$
4. 2 l of 2 M HBr

50. The atoms of the same element have the
1. same number of protons as $^{1}{}^{2}C$.
2. same number of protons.
3. same number of electrons as $^{1}{}^{2}C$.
4. same number of electrons.

**PAPER 2 1988**
**SECTION A**

1 (a) Name
(i) Two major components of air.
……
……

(ii) the process by which the components of air are separated.
……
……

(b) Explain why the process you have named in
……
……

(a) (ii) can be used to separate the component of air.
……
……

(c) Which one of the components of air is used as a plant nutrient?
……
……

2. Glucose, $C_6H_{12}O_6$, can be converted to ethanol by a catalytic reaction caused by an enzyme produced from yeast.
(a) Name
(i) the reaction in which yeast converts glucose into alcohol.

……
……

(ii) the enzyme produced by yeast during the reaction.
……
……

(b) Write the equation for the reaction that leads to the formation of ethanol
……
……

(c) Briefly describe how the ethanol produced can be concentrated.
……
……

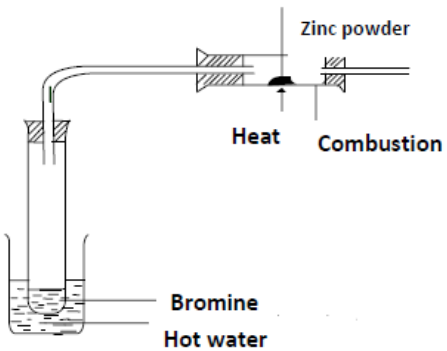
**3.** The electronic structure of an element X is 2: 8: 6
(a) Write the formula of the most common ion of X.
……
……

(b) To which group of the periodic table does X belong?
……
……

(c) Element X reacts with an element M (atomic number = 12).
(i) Write the electronic structure of M.
……
……

(ii) State the type of bond that exists in the compound between M and X.
……
……

4. An apparatus to investigate the reaction of bromine with zinc was set up as shown in the diagram below




(i) State what was observed in the combustion tube.
……
……

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

(b) The product was dissolved in water and aqueous ammonia added drop wise to the solution until it was in excess. State what was observed.
……
……

5.(a)Write one equation in each case for the reaction in which sulphuric acid behaves as
(i) an acid.
……
……

(ii) an oxidizing agent.
……
……

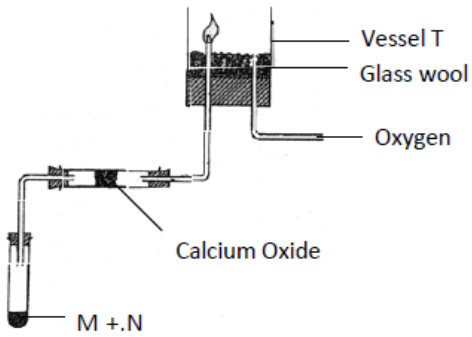
(b) State the conditions for each of the reactions in (a).
……
……

6.(a)A compound X, of molecular mass 28 contains 87.5% carbon and 14.3% hydrogen.
Calculate the simplest formula of X.
(b) (i) Determine the molecular formula of X.
……
……

(c) State what is observed if X reacted with bromine.
……
……

(d) Write an equation for the reaction in (c)
……
……

7. In the apparatus shown in the diagram below, compounds M and N are reacted to produce ammonia which is conveyed to vessel T where it is burnt.




**(a)** Name the substance
(i) M
……
……

(ii)
N……
……

(b) State the role of
(i) the glass wool.
……
……

(ii) Calcium oxide……
……

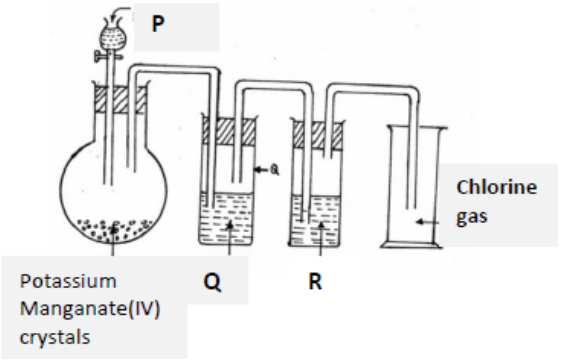
(c ) Write an equation for the combustion ammonia.
……
……

(d) State one industrial use of ammonia.
……
……

**8.** A steady current of 0.65 A was passed for 35 minutes through acidified water to electrolyze it using carbon electrodes.
(a) State the electrode at which oxygen was liberated.
……
……

(b) Calculate the mass of oxygen liberated
(1 faraday = 96, 500 coulombs).
……
……
……
……

**9. (a)** The diaghram below shows an arrangement of the apparatus for the laboratory preparation of chlorine.




) Identify liquids
P
Q

(ii) What is the function of liquid R?
……
……

(iii) Why is chlorine collected as shown?
……
……

(b) Write an equation for the reaction between chlorine and aqueous iron (II) chloride……
……

(c) State one use of chlorine.
……
……

10. 7.5g of methane, $CH_4$, was completely burnt in air. Methane burns in air according to the following equation:
$CH_4(g) +_{(g)} + 2H_2O_{(g)}$ $\Delta H = -890kJ\ mol^{-1}$.
Calculate:
(i) the mass of carbon dioxide formed.
……
……
(ii) the heat evolved.

……
……

**SECTION B**

***Attempt any two questions in this section.***

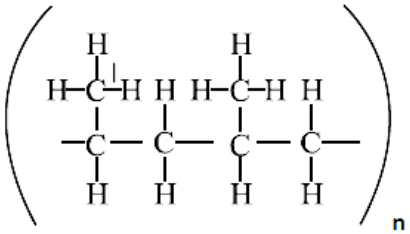
11. (a) Explain what is meant by the terms
(i) solubility of a salt.
(ii) saturated solution.
(b) 75g of a saturated solution contains 30g of salt. Calculate
(i) the solubility of the salt.
(ii) the percentage of the salt in the saturated solution.
(c) (i) Briefly describe how a dry sample of copper (II) sulphate crystals can be obtained from copper (II) oxide in the laboratory.
(ii) Write an equation for the reaction.

12. (a) (i) Name one ore of each of the following metals: sodium and iron.
(ii) Briefly describe how sodium and iron are extracted from their ores. Explain why the method you have described can be used to extract the metal from the ore.

(b) State the conditions under which sodium and iron can react with water. Write equation for the reaction in each case.

13. (a) Describe briefly how you would prepare a pure sample of lead (II) bromide.
(b) Molten lead (II) bromide conducts electricity whereas solid lead (II) bromide does not. Explain this observation.
(c) (i) Describe and explain what would be observed when molten lead (II) bromide 1 electrolysed between carbon electrodes.
(ii)Write equations for the mass of lea deposited when 1930 coulombs was passed through molte lead (II) bromide.
(1 mole of electrons = 96 500 coulombs).

14. (a) (i) Explain what is meant by the term polymerization.
(ii) Name two naturally occurring polymers and one synthetic polymer.
(b) The structure of a polymer is shown below.




Write down the structural formula of the monomer of the polymer.
(c ) Distinguish between a thermoplastic and a thermosetting plastic.
(d) Explain the term cracking.
Draw a fully labeled diagram of the apparatus that can be used to crack liquid paraffin in the laboratory.

**PAPER 1 1989**
**SECTION A**

1. The reaction in which soap is manufactured from oil and fats is known as
A. fermentation. B. hydrogenation.
C. polymerization. D. saponification.

2. 45 kJ of energy is produced when 3 g of butter is oxidized in the body. The energy produced in the body of a person who eats 1g of butter daily for one week is
A. 1050 kJ. B. 105 kJ.
C. 15 kJ. D. 10.5 kJ.

3. Which one of the following nitrates does NOT give off oxygen when heated?
A. zinc nitrate B. sodium nitrate.
C. ammonium nitrate. D. calcium nitrate.

4. Which one of the following salts can be prepared by precipitation?
A. Calcium sulphate B. Copper (II) chloride
C. lead (II) nitrate. D. Sodium chloride.

5. Which one of the following reagents can be used to differentiate between lead (II) and aluminum ions in aqueous solution?
A. $NaOH_{(aq)}$. B. $Kl_{(aq)}$
C. $NH_{3(aq)}$ D. $HNO_{3(aq)}$

6. Which one of the following hydroxides when strongly heated produce a yellow solid on cooling?
A. $Cu(OH)_2$. B $Zn(OH)_2$.
C. Pb $(OH)_2$ D. $Fe(OH)_2$

7. Which one of the following compounds does not give off carbon dioxide when strongly heated ?
A. sodium carbonate.
B. calcium carbonate.
C. calcium hydrogen carbonate.
D. sodium hydrogen carbonate.

8. Which one of the following oxides can be rduced by carbonmonoxide?
A. MgO B. CaO
C. CuO D. $K_2O$

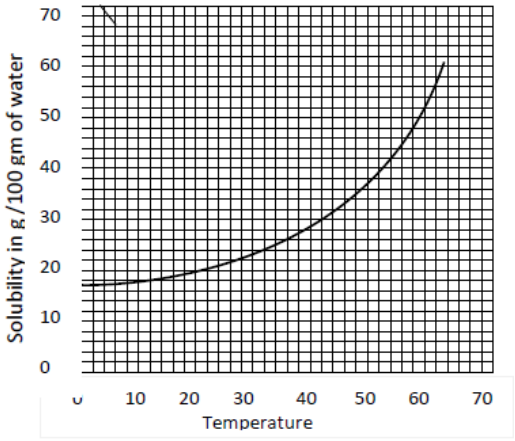
9. Propane burns in oxygen according to the following equation;

$$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 4H_2O_{(g)} + 3CO_{2(g)}$$

The volume of oxygen required for complete combustion of 10 dm3 of propane is

A. 75 $dm^3$ B. 50 $dm^3$
C. 25 $dm^3$ D. 15 $dm^3$

10. The solubility curve for potassium nitrate is shown in figure 1.



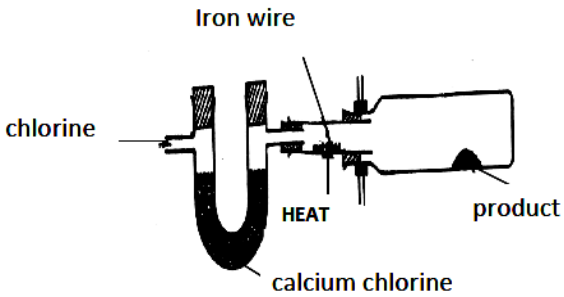

The mass of potassium nitrate which would dissolve in 25g of water at 30°C is

A. 0.6 g. B. 1.2 g.
C. 6.0 g. D. 12.0 g

11. Which one of the following is a basic oxide?

A. $SO_2$. B. ZnO
C. $P_2O_5$ D. CaO

12.




The diagram in figure 2 shows the arrangement of the apparatus which was set up to produce chloride of iron. The product formed was

A Hydrated uron (II) chloride.
B. hydrated iron (III) chloride.
C. anhydrous iron (II) chloride.
D. anhydrous iron (III) chloride.

13. 25.0$cm^3$ of 0.1 M sodium carbonate was found to require 23.5$cm^3$ of hydrochloric acid to be completely neutralized. The molarity of hydrochloric acid is

A. $\frac{23.5x0.1}{25.0x2}$ B. $\frac{2x23.5x0.1}{25.0}$
C. $\frac{2x25.0}{23.5x0.1}$ D. $\frac{2x25.0x0.1}{23.5}$

14. Alkanes are hydrocarbons with the general formula

A. $C_nH_{2n+2}$ B. $C_nH_{2n}$
C. $C_nH_n$ D. $C_nH_{2n-2}$

15. Which one of the following oxides can be reduced by ammonia?

A. zinc oxide.
C. magnesium oxide
B. coper (II) oxide.
D. iron (II) oxide.

16. Ammonium chloride, $NH_4Cl$ was dissolved in water. The resultant solution

A. had no effect on litmus paper.
C. changed blue litmus paper red.
B. change red litmus paper blue.
D. bleached litmus paper.

17. Beginning with the least reactive, the order of reactivity of the following metals with dilute hydrochloric acid is

A. iron, aluminum lead, zinc.
C. lead, iron, zinc, aluminum.
B. zinc, lead, aluminum, iron.
D. aluminum, zinc, iron, lead.

18. Calcium reacts with water according to the following equation;

$$Ca_{(s)} + 2H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)} + H_{2(g)}$$

The volume of hydrogen formed when 0.3 mole of calcium reacts with water at 25°C is (1 mole of a gas occupies 24 $dm^3$ at 25°C)

A.0.72 $dm^3$ B. 7.2 $dm^3$
C. 72 $dm^3$ D. 720 $dm^3$

19. How many grams of sodium hydroxide are present in 250$cm^3$ of a 2 M solution?
(Na = 23, O = 16, H = 1)

A.10 g B. 20 g
C. 40 g D. 80 g.

20. The atomic number of an lement is

A. the number of electrons and protons.
B. the number of protons and neutrons.
C. the number of neutrons.
D. the number of protons.

21. 10 amps of current was passed through silver nitrate solution for one minute. The mass of silver deposited at the cathode is
(Ag = 108, faradays constant = 96.500 coulombs)

A. $\frac{96.500x60x10}{108}$g B. $\frac{10x108}{96.500x60}$g
C. $\frac{10x60x108}{96.500}$g D. $\frac{10x60}{96.500x108}$g

22. Potassium hydrogen carbonate is decomposed by heat to potassium carbonate. The mass of potassium carbonate produced on heating 5g of potassium hydrogen carbonate is
(K = 39, C = 12, H = 1, O = 16)

A. $\frac{138x5}{200}$ B. $\frac{138x5}{100}$

C. $\frac{200x5}{138}$ D. $\frac{100x5}{138}$

23. The number of moles of nitrogen molecules in 42g of nitrogen is
(N = 14)
A. 0.33. B.0.67.
C. 1.50. D. 3.00.

24. The atomic numbers of elements X and Y are 7 and 9 respectively. The formula of the compound formed between X and Y is
A. $XY_3$ B. $XY_2$
C. $X_3Y$ D. $X_2Y$

25. Isotopes are different atoms of the same element with the
A. same number of protons, neutrons and electrons.
B. same number of electrons and neutrons but different numbr of protons.
C. same number of protons and neutrons but different number of electrons.
D. same number of protons and electrons but different number of neutrons.

26. Which one of the following substances does not conduct electricity?
A. Graphite. B. Diamond.
C. Lead. D. Zinc.

27. If a solution containing 1M copper (II) sulphate and 1M zinc sulphate is electrolyzed, the substance formed at the cathode is
A. oxygen. B. hydrogen.
C. copper. D. zinc.

28. When a gas X with a pungent smell was passed over hot platinum foil a colourless gas Y was formed . Gas Y turned brown on mixing with air. Gas X is most likely to be
A. sulphur dioxide. B. ammonia
C. hydrogen sulphide. D. nitrogen monoxide

29. How many electrons are there in oxygen ($O_2$) ion?
(The atomic number of oxygen is 8)
A. 6 B. 8
C. 10 D. 16

30. Which one of the following gases will not reduce copper (II) oxide to copper?
A. hydrogen. B. carbon monoxide
C. ammonia D. carbon dioxide.

31. An atom of an element X has 19 electrons. In the periodic table X belongs to
A. group I B. group II
C. group III D. group IV

32. During quantitative determination of the ratio of oxygen to nitrogen in air by the action of air on hot copper, the gas collected in the evacuated flask is mainly
A. nitrogen. B. oxygen.
C. carbon dioxide D. water vapour.

33. Which one of the following is formed when hydrogen sulphide is bubbled through hydrogen peroxide?
A. $SO_4^{2-}$ B. $SO_3$
C. $SO_2$ D. S

34. Solid X is insoluble in water but dissolves in nitric acid to form a colourless solution. When the solution was treated with aqueous sodium hydroxide a white precipitate insoluble in excess alkali was formed. X is
A. potassium carbonate
B. calcium carbonate
C. zinc carbonate
D. lead carbonate

35. Which one of the following gases decolourises aqueous potassium permanganate?
A. $NO_2$ B. $NH_3$
C. $SO_2$ D. HCI

36. An atom $^{41}_{20}M$ forms a chloride of the formula $MCl_2$. Which one of the following atoms forms a chloride with a similar formula?
A. $^{25}_{12}R$ B. $^{25}_{13}T$
C. $^{21}_{10}Y$ D. $^{22}_{11}Z$

37. In the order of the reactivity of the elements K, Na, Mg, Al, C, Zn and Cu, potassium is the most reactive and lead is the least reactive. Which one of the following reaction is possible?
A. $2NaO_{(s)} + C_{(s)} \xrightarrow{heat} 4Na_{(s)} + CO_{2(g)}$
B. $2MgO_{(s)} + C_{(s)} \xrightarrow{heat} 2Mg_{(s)} + CO_{2(s)}$
C. $Mgs_{(s)} + CuO_{(s)} \xrightarrow{heat} MgO_{(s)} + Cu_{(s)}$
D. $2Al_{(s)} + 3K_2O_{(s)} \xrightarrow{heat} Al_2O_{(s)} + 6K_{(s)}$

38. 15.00$cm^3$ of a 0.1 M solution of an acid was completely neutralized by 45.00$cm^3$ of a 0.1 M sodium hydroxide solution. The basicity of the acid is
A. 1 B. 2
C. 3 D. 4

39. Which one of the following is molecular formula of ethene?
A. $C_2H_4$ B. $C_2H_6$
C. $C_3H_6$ D. $C_3H_8$

40. Compound R contains 15.8% of X and 84.2% of Y. The empirical formula of R is
A. $XY_3$ B. $X_2Y$
C. $XY_2$ D. $X_1Y$
**(X = 12, Y = 32)**

***Each of the questions 41 to 44 consists of an assertion (statement) on the left hand side and a reason on the right hand side. Select.***
***A. if both assertion and reason are true statements and the reason is a correct explanation of the assertion.***
***B. if both assertion and reason are true statements but the reason is not a correct explanation of the assertion.***

***C. if the assertion is true but the reason is an incorrect statement.***
***D. if the assertion is incorrect but the reason is a true statement***

| *Instructions summarised* | | |
|---|---|---|
| | *Assertion* | *Reason* |
| A | True | True(Reason is a correct explanation) |
| B | True | True (reason is not a correct explanation) |
| C | True | Incorrect |
| D | Incorrect | True statement |

.

41. Complete combustion of ethanol because in both processes a gas that and fermentation of glucose are turns lime water milky is similar processes. Produced

42. Sulphur dioxide is an acid anhydride. because it dissolves in water.

**43.** Carbon reacts with nitric acid. because carbon is an oxidizing agent.

44. Elements of group 1 of the periodic table are very electro – positive. because their outermost shell electrons are not strongly attracted by the nucleus.

*In each of the questions 45 to 50 one or more of the Answers given may be correct. Read each question carefully and then indicate on your Answer sheet according to the following.*
*A. if 1, 2, 3 only are correct.*
*B. if 1, 3 only are correct.*
*C. if 2, 4 only are correct.*
*D. if 4 only is correct*

| *Instructions summarised* | | | |
|---|---|---|---|
| A | B | C | D |
| 1,2,3 Only correct | 1,3 Only correct | 2,4 Only correct | 4 Only correct |

45. Chlorine gas can be obtained in the laboratory by
1. heating a mixture of manganese (IV) oxide and concentrated hydrochloric acid.
2. adding concentrated hydrochloric acid to lead (II) oxide.
3. the action of concentrated hydrochloric acid on potassium permanganate.
4. adding concentrated sulphuric acid to sodium chloride.

46. Which of the following may be observed if copper (II) sulphate crystals are heated strongly?
1. water vapour is produced.
2. A black residue is obtained.
3. the crystals turn white.
4. brown fumes are produced.

47. Hydrogen gas
1. is neutral to litmus solution.
2. is a reducing agent.
3. burns in air.
4. is soluble in water.

48. Which of the following ions can cause hardness in water?
1. $Mg^{2+}$ 2. $Fe^{2+}$
3. $Ca^{2+}$ 4. $Pb^{2+}$

**49.** Red hot zinc reacts with steam to form
1. water and hydrogen.
2. zinc oxide.
3. zinc hydroxide
4. hydrogen

**50.** The yield of sulphuric acid in the contact process is increased by
1. increasing pressure.
2. the presence of vanadium (V) oxide.
3. using high temperature.
4. using excess oxygen.

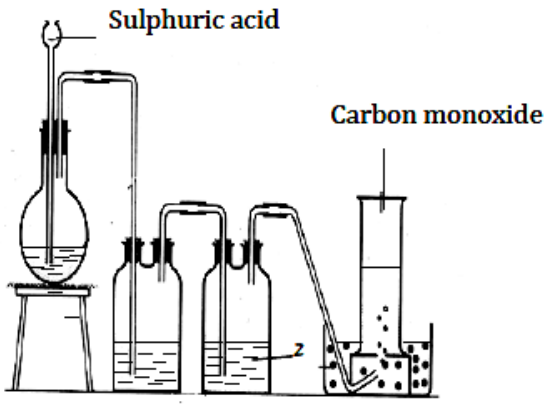
**PAPER 2 1989**
**SECTION A**

1. Carbon dioxide is prepared in the laboratory using marble chips and an acid. Choose one acid which is more suitable for preparing carbon dioxide from each of the following pairs of acids. In each case explain your answer.

(a) 1 M hydrochloric acid and 1 M sulphuric acid.
……
……

(b) 1 M ethanoic acid and 1 M nitric acid.
……
……
……
……

2. The apparatus shown in the diagram in figure 1 was used to prepare carbon monoxide in the laboratory.




(a) Name the substance in the flask that reacts with sulphuric acid.

……
……

(b) State the conditions necessary for the reaction.

……
……

(c ) Write an equation for the reaction.

……
……

(d) Identify Z and state its role.

……
……

3. A gaseous hydrocarbon, X, contains 20% hydrogen by mass 7.5g of X occupy 5.6 $dm^3$ at s.t.p

(a) Calculate

(i) the empirical formula of X.

……
……

(ii) the molar mass of X.

……
……

(iii) the molecular formula of X.

……
……

(b) Write

(i) the name of the hydrocarbon, X.

……
……

(ii) the structural formula of X.

……
……

4. Excess lead (II) oxide was added to warm dilute nitric acid and the mixture was stirred. After cooling, the mixture was filtered and a solution of sodium chloride was added to the filtrate.

(a) Write an equation for the reaction between lead (II) oxide and nitric acid.

(b) State what was observed when sodium chloride solution was added to the filtrate(c )

……
……

(c)Write an equation for the reaction in (b).

……
……

(d) Describe what happens when the mixture in (b) is heated.

……
……

**5.** When 6.5g of zinc powder were added to 250$cm^3$ of a 0.1 M copper (II) sulphate solution in plastic cup, 5.45 kJ of heat was liberated.

(a) Explain why a plastic cup was used instead of metallic cup.

……
……

(b) Writ an equation for the reaction between zinc powder and copper (II) sulphate.

……
……

(c) Calculate

(i) the number of moles of zinc in 6.5g of zinc powder.

……
……

(ii) the number of moles of zinc which reacted with copper (II) sulphate.

……
……

(iii) the heat energy produced when 1 mole of zinc reacts with 1 mole of copper (II) sulphate.

……
……

6. (a) 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.

……
……

(b) A little of the brown layer was dissolved in dilute nitric acid dilute sodium hydroxide was added dropwise until in excess.

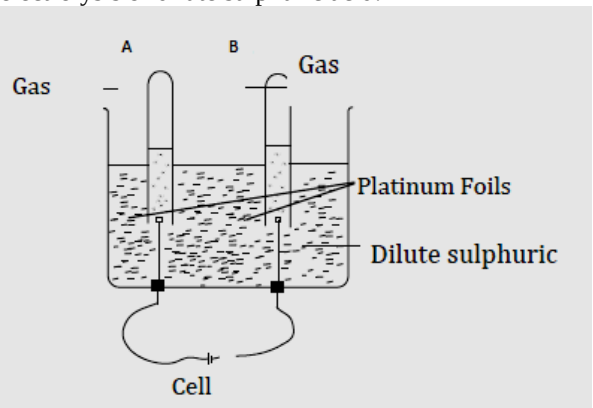
(i) State what was observed.

……
……

(ii) Write an ionic equation for the reaction.

……
……

7. Figure 2 shows the diagram of an apparatus for the electrolysis of dilute sulphuric acid.




(a) Name all the ions present in dilute sulphuric acid.

……
……

(b) Write

(i) Equations for the reaction at each electrode.

Reaction at anode

| Atom | Number of protons | Number of nuetrons |
|---|---|---|
| A | 6 | 6 |
| B | 12 | 12 |
| C | 6 | 8 |
| D | 17 | 20 |

……
……

(ii) The equation for the overall reaction.
……
……

8. Table 1 shows some tests which were carried out on a green solid, P and the observations that were made.

| Test | Observation |
|---|---|
| (i) P was heated until there was no further change | A colourless liquid on the cooler part of the test tube. Acolourless gas which turned aqueous potassium dichromate(vi) green was given out and residue R was left |
| (ii)chlorine gas was bubbled through an aqueous solution P | Solution turned from green to yellow. |

(a) Identify substances P and R.
……
……

(b) Name a substance that could be used to test for the colourless liquid.
……
……

(c) Write an equation for the reaction that took place in test (i)
……
……
(d) Explain the reactions that took place in test (ii).
……
……

9. Table II shows results obtained when soap solution was added to 10cm$^3$ of water samples P, Q and R in separate containers.
(a) Identify which sample was rain water, temporary hard water and permanent hard water. Give reasons for your Answers.

| | Before boiling | | | After boiling | | |
|---|---|---|---|---|---|---|
| Sample of water | *P* | *Q* | *R* | *P* | *Q* | *R* |
| Volume of soap solution required to form permanent lather(cm$^3$) | 2 | 8 | 5 | 2 | 8 | 3 |

(i) Rain water
Reason
……
……
(ii) Temporary hard water.
Reason
……
……
(iii) Permanent hard water
Reason
……
……
(b) Name one substance which can cause permanent hardness in water.
……
……

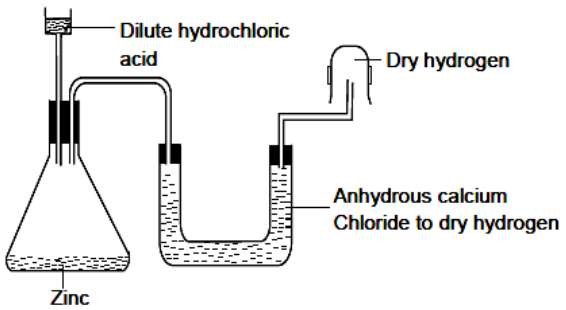
**10.** The number of protons and neutrons of atoms A, B, C and D are shown in table III.
(a) Which of these atoms are isotopes?
Give reason for your Answer.
……
……
(b) Which one of the atoms is of an element in group II of the periodic table? Give a reason for your Answer.
……
……

(c) Name the type of bond which is formed when B and D react.
……
……

**SECTION B**
***Attempt any two questions in this section***

**11.** Explain what is meant by the terms
(i) miscible liquids.
(ii) immiscible liquids
Give an example in each case.
(b) Describe how mixture of
(i) immiscible liquids
(ii) miscible liquids can be separated. In each case draw labeled diagrams to illustrate your Answer.

**12.(a)**(i) Draw a labeled diagram to show how a sample of dry hydrogen can be prepared. Your diagram should include apparatus and reagents used.




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

(b) 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.

(c ) Iron reacts with steam according to the equation
$3Fe_{(s)} + 4H_2O_{(g)} \rightarrow Fe_3O_{4(s)} + 4H_{2(g)}$
Calculate the mass of iron required to produce 2.241 of hydrogen at STP.

**13.** (a) Name one reagent that can be used to differentiate between each of the following pairs of cations. In each case state what would be observed if each cation is reacted with the reagent.
(i) $Al^{3+}_{(aq)}$ and $Pb^{2+}_{(aq)}$
(ii) $Cu^{2+}_{(aq)}$ and $Zn^{2+}_{(aq)}$
(iii) $NH^{4+}_{(aq)}$ and $Ca^{2+}_{(aq)}$

(b) Name one of reagent that reacts with $CO_3^{2-}$ (aq) and $SO_4^{2}$ (aq) to show similar observation and another one which can be used to distinguish the two anions. In each case state the observation.

**14.(a)**Sodium metal is extracted by the electrolysis of molten sodium chloride to which calcium chloride has been added.
(i) Give a reason for the addition of calcium chloride.
(ii) Name a material that can be used as the cathode and another that can be used as the anode.
(iii) Write equations for the reactions that take place at each electrode.
(iv Describe how the product at the cathode is collected.
(v) Name one other element that can be extracted by a similar method.

(b) Name a place in Uganda where a plant for the extraction of sodium could be constructed. Give a reason for your Answer.
(c) Describe what would be observed if a small piece of sodium metal was heated and quickly plunged into a gas jar of oxygen? Write an equation for the reaction that takes place.

**PAPER 1 1990**
**SECTION A**

1 .A separating funnel can be used to separate a mixture of water and petrol because the two liquids
A. are miscible
B. are immiscible
C. have different densities.
D. have different boiling points.

2. To a solution containing calcium ions, sodium carbonate solution was added followed by dilute hydrochloric acid. Which one of the following best describes what was observed?
A. A white precipitate was formed.
B. A white precipitate was formed and later dissolved.
C. A white precipitate was formed but dissolved later with effervescence.
D. Effervesce occurred and a colourless gas was evolved.

3. Which one of the following substances would form a solution in water that is acidic to litmus?
A. $NH_4CI$ B. NaCl
C. $Na_2CO_3$ D. $CH_3COONa$

4. The number of moles of sodium ions contained in $100cm^3$ of 2M solution of sodium carbonate is
A 0.2 B. 0.4
C. 2.0 D. 4.0

5. Which one of the following substances is the best conductor of electricity?
A. Aqueous ethanoic acid
B. Solid lead (II) chloride.
C. A aqueous ammonia
D. Dilute sulphuric acid.

6. When sodium nitrate is heated it gives
A. nitrogen dioxide
B. sodium oxide and nitric oxide.
C. oxygen
D. oxygn and nitrogen dioxide.

7. Which one of the following substances has giant ionic structure?
A. Iodine B. Graphite
C. Sodium chloride D. Hydrogen chloride.

8. What volume of 0.2M sodium hydroxide solution would be required to completely precipitate iron (III) hydroxide from $2cm^3$ of a 0.1M solution of iron (III) ions?
A. 0.5 B. 1.0
C. 2.0 D. 3.0

9. Which one of the following solutions reacts with marble chips to liberate carbon dioxide? A solution of
A. tartaric acid in methylbenzene
B. tartaric acid in water.
C. hydrogen chloride in benzene
D. hydrogen chloride in methylbenzene

10. Which one of the following is formed at anode when aqueous solution of copper (II) sulphate is electrolyzed between two carbon electrodes?
A. $SO_2$ B. $H_2$
C. Cu D. $O_2$

11. Ammonia solution was added drop wise to a solution of $Fe^{2+}$ ions until ammonia solution was in excess. What was observed?
A. A green
B. A green precipitate soluble in excess ammonia
C. A reddish brown precipitate
D. A redish brown precipitate soluble in excess ammonia.

12. A colourless gas was found to decolourise aqueous potassium permanganate (VII)solution, but had no effect on moist litmus paper. The gas is
A. Sulphur dioxide B. ethene
C. hydrogen chloride D. hydrogen

13. Which one of the following combinations would produce oxygen at the fastest rate?
A. $100cm^3$ of 2M $H_2O_2$ heated to $30^0C$.
B. a mixture of 1g of $MnO_2$ and $100cm^3$ of 2M $H_2O_2$ at room temperature.
C. $100cm^3$ of 1M $H_2O_2$ heated at $30^0C$
D. A mixture of $100cm^3$ of 1M $H_2O_2$ and 0.5g of $MnO_2$ heated to $30^0C$.

14. Which one of the following properties is Not shown by group VII elements? They
A. are all non – metals
B. are all gases at room temperature.
C. all form ionic compounds with group 1 elements.
D. all form diatomic molecules.

15. Which one of the following is Not a large scale use of chlorine?
A. manufacture of bleaching powder.
B. purification of drinking water.
C. electrolysis of sodium chloride
D. manufacture of plastics.

16. Which one of the following is Not a property of aqueous hydrogen chloride solution? It
A. gives a white precipitate with aqueous $Ag^+$ ions.
B. liberates hydrogen chloride gas on heating.
C. has a pH of less than 7,
D. is a proton donor.

17. Concentrated nitric acid was added to an aqueous solution of iron (II) sulphate. What was observed?
A. A brown ring
B. A pale yellow solution
C. A green precipitate
D. A green solution.

18. Lead (II) chloride can be prepared in the laboratory by the action of hydrochloric acid on
A. lead metal
B. lead (II) oxide
C. lead (II) carbonate
D. lead (II) nitrate.

19. The process by which water vapour is changed into dew is called?
A. distillation B. efflorescence
C. condensation D. evaporation.

20. Sulphur dioxide is normally prepared in the laboratory by
A. heating mixture of dilute sulphuric acid and sodium sulphite.
B. heating mixture of concentrated sulphuric acid and sodium sulphite.
C. reacting sodium sulphite with dilute sulphuric acid in the cold
D. reacting sodium sulphite with concentrated sulphuric acid in the cold

21. Atoms of elements in the same group of the periodic table have the same number of
A. outer shell electrons.
B. electrons outside the nucleus.
C. protons in the nucleus
D. neutrons in the nucleus.

22. When heated, calcium carbonate decomposes according to the equation

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

The loss in mass of calcium carbonate when 40g of the carbonate is heated to constant mass is (Ca = 40, O = 16, C = 12)

A. $\frac{100-40}{44}$ B. $\frac{40x44}{100}$
C. $\frac{100-44}{40}$ D. $\frac{100x40}{44}$

23. A metal normally reacts with dilute mineral acids to give
A. the oxide of the metal and hydrogen
B. a salt of the metal and water.
C. the hydroxide of the metal and hydrogen
D. a salt of metal and hydrogen.

24. Which one of the following carbonates is soluble in water?
A ammonium carbonate
B. lead (II)carbonate
C. zinc carbonate
D. magnesium carbonate

25. Which one of the following represents a reduction – oxidation reaction?
A. $2NaOH(aq) + CuCl_2(aq) \rightarrow Cu(OH)_2(s) + 2NaCl(aq)$
B. $2FeCl_2(aq) + Cl_2(g) \rightarrow 2FeCl_3(aq)$
C. $2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$
D. $ZnCO_3(s) + 2HNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + H_2O(l) + CO_2(g)$

26. Which one of the following hydroxides will dissolve in excess aqueous ammonia?
A. $Pb(OH)_2$ B. $AI(OH)_3$
C. $Zn(OH)_2$ D. $Fe(OH)_3$

27. Sulphuric acid reacts with sodium hydroxide according to the following equation:

$$2NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$$

The maximum volume of 0.1M sulphuric acid required to react completely with $10cm^3$ of 0.5M sodium hydroxide is
A. $10cm^3$ B. $20cm^3$
C. $25cm^3$ D. $50cm^3$

28. An atom of an element has the structure $^{20}_{10}X$. The element
A. forms covalent bonds readily with non – metals
B. forms ionic bonds with non – metal
C. belongs to group II of the periodic table
D. has full shells of electrons.

29. The percentage of oxygen in baking powder, $NaHCO_3$, is
(Na = 23, H = 1, C = 12, O = 16)

A. $\frac{48x100}{84}$ B. $\frac{16x100}{84}$

C. $\frac{16x100}{102}$ D. $\frac{48x100}{102}$

30. Which one of the following sets of elements are arranged in their correct order of reactivity, beginning with the least reactive?
A. magnesium, hydrogen, copper.
B. hydrogen, copper, magnesium
C. copper, hydrogen, magnesium.
D. hydrogen, magnesium, copper.

31. During the preparation of hydrogen from zinc and hydrochloric acid, the rate of reaction is increased by
A. heating the mixture strongly.
B. adding copper (II) sulphate to the mixture.
C. adding copper (II) oxide to the mixture.
D. adding manganese (IV) oxide to the mixture.

32.Barium carbonate reacts with dilute acids according to the following equation

$BaCO_{3(s)} + 2H^+_{(aq)} \rightarrow Ba^{2+}_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

The maximum volume of carbon dioxide that would be evolved on reacting 2.0g of barium carbonate with excess dilute hydrochloric acid at s.t.p is
($BaCO_3$ = 197; The molar gas volume at s.t.p = 22.4 $dm^3$)
A. 112$cm^3$ B. 224$cm^3$
C. 227$cm^3$ D. 448$cm^3$

33. Sodium hydrogen carbonate and sodium carbonate occur in solution in lake Magadi.
The two salts are separated by a method known as
A. fractional distillation
B. fractional crystallization
C. evaporation
D. chromatography.

34. The ion formed by the element X of atomic number 13 is
A. $X^{3+}$ B. $X^{2+}$
C. $X^{2-}$ D. $X^{3-}$

Each of the question 35 to 40 consists of an assertion (statement) on the the left hand side and a reason on the right hand side.
Select:

*A. If both assertion and reason are true statements and the reason is a correct explanation of the assertion.*
*B. if both assertion and reason are true statements but the reason is not correct explanation of the assertion.*
*C. if the assertion is true but the reason is an incorrect statement.*
*D. if the assertion is incorrect but the reason is a true statement*

.

| *Instructions summarised* | | |
|---|---|---|
| | *Assertion* | *Reason* |
| A | True | True(Reason is a correct explanation) |
| B | True | True (reason is not a correct explanation) |
| C | True | Incorrect |
| D | Incorrect | True statement |

| | | |
|---|---|---|
| 35. An impure sample of iodine can be purified by sublimation. | because | iodine is a volatile substance |
| 36. Diamond conducts electricity | because | it has a giant atomic structure. |
| 37. Chlorine bleaches moist litmus paper. | because | chlorine is a reducing agent. |
| 38. When hot platinum wire is brought into contact with ammonia vapour in air, the platinum wire glows red. | because | platinum catalyses the oxidation of ammonia |
| 39. Sodium and potassium belongs to group 1 in the periodic table. | because | sodium and potassium are both reactive metals. |
| 40. Hydrogen can be collected by upward displacement of air. | because | hydrogen is less dense than air. |

***In each of the question 41-50 one or more of the Answers given may be correct. Read each question carefully and then indicate on your Answer sheet according to the following:***
***A. if 1,2,3 only are correct.***
***B. if 1,3 only are correct***
***C. if 2,4 only are correct***
***D. if 4 only is correct***

| *Instructions summarised* | | | |
|---|---|---|---|
| A | B | C | D |
| 1,2,3 Only correct | 1,3 Only correct | 2,4 Only correct | 4 Only correct |

41. Which of the following would be formed when anhydrous copper (II) carbonate is heated strongly?
1. A white solid 2. A black solid 3. Oxygen 4. Carbon dioxide

42. When sulphur dioxide is passed through sodium hydroxide solution for a long time, which of the following products is formed?
1. sodium sulphate 2. sodium sulphite

3. sodium hydrogen sulphite. 4. sodium hydrogen

43. Which of the following will take place when a piece of burning phosphorus is lowered into a gas jar of oxygen?
1. the phosphorus burns with a bright flame.
2. there is an increase in weight.
3. an acid anhydride is formed.

4. a colourless gas is formed.

44. Which of the following gases cannot be dried using concentrated sulphuric acid?
1. hydrogen sulphide
2. hydrogen chloride
3. ammonia
4. sulphur dioxide.

45. A compound
1. can have varying composition
2. can only be decomposed by chemical meAns.
3. has properties that are the sum of the properties of its constituents.
4. contains elements which are chemically combined together.

46. Which of the following can affect the rate of reaction of gases?
1. size of the molecules
2. temperature
3. surface area
4. pressure.

47. Which of the following ions will form a precipitate with soap solution?
1. $HCO_3^-$ 2. $NH_4^+$
3. $SO_4^{2-}$ 4. $Mg^{2+}$

48. Which of the following are observed when potassium metal is put in water?
1. The metal reacts violently and catches fire.
2. The metal floats but moves about the water surface.
3. The resultant solution turns litmus blue.
4. Bubbles of a gas can be seen.

49. Which of the following solutions contain the same concentration of $H^+$ ions?
1. 1 litre of 1M $H_2SO_4$
2. 2 litres of 1M HCI
3. 1 litre of 2M HCl
4. 1 litre of 2M $H_2SO_4$

50. When a solution of copper (II) sulphate is electrolysed using copper electrodes
1. the anode loses weight. 2. the colour of the solution remains the same.
3. the cathode gains weight 4. the solution turns to colourless eventually.

## PAPER 2 1990
## SECTION A

1. Oxygen can be prepared in the laboratory using hydrogen peroxide and a substance X.
(a) Name X.
……
……
(b) Write an equation leading to the formation of oxygen.
……
……
(c ) State
(i) the role of X
……
……
(ii) the conditions for the reaction.
……
……
(d) Name one process that increases the amount of oxygen in the atmosphere.
……
……

2. (a) A compound Q contains 14.3% hydrogen, the rest being carbon. Calculate the empirical formula of Q
……
……
(b) the relative molecular mass of Q is 28. Determine the molecular formula of Q.
……
……

(c ) Write an equation for the reaction between Q and hydrogen in the presence of a catalyst.
……
……

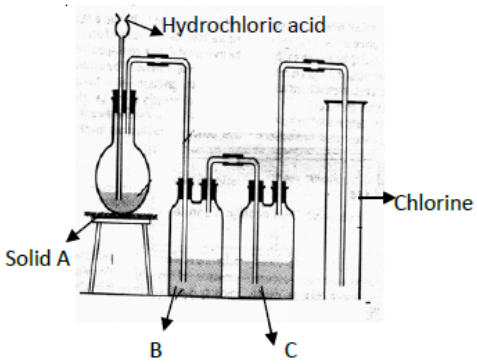
3. (a) When methane burns in oxygen, heat is produced. Write an equation for the combustion of methane in excess oxygen.
……
……
(b) The heat of combustion of methane is $^-890kJ\ mol^{-1}$. Calculate the volume of methane at s.t.p that when burned in excess oxygen would raise the temperature of 178g of water by $10^0C$. (s.h.c.of water = $4.2J/g/^0C$)
……
……
……
……

4. Part of the periodic table indicating the position of elements W, X and Z is shown below.
(a) (i) Write the formula of the oxide of W.
……
……

(ii) The oxide of W was dissolved in water.
State whether the resultant solution is acidic, neutral or alkaline. Explain your Answer.
……
……
(b) Write the formula of the compound formed between X and Z.
……
……

(c ) Which one of the atoms W, X, and Z has the largest atomic radius?
……
……

5. The diagram in figure below shows a set up of the apparatus for the laboratory preparation of dry chlorine from hydrochloric acid.




(a) (i) Name substances A, B and C.

……

……

(ii) State the role of substances B

……

……

(b) State the condition for the reaction.

……

……

(c ) Write an equation for the reaction.

……

……

6. (a) Smoke was put in a glass – cell and viewed under a microscope.

(i) State what was observed.

……

……

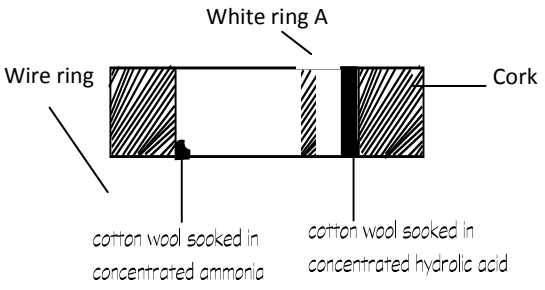
(ii) Explain the observation in (i)

……

……

(b) One piece of cotton wool was soaked in concentrated ammonia and another in concentrated hydrochloric acid. The two pieces of cotton wool were placed in a glass tube as shown in figure below

.




(i) Write the formula of the substance that formed the white ring

……

……

(ii) Explain why the white ring is formed in the position A not in the middle of the tube.

……

……

7. The number of electrons, protons and neutrons in atoms A, B, C and D are shown in the table below.

| Atom | Electrons | Protons | Neutrons |
|---|---|---|---|
| A | 8 | 8 | 8 |
| B | 16 | 16 | 16 |
| C | 13 | 13 | 14 |
| D | x | 3 | 4 |

(a) Determne

(i) the value of x

……

……

(ii) the approximate relative atomic mass of C

……

……

(b)Write the electronic configurations of the following atoms and ions.

(i) A

……

……

(ii) $A^{2-}$

……

……

(iii) C

……

……

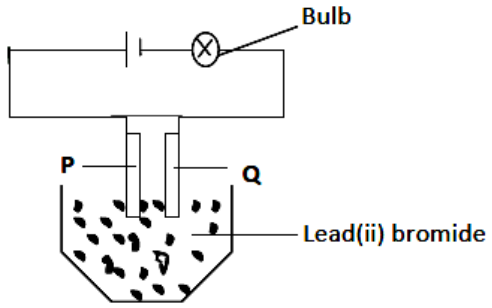
(iv) $C^{3+}$

(c) State two atoms that are of elements in the same group in the periodic table.

……

……

8. The circuit shown in the diagram below was used in the experiment to study the effect. Electricity on the lead (II) bromine




(a) State what was observed

(i) before lead (II) bromine had melted.

……

……

(ii) after lead (II) bromine had completely melted

……

……

(b) Explain your Answer in (a)

(c) Write an equation for the reaction that took place at

(i) P

……

……

(ii) Q

……

……

When 0.107g of ammonia chloride was heated with excess calcium hydroxide, a gas was evolved.

(a) Write an equation for the reaction

……

……

(b) Calculate the volume of gas that was evolved at room temperature.

……

……

10. State what would be observed and write ionic equation (s) for the reaction that takes place.

(i) a solution of silver nitrate is added to potassium chloride solution.

……

……

(ii) sodium hydroxide solution is added drop wise until in excess to solution of aluminum sulphate.

……

……

SECTION B

11. 8g of zinc powder was added to $50cm^3$ of 1M hydrochloric acid in a conical flask.

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

(b) (i) Describe how the rate of reaction can be determined. Draw a diagram to illustrate your r.

(ii) Sketch a graph to show the rate of reaction. Label this graph X.

(c ) In another experiment, 8g of zinc powder was added to $100cm^3$ of 0.5M hydrochloric acid.

(i) Sketch a graph for the rate of the reaction using the same axes in b(ii). Label this graph Y.

(ii) Explain the shapes of the two graphs.

12. (a) One of the ores from which iron can be extracted is siderite, $FeCO_3$

Name and write the formula of the two other ores from which iron can be extracted.

(b) Outline the process by which iron metal is obtained from one of the ores you have named in (a). Write an equation for the reaction that takes place.

……

……

(c ) Iron rusts when exposed to moist air.

Give two methods by which iron can be prevented from rusting.

……

……

13. (a) Describe how sodium carbonate powder can be obtained in the laboratory starting from sodium hydroxide. Write an equation for the reaction that takes place.

(b) Crystals of sodium carbonate decahydrate ($Na_2CO_3 . 10H_2O$) were exposed to air for about two days.

(i) State what was observed.

(ii) Name the process that has taken place.

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

(c ) Calculate the numer of moles of sodium ions in one litre of 2M sodium carbonate solution.

14. (a) Beer or crude ethanol is manufactrured by process a known as fermentation.

(i) Explain what is meant by the term fermentation.

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

(iii) Is the process of fermentation endothermic or exothermic?

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

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

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

PAPER 1 1991

SECTION A

1. Which one of the following mixtures is best separated by chromatography?

A. Ink B. Crude petroleum C. Water and oil D. Water and ethanol.

2. Which one of the following oxides is soluble in excess sodium hydroxide solution and excess aqueous ammonia?

A. PbO B. ZnO

C. $Al_2O_3$ D. $Fe_2O_3$

3. Which one of the following gases is a major sewerage product?

A. $N_2$ B. $SO_2$

C. $C_2H_6$ D. $CH_4$

4. The volume of 0.01 M sodium hydroxide is required to react exactly with $25.0cm^3$ of 0.02M hydrochloric acid is

A. $12.5cm^3$ B. $25.0cm^3$

C. $50.0cm^3$ D. $75.0cm^3$

5. Solution X forms a white precipitate with silver nitrate solution. The precipitation is insoluble in nitric acid. X is likely to contain.

A. $SO_4^{2-}$ B. $CI^-$

C. $NO_3^-$ D. $CO_3^{2-}$

6. Which one of the following reactions does Not normally require a catalyst?

A. production of oxygen from hydrogen peroxide.

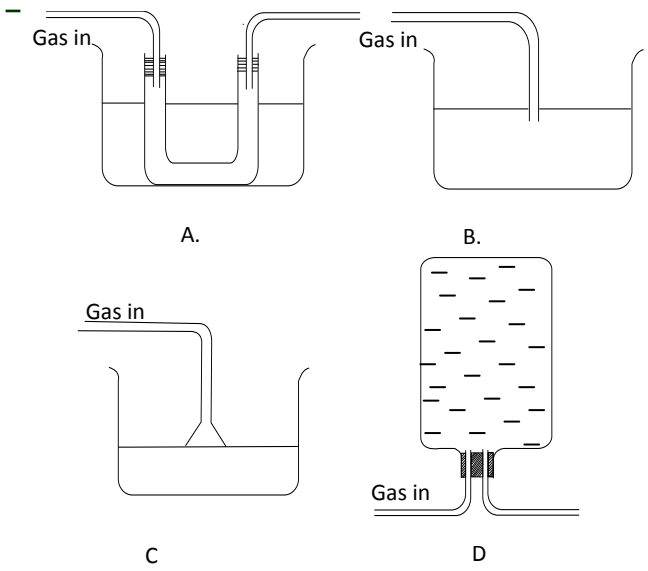
B. synthesis of sulphur trioxide from sulphur dioxide and oxygen.

C. synthesis ammonia from nitrogen and hydrogen.
D. production of chlorine from manganese (IV) oxide and concentrated hydrochloric acid.

7. Which one of the following substances has a giant atomic structure?
A. Sulphur B. Iodine
C. Diamond D. Phosphorus.

8. The mass of nitric acid ($HNO_3$) required to make $200cm^3$ of a 2M solution is
A. 31.5g B. 25.2g
C. 15.8g D. 12.6g

9. Which one of the following set up of apparatus can be used for the preparation of ammonia solution?




10. Which one of the following nitrates does Not give off brown fumes when heated?
A. $Mg(NO_3)_2$ B. $NaNO_3$
C. $Ca(NO_3)_2$ D. $Ba(NO_3)_2$

11. Which one of the following is an electronic configuration of an atom of an inert gas?
A. 2 : 8 : 8 B. 2 : 8 : 7
C. 2 : 8 : 6 D. 2 : 8 : 8 : 1

12. Copper (II) carbonate when heated in air decomposes according to the equation
$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$
What volume of carbon dioxide is produced at s.t.p when 0.5 moles of copper (II) oxide is formed?
( Cu = 64, O = 16, 1 mole of gas at STP occupies 22.4 $\ell$ )
A. 112.0 $\ell$ B. 44.0 $\ell$
C. 22.4 $\ell$ D. 11.2 $\ell$

13. The number of neutrons in the nucleus of an atom ${}^{37}_{17}X$
A. 17 B. 20
C. 37 D. 54.

14. An oxide of metal Z reacts with magnesium when heated but it does Not react with copper. The order of reactivity of Z, magnesium and copper starting with the most reactive is
A. Cu, Z, Mg B. Z, Mg, Cu C. Mg, Cu, Z
D. Mg, Z, Cu.

15. Which of the following formula represents an alkene?
A. $C_3H_8$ B. $C_3H_6$
C. $C_2H_2$ D. $C_2H_6$

16. 5.3kJ of heat energy is required to vaporize 13g of a liquid of relative molecular mass 78. The heat of vaporization of the liquid in kJ $mol^{-}1$ is
A. 78.0 B. 68.9
C. 31.8 D.11.3

17. Which one of the following substances sublimes when heated?
A. ZnO B. $CaCl_2$
C. $l_2$ D. P

18. Hot excess concentrated sulphuric acid reacts with ethanol to give a gas which decolourizes bromine water. The gas is
A. methane B. ethane
C. ethyne D. ethane.

19. The atomic numbers of elements Q, R, S, T are 8 9, 13 and 17 respectively, which one of the following pairs of elements belong in the same group in the periodic table?
A. Q and R B. Q and S
C. R and T D. S and T

20. Which one of the following salts can be prepared by neutralization?
A. $CaSO_4$ B $PbSO_4$
C. $ZnSO_4$ D. $(NH_4)_2SO_4$.

21. The mass of copper deposited when 240 coulombs of electricity is used in the electrolysis of copper (II) sulphate is
A. $\left[\frac{240x64}{2x96,500}\right]g$ B. $\left[\frac{64x96,500}{2x240}\right]g$
C. $\left[\frac{240x2x64}{96,500}\right]g$ D. $\left[\frac{2x96,500}{240x64}\right]g$

22. Which one of the following compounds dissolves in water to give a solution with a pH greater than 7 ?
A. $CH_3COONa$ B. $NH_4CI$
C. $CO_2$ D. $SO_2$

23. The red brown coating formed when iron nail is left in moist air for a long time is
A. hydrogen iron (II) oxide
B. hydrated iron (III) oxide
C. an hydrous iron (II) oxide
D. an hydrous iron (III) oxide.

24. Which of the following gases turns a solution of potassium dichromate (VII) green?
A. $CI_2$ B. $NO_2$
C. $CO_2$ D. $SO_2$

25. Which one of the following hydroxides when exposed to air turns brown?
A. $Pb(OH)_2$ B. $Fe(OH)_2$
C. $Zn(OH)_2$ D. $Mg(OH)_2$

26. Which one of the following methods is normally used to prepare hydrogen in the laboratory?
A. Electrolysis of water
B. Action of water on magnesium
C. Action of dilute hydrochloric acid
D. Action of steam on zinc.

27. An oxide of an element X is made up of 50% X. The simplest formula of the oxide is (X = 32, O = 16)
A. XO B. $X_2O$
C. $XO_2$ D. $X_2O_3$

28. A carbonate of an element Y has the formula $Y_2(CO_3)_3$. To which group in the periodic table does Y belong?
A. 1 B. 2
C. 3 D. 4.

29. Which one of the following metals can burn in both oxygen and carbon dioxide?
A. AI B. Ca
C. Fe D. Mg.

30. Which one of the following equations does Not represent reduction reaction?
A. $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$
B. $Fe_{(s)} \rightarrow Fe^{3+}_{(aq)} + 3e$
C. $CI_{2(g)} + 2e \rightarrow 2Cl^-_{(aq)}$
D. $Cu^{2+}_{(aq)} + 2e \rightarrow Cu_{(s)}$

31. Which one of the following reagents is used for softening hard water?
A. $Na_2CO_3$ B. $NaSO_4$
C. $CaCO_3$ D. $CaSO_4$

32. When a stream of air is passed through sodium hydroxide solution and then over heated copper, the residual gas is mainly
A. Ne B. $CO_2$
C. $O_2$ D. $N_2$

33. The reaction between dilute hydrochloric acid magnesium ribbon is fast at the beginning and gradually slows down there after. This observed gradual decrease in the rate of reaction is due to the
A. gradual decrease in number of hydrogen ions during the reaction.
B. insolubility of magnesium chloride being produced
C. increase in the pressure above the reaction vessel brought about by the hydrogen gas being produced.
D. endothermic reaction between magnesium ions and chloride ions.

34. Methane burns in oxygen according to the equation
$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$
If $10cm^3$ of methane and $20cm^3$ of oxygen are mixed and exploded and final products cooled to room temperature, the final gaseous volume is
A. $10cm^3$ B. $15cm^3$
C. $25cm^3$ D. $30cm^3$

*In each of the question 41-50 one or more Answers given may be correct. Read each question carefully and then indicate on your Answer sheet according to the following*:
*A. if 1,2,3 only are correct.*
*B. if 1,3 only are correct*
*C. if 2,4 only are correct*
*D. if 4 only are correct*

| *Instructions summarised* | | | |
|---|---|---|---|
| A | B | C | D |
| 1,2,3 Only correct | 1,3 Only correct | 2,4 Only correct | 4 Only correct |

35. Element Y burns with a yellow flame and react vigorously with water producing an alkaline solution and a gas that gives a pop sound with a lighted splint. Which of the following is / are correct?
1. Y could be a group 1 element.
2. the gas given off is hydrogen.
3. Y burns in air forming a basic oxide
4. Y will most likely form a covalent chloride.

36. When water is added to quick lime
1. heat is given off
2. there is hissing sound
3. the quick lime crumbles to powder
4. the quick lime dissolves

37. Which of the following substances are efflorescent?
1. $MgSO_4 . 7H_2O$ 2. $NaB_2O_7 . 10H_2O$
3. $NaCO_3 . 10H_2O$ 4. $CaCI_2 . 2H_2O$

38. Which of the following are mixtures?
1. diamond 2. brass
3. aluminum 4. steel.

39. When copper (II) sulphate solution is electrolysed using platinum electrodes.
1. copper is formed at the anode.
2. the colour of the solution remains unchanged.
3. oxygen is produced at cathode.
4. the final solution is acidic.

40. Which of the following conditions does Not affect the rate of the reaction between lumps of calcium carbonate and dilute hydrochloric acid?
1. grinding the calcium carbonate 2. adding iron powder to mixture
3. warming the reaction mixture 4. exposing the reaction mixture to light.

41. When magnesium is burnt in air
1. there is an increase in mass 2. bright light is observed
3. magnesium nitride is formed 4. there is a decrease in mass.

42. Ionic compounds are generally
1. conductors of electricity when in molten state only.
2. soluble in water
3. soluble in solvents
4. have high melting points.

43. Which of the following compounds is / are used in the purification of water?
1. calcium hypochlorite.
2. calcium chloride
3. chlorine gas
4. carbon dioxide gas.

44. Which of the following salts when in solution will form a white precipitate with dilute hydrochloric acid?
1. $Zn(NO_3)_2$ 2. $AgNO_3$
3. $Ca(NO_3)_2$ 4. $Pb(NO_3)_2$

45. Which of the following substances can be displaced by chlorine in a chemical?
1. Fluorine 2. Iodine
3. Hydrogen 4. Bromine.

| *Instructions summarised* | | |
|---|---|---|
| | *Assertion* | *Reason* |
| A | True | True(Reason is a correct explanation) |
| B | True | True (reason is not a correct explanation) |
| C | True | Incorrect |
| D | Incorrect | True statement |

46. During the electrolysis of brine by using carbon electrodes, chlorine is liberated at the anode **because** chloride ion is higher in the electrochemical series than hydroxide ion

47. Ammonium chloride and sodium chloride are separated by sublimation **because** sodium chloride has lower melting point than ammonium chloride.

48. When sulphur dioxide reacts with iron (III) sulphate, the solution turns from brown to green. **because** sulphur dioxide is oxidized by iron (III)ions

49. Water purified by filtration is made suitable for drinking by adding alum (potassium aluminum sulphate) **because** alum kills all the bacteria in water.

50. Rubber is more elastic than Polythene **because** rubber is a natural polymer

## PAPER 2 1991
## SECTION A

1. The atomic number of element Q is 13
(a) Write the electronic configuration of an atom of Q.
……
……

(b) To which group of the periodic table does Q belong?
……
……

(c) State whether Q would conduct electricity or not.
……
……

(d) (i) Write the formula of the oxide of Q.
……
……

(ii State the type of bonding in the oxide of Q.

2. 2.5g of zinc carbonate was heated strongly until there was no further change.
(a) State what was observed.
……
……

(b) Write an equation for the reaction.
$Zn\,CO_3(s) \rightarrow ZnO(s) + CO_2(g)$
……
……

(c) Calculate the mass of the residue.
……
……

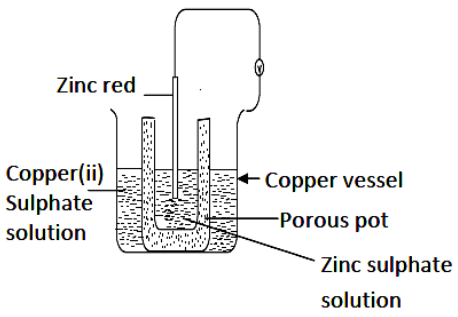
3. (a) Write the structural formula of ethene.
……
……

(b) Ethene can be prepared by reacting ethanol with sulphuric acid.
State the conditions for the reaction.
……
……

(c) (i) State what would be observed when ethene is reacted with bromine.
……
……

(ii) Write an equation for the reaction.
……
……

4. Figure 1 shows a diagram of an electrochemical cell



(a) (i) Write an equation for the overall cell reaction.
……
……

(ii) State what would be observed if the reaction is allowed to continue for a long time.
……
……

(b) The reading on the voltmeter V, was 1.1 V. Calculate the energy, in kJ, produced.
……
……

5. A hydrocarbon, R, contain 80% carbon by mass.
(a) Calculate the empirical formula of R.
……
……

(b) If the molecular mass of R is 30, determine the molecular formula……
……

(c) Write an equation for complete combustion of R.
……
……

6. Part of the periodic table is shown below. The letters are not the usual symbols for the elements.

| I | II | | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | T | |
| P | Q | | | S | | U | | |
| | | | | | | | W | V |

(a) Which is the least reactive element?
……
……

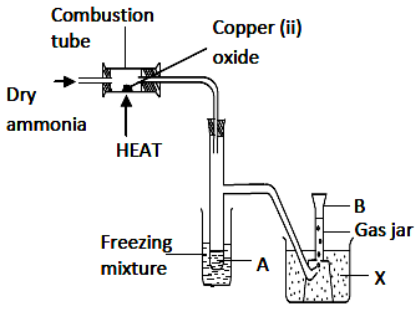
(b) Which one of the elements T, U and W react most vigorously with Q?
……
……

(c) Write the formula of the compound formed between Q and S.
……
……

(d) The compound formed between P and W was dissolved in water
State whether the resultant solution was acidic, basic or neutral.
……
……

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

7. Substances A and B were obtained from a reaction between ammonia gas and copper (II) oxide using the apparatus shown in the diagram in figure below.




(a) Name substance
(i)
……
……
(ii)
……
……

(b) Write an equation for the reaction that takes place in the combustion tube.
……
……

(c) State why it is not possible to collect excess ammonia in the gas jar.
……
……

(d) Name one other oxide that can be used instead of copper (II) oxide.
……
……

8. In an experiment to measure the volume of carbon dioxide evolved when excess hydrochloric acid reacts with a known mass of sodium carbonate, a small amount of the carbonate is added to the acid before adding the weighed mass of the carbonate.
(a) State the purpose of adding a small amount of sodium carbonate before adding a known mass of the carbonate.
……
……

(b) Write an equation for the reaction.
……
……

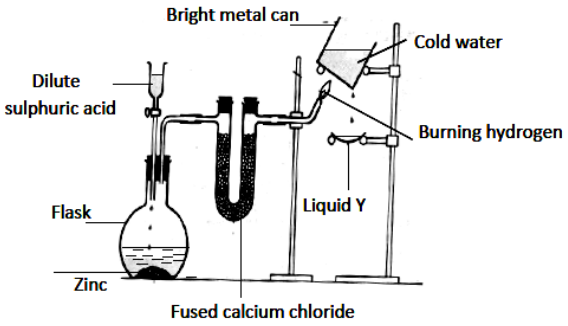
(c) Calculate the mass of sodium carbonate that would be required to liberate 120cm$^3$ of carbon dioxide at room temperature.
……
……

9. Copper (II) sulphate -5- water decomposes when heated
(a) State what would be observed when copper (II) sulphate -5- water is strongly heated
The blue crystals turn to white anhydrous $CuSO_4$ and with strong heating the white CuSO4 decomposes into a black Oxide (CuO) and a colourless acidic gas – $SO_3$.
……
……

(b) Write an equation for the reaction.
$CuSO_4 . 5H_2O_{(s)} \rightarrow CuSO_{4(s)} + 5H_2O_{(l)}$
$CuSO_{4(s)} \rightarrow CuSO_{(s)} + SO_{3(g)}$
……
……

(c ) Name one reagent that can be used to convert the residue back to copper (II) sulphate
Water.
……
……

10. The diagram below in figure 3 shows a set up of the apparatus which was used to prepare hydrogen and to show that it burns to form a liquid, Y.
The hydrogen produced was allowed to pass through the apparatus for some time before it was lit.




(a)(i) Name liquid Y.
……
……
(ii) Describe one chemical test that can be used to identify liquid Y.
……
……
(iii) Explain why hydrogen was allowed to pass through the apparatus for some time before being lit.
……
……

(b) Write an ionic equation for the reaction between zinc and dilute sulphuric acid.
$Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(aq)$
……
……

**SECTION B**

11. (a) Describe how sulphur is extracted by the Frasch process.
(b) Write equations to show how fuming sulphuric acid can be obtained from sulphur.
(c ) State what would be observed if concentrated sulphuric acid is added to sugar.

12. (a) Describe how you would prepare pure crystals of lead (II) nitrate in the laboratory starting from lead (II) oxide.
Write an equation for the reaction that takes place.
(b) State what happens when lead (II) nitrate is strongly heated.
(c) State what is observed if ammonia solution is gradually added to a solution of lead (II) nitrate until the alkali is in excess.
Write an equation for the reaction hat takes place.

(d) Lead (II) ions react with iodide ions according to the following equation:
$Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI(s)$
$400cm^3$ of 0.1 M solution of iodide ions was added to a solution containing excess lead (II) ions Calculate the mass, in grams, of lead (II) iodide formed.

13. (a) Explain each of the following observations. Write an equation to illustrate your Answers.
(i) When zinc dust is put into a solution of copper (II) sulphate, the blue colour of the solution fades and solution becomes hot.
(ii) When a test tube filled with chlorine water is inverted into a trough of water and the set up exposed to sunlight, a gas which relights a glowing split is produced in the test tube.
(b) $25.0cm^3$ of 0.1M sulphuric acid had a pH less than 7. A solution of sodium hydroxide was gradually added and pH gradually increased. After $20.0cm^3$ of the sodium hydroxide solution had been added the resultant solution had a pH of 7.
(i) Explain why the pH of the acid increased when sodium hydroxide solution was added.
(ii) Calculate the concentration of the sodium hydroxide solution in moles per litre.

14. (a) Draw a well labeled diagram to show how a sample of dry hydrogen chloride can be prepared.

(b) Dry hydrogen chloride gas was passed over heated iron fillings. Write an equation for the reaction that took place.
(c) The solid product in (b) was dissolved in water and aqueous sodium hydroxide added to the resultant solution drop wise until in excess.
(i) State what was observed.
(ii) Write an equation for the reaction.

(d) Chlorine gas was passed through a solution of the product in (b).
(i) State what was observed.
(ii) Write an ionic equation for the reaction.

(e) Name one reagent that can be used to test for
(i) the cation formed in (d)
(ii) the anion formed in (d).
In each case state what is observed when the reagent you have named is used.

(ii)To test for $Cl^-$ ions – use acidified silver nitrate solution – a white precipitate is formed, soluble in aqueous ammonia.

**`CHEMISTRY Paper 1/2017**
**1 hour 30MINUTES**
***Answer all questions***

**1.** mass is an alloy of
A. Lead and tin.
B. Iron and Carbon.
C. copper and Zinc.
D. Magnesium and aluminum.

**2.** A mixture of sodium carbonate and sodium hydrogen carbonate can best be separated by fractional crystallization because the two salts have different
A. densities.
B. solubilities.
C. melting points.
D. boiling points.

**3 .** The atomic number of an element T is 15 which one of the following is the nature of the oxide of T?
A .Acidic.
B. Neutral.
C. Basic.
D .Amphoteric.

**4.** Which one of the following substances is formed sodium is burnt in limited amount of air?
A. Sodium oxide
B .Sodium peroxide.
C. Sodium Carbonate.
D. Sodium nitride.

**5.** Which one of the following allotropes of sulphur is stable above 96C?
A. Monoclinic Sulphur
B. Rhombic sulphur
C. Plastic Sulphur
D. Amorphous sulphur

**6.** The atomic numbers of elements W,X,Y and Z are 9,11,12,and 14 respectively, Which one of the following pairs of elements can combine to form a coverlet compound.
A. W and X.
B. X and Y.
C.Y and Z.
D.Z and W.

**7.** Which one of the following anions when in solution would form a yellow precipitate with lead(II)ions?
A.Cl-(aq)
B.CO3 2-(aq)
C. I-(aq)
D.SO4 (aq)

**8.** Which one of the following carbonates when heated decomposes without leaving a solid residue?
A. Ammonium carbonate.
B. Copper (II)carbonate
C. Magnesium carbonate.
D.Lead(II)carbonate

**9.** In which one of the following gases with magnesium burn to form a white solid that will react with water to form ammonia?
A.$NO_2$
B.N2O
C.NO.
D.$N_2$

**10.** The full symbol of an atom element Z is 39/19Z.Which one of the following is the number of neutrons in the nucleus of Z?
A.19
B.20
C.39
D.58

**11.** Which one of the following properties is true about carbon and sulphur? Both elements.
A .Form covalent compounds only
B. Form acidic oxides only
C. Conduct electricity
D. Have allotropes.

**12.** Which one of the following substances can conduct electricity either in solution or molten state?
A. Hydrogen chloride.
B. Sugar
C. Ethanol.
D. Sulphur.

**13.** Which one of the following substances contain the same number of moles as $10cm^3$of a 0.5m nitric acid?(1 mole of gas occupies 22.4 $dm^3$ at atp H=1:c=12:N=14)
A. 5.6$dm^3$ of carbon deoxide at stp
B. 17gof ammonia.
C.112 $cm^3$ of Oxygen at stp
D.12g of Carbon.

**14.** Which one of the following metals is used in the laboratory preparation of hydrogen?
A. Iron
B. Zinc
C. magnesium
D. potassium

**15** which one of the following set as of the compound belonged to the same hamologous series?
A.$C_2H_4$, $C_3H_6$ *and* $C_4H_8$
B. $C_2H_6$, $C_2H_2$ *and* $C_3H_8$
C. $C_2H_2$, $C_3H_6$ *and* $C_4H_{10}$
D $C_2H_6$, $C_2H_{10}$ *and* $C_3H_8$

**16.** The atomic number of elements T,U,V and Z are 11,16,17 and 20 respectively. Which one of the elements forms an ion with a charge of negative two?
A.T.
B.U.
C.V.
D.Z

**17.**Sulpric acid reacts with sodium hydroxide according to the following equation
Which one of the following is the volume of 2M sulpheric acid required to react completely with $10cm^3$ of a 2M sodium hydrdoxide solution?
A.50 $cm^3$
B.10.0$cm^3$
C. 30.0$cm^3$
D.40.0$cm^3$

**18.** when a piece of copper was powered into a bell jar of air, the volume of air in the jar decreased which one of the following gasses caused the decrease in the volume?
A. Water Vapour
B. Carbondioxide
C. Oxygen
D. Nitrogen.

**19.** Which one of the following substances is not decomposed when strongly heated?
A.$K_2CO_3$
B.$NaNO_3$
C.$FeSO_4$
D.$NaHCO_3$

**20.** Which one of the following pairs of substances will react when strongly heated together?
A. Magnesium Oxide and iron
B. Zinc and aluminium oxide
C. Iron(III)oxide and copper.
D. Lead(II)oxide and magnesium

**21.** Ammonia burns in oxygen according to the following Equation
The maximum volume required to burn $60cm^3$ of ammonia is?
A.45$m^3$
B.80$cm^3$
C.90$cm^3$
D.180$cm^3$

**22.** The electronic configuration of elements X and Y are 2:8:3 and 2: 6 respectively .which one of the following is the formula of the compound formed between X and Y?
A.$XY_3$
B.$X_2Y_3$
C.$X_2Y$
D.$X_3Y_2$

**23.** Which one of the following equations represents the reaction that does not take place during the manufacture of nitric acid from ammonia?
A. $4NH_{2\,(g)} + 5O_{2(g)} \longrightarrow NO_{g)} + 6H_2O_{2(l)}$
B. $4NO_{2\,(g)} + 6H_2O_{2(l} + O_{2(g)} \longrightarrow 4HNO_{3\,(aq)}$
C. $4NH_{3\,(g)} + 3O_{2(g)} \longrightarrow 6H_2O_{2(l)} + 2N_{2\,(g)}$
D. $2NO_{(g)} + O_{2(g)} \longrightarrow 2NO2_{(g)}$

**24.** 0.4g of metal hydroxide MOH reacted completely with $20cm^3$of a 0.5M hydrochloric acid. The relative formula mass of MOH is?
A. $\left(\frac{05 \times 20}{0.4 \times 1000.}\right)$
B. $\left(\frac{0.4 \times 20 \times 0.5}{1000.}\right)$
C. $\left(\frac{1000 \times 0.5}{0.4 \times 20.}\right)$
D. $\left(\frac{0.4 \times 1000}{0.5 \times 20.}\right)$

**25.** Which one of the following carbonates will react with dilute sulphric acid to give a blue solution and a gas that turns lime water milky?
A. Zinc carbonate
B. Iron(II)carbonate
C. Magnesium carbonate.
D. Copper (II) carbonate.

**26.** Whicch one of the following substances will react with ammonium chloride to form ammonia?
A. $HNO_3$
B. CuO
C. KOH
D. $SO_2$

**27.** When a solution containing 2g of sodium hydroxide was completely reacted with hydrochloric acid,2730 J of heat was evolved. Which one of the following is the heat neutralization of sodium hydroxide by hydrochloric acid? (NaOH=40)
A. $-\left(\frac{2730 \times 2}{100 \times 40.}\right) kJmol^{-1}$
B. $-\left(\frac{1000 \times 40}{2 \times 2730.}\right) kJmol^{-1}$
C. $-\left(\frac{2730 \times 1000 \times 2}{40}\right) kJmol^{-1}$
D. $-\left(\frac{2730 \times 40}{1000 \times 2.}\right) kJmol^{-1}$

**28.** Which one of the following gasses can bleach flowers but not litmus paper?
A. Sulphur dioxide
B. Nitrogen dioxide
C. Sulphur trioxide
D. Chlorine.

**29.** Which one of the following is the concentration of grams per liter of a solution that contains 0.05moles of sodium chloride in 50cm3?
A $\left(\frac{0.05 \times 50}{1000 \times 58.5.}\right)$
B. $\left(\frac{0.05 \times 1000 \times 58.5}{50.}\right)$
C. $\left(\frac{0.05 \times 50 \times 58.5}{1000.}\right)$
D. $\left(\frac{1000 \times 50}{58.5 \times 0.05}\right)$

**30.** Which one of the following statements is true about Chlorine?
A. it displaces fluorine from solution of its salts.
B. Its a reducing agent.
C. Its less dense than air.
D. it forms a precipitate with Lead (II) nitrate solution.
31. Which one of the following equations represents a redox reaction?
A. $Pb^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow PbSO_{4(s)}$

B. $CO_3^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \longrightarrow H_2O_{(l)} + CO_{2\,(g)}$
C. $Fe_{(s)} + 3Cl2_{(g)} \longrightarrow 2FeCl3_{(s)}$
D. $HCl_{(aq)} + NaOH \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

**32.** When 0.25g of methanol was burnt, the heat evolved raised the temperature of 85g of water from 20.3 C. Which one of the following is the molar heat of combusion of methanol? (The specific heat capacity of water =4.2jg-1 k-1,C=12, H=1, O=16)

A. $\left(\frac{85 \times 4.2 \times 32 \times 33}{0.52 \times 1.}\right)$J
B. $\left(\frac{0.52 \times 1}{85 \times 4.2 \times 32 \times 33.}\right)$J
C. $\left(\frac{85 \times 4.2 \times 33}{0.52 \times 32 \times 1.}\right)$J
D. $\left(\frac{0.52 \times 32 \times 1}{85 \times 4.2 \times 33.}\right)$J

**33.** Which one of the following acids when reacted with given mass of copper (II) Carbonate will liberate the least amount of carbondioxide?
A.1M sulphuric acid
B. 2M nitric acid
C.2M ethanoic acid
D. 2M hydrochloric acid

**34.**The mass of oxalic acid ($H_2C_2O_4$)required to prepare 250cm3 of a 1.5M solution of the acid is (H=1 C-12:0=16)
A. $\left(\frac{1.5 \times 250}{1000 \times 90.}\right)$g
B. $\left(\frac{1000 \times 250}{90 \times 1.5}\right)$g
C. $\left(\frac{90 \times 250}{1000 \times 1.5}\right)$g
D. $\left(\frac{1.5 \times 250 \times 90}{1000.}\right)$g

**35.** Which one of the following are produced when a small amount of carbon dioxide is bubbled into sodium hydroxide solution.
A. Sodium hydrogen carbonate and water.
B. Sodium carbonate and water.
C. Sodium hydrogen carbonate only
D. Sodium carbonate only.

**36.** The order of reactivity of the elements X,Y and Z is Z>X>Y. which one of the following equations represents a possible reaction?
A. $S_{(s)} + X^{2+}{}_{(aq)} \longrightarrow X_{(s)} + Y^{2+}{}_{(aq)}$
B. $X_{(s)} + Z^{2+}{}_{(aq)} \longrightarrow Z_{(s)} + X^{2+}{}_{(aq)}$
C. $Y_{(s)} + Z^{2+}{}_{(aq)} \longrightarrow Y^{2+}{}_{(aq)} + Z_{(s)}$
D. $Z_{(s)} + Y^{2+}{}_{(aq)} \longrightarrow Z^{2+}{}_{(aq)} + Y_{(s)}$

**37.** Chlorine reacts with iron from iron(III)chloride according to the following equation.
Which one of the following will be the volume of chlorine that would react with 5.6g of iron to produce iron (III)chloride at s.t.p?
A. . $\left(\frac{3 \times 5.6 \times 22.4}{56}\right)$l
B. $\left(\frac{3 \times 5.6 \times 22.4}{2 \times 56}\right)$l
C. $\left(\frac{3 \times 5.6 \times 22.4}{2 \times 5.6}\right)$l
D. $\left(\frac{2 \times 56 \times 22.4}{3 \times 5.6}\right)$l

**38.** The formula of iron can be formed when excess ammonia is added to aqueous solution of copper (II)ions is.
A. $Cu(OH)_4^{2+}$
B. $Cu(OH)_4^{2-}$
C. $Cu(NH_3)_4^{2+}$
D. $Cu(NH_3)_4^{2-}$

**39.** The electronic configuration of an atom of element Gis 2:8:2 which one of the following elements will show properties similar to G?
A . $^{28}_{14}Q$
B. $^{27}_{13}R$
C. $^{39}_{13}W$
D. $^{40}_{20}T$

**40.** Ammonia reacts with copper(II)oxide to form copper according to the following equation.

The mass of copper formed when 12g of ammonia is reacted with copper (II) oxide is.
A. $\left(\frac{12 \times 64}{17 \times 3.}\right)$g
B. $\left(\frac{12 \times 64}{2 \times 17.}\right)$g
C. $\left(\frac{12 \times 2 \times 64}{3 \times 17.}\right)$g
D. $\left(\frac{12 \times 3 \times 64}{2 \times 17.}\right)$g

***Each one of the questions 41 to 45 consists of an assertion (statement) on the left hand side and a reason on the right hand side.***
**Select**
A. if both the assertion and reason are true statements and the reason is a correct explanation of the assertion.

B. If both the assertion and reason are true statements but the reason is not a correct explanation of the assertion.

C. If the assertion is true but the reason is not a correct statement.

D. If the assertion is not correct but the reason is a correct statement.

**INSTRUCTIONS SUMMARISED:**

| Assertation | Reason |
|---|---|
| A. TRUE | True(Reason is correct Explanation) |
| B. True | True(Reason is not a correct Explanation) |
| C. True | Incorrect. |

| | | |
|---|---|---|
| D. Incorrect | | Correct |
| **41.** Water can be separated from it's mixture with cooking oil by using a separating funnel | **because** | Water and cooking oil have different boiling points. |
| **42.** In the manufacture of sulphuric acid by the contact process,Sulphur trioxide is dissolved in concentrated sulphuric acid instead of water. | **because** | Sulphur trioxide is insoluble in water. |
| **43.** Washing with hard water takes a lot of soap | **because** | Hard water contains sulphates and hydrogen carbonate ions |
| **44.**concetrated nitric acid reacts with sulphur to form sulphur dioxide | **because** | The concentrated acid is an oxidizing agent . |
| **45.**powdered zinc reacts faster with hydrochloric acid than equal mass of zinc foil | **because** | Zinc powder contains more atoms than zinc foil. |

***In each of the questions 46 to 50 one or more of the answers given may be correct. Read each question carefully and then indicate the correct answer according to the following:***

A If 1,2 and 3 only are correct
B. If 1 and 3 only are correct
C. If 2 and 4 only are correct.
If 4 only is correct.

**46.** Which of the following salts can be prepared by passing dry hydrogen chloride over the heated metal?
1.$CuCl_2$
2.$ZnCl_2$
3.$FeCl_3$
4.$MgCl_2$

**47.**Which of the following is/are characteristics of alkenes?
Alkenes
1.are hydrocarbons.
2.decolourise bromine water.
3.burn to form water and carbon dioxide.
4.are saturated compounds.

**48** .Which of the following oxides is/are soluble in excess potassium hydroxide solution?
1.PbO
2.CuO
3.ZnO
4.FcOf

**49.** which one of the following is/are property(ies)of aqueous hydrogen chloride?
1.it reacts with copper to form hydrogen
2.it reacts with carbonate to form carbon dioxide.
3.it bleaches litmus paper
4.it reacts with calicium oxide to form salt and water.

**50.** Which of the following is/are true about the product obtained when copper is heated in air?
1.it is a black solid
2.it reacts with sodium hydroxide.
3. it reacts with nitric acid
4.it is a brown solids.

## Paper 2
## SECTION A: (50 MARKS)
***Answer all questions m this section,***

**1.** Air is a mixture consisting mainly of two gases X and Y in the ratio 1:4 by volume respectively.
(a) Name gas
(i) X ……**(0lmark)**
(ii) Y……**(0lmark)**
(b) (i) State a suitable method by which the mixture of X and Y can be separated industrially.
……**(0l mark)**
(ii) Give a reason for the choice of the method you have stated in (b) (i).
……**(0l mark)**

(c)Name one process during which the concentration of X in the atmosphere can be increased.
**( ½ mark)**
……
……

(d) State one industrial use of Y. **( ½ mark)**
……
……
**2.** (a) State the difference between hard water and soft water. **(01 mark)**
……
……

(b) Name one substance that causes
(i) temporary hardness of water. **(01 mark)**
……
……
(ii) permanent hardness of water. **(01 mark)**
……
……

(c) State one method that can be used to remove,
(i) temporary hardness in water. **(01 mark)**
……
……
(ii) permanent hardness in water. **(01 mark)**
……
……

**3.** The number of electrons, protons and neutrons in the atoms of elements A, B, C, D and E are shown in the table below.

| Atoms | Electrons | Protons | Neutrons |
|---|---|---|---|
| A | 8 | 8 | 8 |
| B | 13 | 13 | 14 |
| C | 16 | 16 | 16 |
| D | Y | 11 | 11 |
| E | 8 | z | 10 |

(a) Determine the values of
(i) Y …… **( ½ mark)**
(ii) Z ……**( ½ mark)**

(b) State the mass number of atom C. **(½ mark)**
……..……
……

c) Indicate which of the atoms
……..……
……

(i) are isotopes. **(½ mark)**
……..……
……
(ii) belong to the same group in tbs Periodic Table. **(1½ marks)**
……..……
……

(d) Write the electronic configuration of
(i) atomC …… **( ½ mark)**
(ii) ion $A^{2-}$……..**( ½ mark)**
(iii) ion $B^{3+}$ …… **( ½ mark)**

**4.** An oxide W of formula mass 160 consists of 70.0% iron.
**(a)** (i) Calculate the empirical formula of W. (O=16,Fe=56) **( 2½ marks)**
……..……
……
……..
(ii) Deduce the formula of W. **(1½ marks)**
**……**
(b) Write the chemical name of W**. (01 mark)**
……..……
……

**5.** In the preparation of ammonia in the laboratory, a mixture of ammonium chloride and calcium hydroxide is heated. The gas evolved is passed into a tower packed with calcium oxide before it is collected using upward delivery method.
(a) (i) Write an equation for the reaction that leads to the formation of ammonia. **( 1½ marks)**
……..……
……
(ii) State why ammonia Is passed into the tower packed with calcium oxide. **( ½ mark)**
……..……
……
(iii) Give a reason why ammonia is collected using upward delivery method. **(½ mark)**
……..……
……

(b) Name one reagent that can be used to identify ammonia. **(01 mark)**
……..……
……
(ii) State what would be observed if ammonia was treated with the reagent you have named in (b)(i). **( 01 mark)**
……..……
……
(c) Name the catalyst that is used in the oxidation of ammonia during the manufacture of nitric acid. **(½ mark)**
……..……
……

**6.** (a) Hydrogen chloride can be produced from potassium chloride.
(i) Name another reagent that is-used with potassium chloride to produce hydrogen chloride
……..…… **( ½ mark)**

(ii) Write an equation for the reaction leading to the formation of hydrogen chloride. **( 1½ marks)**
……
……

(b) Write an equation for the reaction between hydrogen chloride and
(i) silver nitrate solution. **( 1½ marks)**
……..……
…… (2 ½ marks)

(ii) iron in the presence of water. **( 1½ marks)**
……..……
……

**7.** Ethene is classified as an alkene and can be prepared in the laboratory by dehydration of ethanol
(a) (i) State what is meant by the term alkene.
……..…**( 01 mark)**
(ii) Write the structural formula of ethene.
……..…**( 01 mark)**

(iii) Name the reagent which is used as a dehydrating agent in the preparation of ethene.
……..…**( 01 mark)**

(b) Bromine was added to ethene. Write equation for the reaction that took place. ( 1 ½ marks)
……..……
……
……**( 01 mark)**

(c) Under high temperature and pressure, ethene molecules can react with one another to form a big molecule Z.
(i) Name Z…… **( ½ mark)**
(ii) State one use of Z……..…***( ½ mark)***

**8.** In the extraction of sodium from sodium chloride, calcium chloride is kidded to sodium chloride and the mixture is melted. The molten mixture is then electrolysed using graphite electrodes.
(a) Sate the purpose of adding calcium chloride.
……..……**( ½ mark)**

(b) Write the equation for the fraction that takes place at the
(i) anode……
……**(1½ marks)**
(ii)
cathode……
……**(1 ½ marks)**

(c) Bromine vapour was passed over heated sodium. Write an equation for the reaction that took place,
**(1½ marks)**
……..……
……

**9.** (a) Hydrogen peroxide decomposes quite easily at room temperature.
(i) Write the equation for the decomposition of hydrogen peroxide. **(01 mark)**
……..……
……
(ii) State two ways by which the decomposition can be made faster.
……..……
……
…..…**(02 marks)**

(b) Using the space below, on the same axes, sketch graphs of concentration of hydrogen peroxide versus time for the decomposition of the peroxide at
(i) room temperature, **(01 mark)**
**……..** (01 mark)
(ii) one of the conditions you nave stated in (a) (ii), **(01mark)**
……
……..
**10.** State the condition: under which sulphuric acid can react with
(i) Sucrose $C_{12}H_{22}O_w$
……..……**( ½ mark)**
(ii) zinc oxide.
……..…**( ½ mark)**

(b) Write equation for the reaction of sulphufic acid with
(i) sucrose
……..……
……
……**(1 ½ marks)**
(ii) zinc oxide.
……..……
……
…..**(1 ½ marks)**

(c) State the property of sulphuric acid which is shown by its reaction with ( ½ mark)
(i) sucrose
……..……**( ½ mark)**

(ii) zinc oxide.
……..……**( ½ mark)**

## SECTION B: (30 MARKS)

***Answer two questions from this section.***

**Additional question(s) answered will not be marked.**

**11. (**a)Describe how a pure sample of carbon dioxide can be prepared in the laboratory from calcium carbonate and write the equation for the reaction that takes place. (1 ½ marks)
**(07 marks)**
(Diagram is not required)

(b) Explain with the aid of equations the changes that take, place when excess carbon dioxide is bubbled into sodium hydroxide solution.
**(5 ½ marks)**
(c) Potassium hydrogencarbonate decomposes when heated according to the following equation

Calculate the mass of carbon dioxide (02 marks) when 8 g of potassium hydrogencarbonate is heated strongly.
**(H=1;C = 12;O = 16; K=39) (2 ½ marks)**

**12.** (a) One of the ores from which iron is extracted is spathic iron ore.
(i)Write the fomula of the iron compoud that is in the ore.
**(01mark)**

(ii) Describe how impure iron is extracted from spathic iron ore. **(07 marks)**
(Your answer should include equations).

(b) Write equation(s) where possible and state the conditions) for the reaction of iron with (01 mark)
(i) water. **(04 marks)**
(ii) chlorine, **(2 ½ marks)**
(c) State one use of iron. **(½ mark)**

**13.** (a) The elements copper, zinc and sulphur react with oxygen to form their oxides. Write the formula of the oxide (1½ marks) of each of the elements and state the type of oxide whose formula you have written.
**(03 marks)**

(b) Hydrogen gas was passed separately over the heated (1½ marks) oxides of copper and zinc

(i) State what was observed in each case and explain your observation. **(04 marks)**
(ii) Write equation for any reaction that took place. **(1½ marks)**

(c) Excess dilute sodium hydroxide solution was added to a mixture of the oxides of zinc and copper. State what was observed and give a reason for your observation. **(2½ marks)**

(d) A mixture of the oxides of zinc and copper was added to excess dilute sulphuric acid and warmed- State what was observed and write equations) for the reaction(s) that look place. **(04 marks)**

**14.** (a) (i) Write the equation for the complete combustion of ethanol **(01 mark)**

(ii) Outline an experiment that can be earned out to the laboratory to determine the enthalpy of combustion of ethanol
***(A diagram is not required but your answer should include how the enthalpy of combustion of ethanol can be calculated from, the experimental results).***
(b) When 0.15g of a compound W, molecular mass 60 g was burnt, it caused the temperature of 150 cm3 of water to rise by 8°C. Calculate fee enthalpy of combustion of W. (Density of water =1.0 $gcm^{-3}$, specific heat capacity of water = 4.2 $Jg^{-1}$ $K^{-1}$)

(c) The enthalpies of combustion ΔHC of some hydrocarbons are shown in the table below.

| Hydrogen | $CH_4$ | $C_2H_6$ | $C_3H_8$ | $C_4H_{10}$ | $C_6H_{14}$ |
|---|---|---|---|---|---|
| $\Delta H_c$ | 890 | 1560 | 2220 | 2880 | 4160 |

(i) Plot a graph of enthalpy of combustion (vertical axis) against number of carbon atoms in the hydrocarbon (horizontal axis). **(03 marks)**

(ii) State torn the graph you have plotted in (c)(i), the enthaipy of combustion of $C_5H_{12}$. **( ½ marks)**
(iii) Determine the slope of the graph that you have drawn. **(01 mark)**

(iv) Using your slope and the intercept, calculate the enthalpy of combustion of the hydrocarbon $C_7H_{16}$.

**545/1**
**CHEMISTRY**
**Paper 1**
**Oct./Nov.2018**
**1½**

1. Which one of the following methods is used to separate a mixture of diesel and water?
A. Filtration.
B. Evaporation.
C. Chromatography.
D. Separating funnel.

2. Which one of the following is the major constituent of air? (04 marks}
A.Oxygen.
B.Nitrogen.
C.Carbon dioxide.
D.Water vapour.

3. Which one of the following is a thermosetting plastic?
A.Polyethene.
B.Perspex.
C.Nylon.
D.Rubber.

4. Which one of the following ions if present in water causes hardness?
A.$Na^+$
B.$Al^{3+}$
C.$Mg^{2+}$
D.$NH_4^+$

5. Which one of the following gases can be identified through smell? (6 ½ marks)
A. $H_2S$
B. $CO_2$
C. HCl
D. $O_2$

6. Which one of the following electronic configuration is of a noble gas?
A.2:8:1 **(02 marks)**
B.2:8:8
C.2:8:2
D.2:8:7

7. Ammonia is not used
A.as fertilizer.
B.as refrigerant.
C.for reducing copper(II) oxide to copper.
D.in the manufacture of nitric acid.

8. Which one of the following metals will react most with cold water?
A.Sodium.
B.Calcium
C.Magnesium.
D.Potassium.

9. Which one of the following substances when heated undergoes a chemical change? **(01 mark)**
A.Ammonium Chloride.
B.Copper(II) hydroxide.
C.Candle wax.
D.Sulphur.

10. Which one of the following reagents is normally used to test for the presence of chloride ion in solution?
A.Potassium iodide.
B.Barium nitrate.
C.Silver nitrate.
D.Lead(II) nitrate.

11. Which one of the following substances is used to test for the presence of oxygen?

A. A glowing splint.
B. A burning splint.
C. Litmus paper.
D. Anhydrous copper(II) sulphate.

12. Which one of the following methods is used to separate the alkanes in crude petroleum?
A. Filtration.
B.Decantation.
C.Fractional distillation.
D.Fractional crystallization.

13. Which one of the following will be in the colour of the precipitate formed when lead(II) nitrate solution is added to sodium chloride solution?
A.Blue.
B.Brown.
C.Yellow.
D.White.

14. Which one of the following particles conducts electric current in molten lead(II) bromide?
A.Electrons.
B.Molecules.
C.Atoms.
D.Ions.

15. Which one of the following anions reacts with silver ions in solution to form precipitate that dissolves in aqueous ammonia solution?
A.$SO_4^{2-}$
B.$Cl^-(aq)$.
C.$CO_3^{2-}(aq)$.
D.$NO_3^-(aq)$.

16. The electronic configurations of elements L, M, V and R are 2:8:3, 2:8:6, 2:8:8, 2:8:8:2 respectively. Which one of the following pairs of elements consists of metals only?
A.M and V.
B.L and V.
C.M and R.
D.L and R.

17. Which one of the following reactions of hydrochloric acid is an example of neutralization reaction? Reaction with
A.Zinc.
B.Sodium sulphate.
C.Magnesium oxide.
D.Silver nitrate.

18. Which one of the following is the number of moles of hydrogen ions in $100cm^3$ of a 0.05M sulphuric acids?
A. 0.0025.
B. 0.01.
C. 0.25.
D. 1.00.

19. Which one of the following gases will produce white fumes when placed near concentrated ammonia?
A. Hydrogen chloride.
B. Sulphur dioxide.
C. Hydrogen.
D. Oxygen.

20. When 16.3g of substance R were burnt in air, the heat produced raised the temperature of 200g of water by $x^oC$. Which one of the following is the value of x?
A. $\frac{200x4.2x16.3}{355.5x64}$
B. $\frac{355.5x64}{200x4.2x16.3}$
C. $\frac{16.3x355.5}{200x4.2.64}$
D. $\frac{200x4.2x64}{16.3x355.5}$

21. Which one of the following carbonates when heated strongly will decompose to form a bluish-black residue?
A. Ph $CO_3$.
B. Mg $Co_3$.
C. Zn $CO_3$.
D. Fe $CO_3$.

22. Which one of the following is the molarity of a $25.0cm^3$ sodium carbonate solution required to neutralize $20.0cm^3$ of a 0.15M dibasic acid?
A. 0.060 M.
B. 0.120 M.
C. 0.188 M.
D. 0.240 M.

23. Which one of the following compounds will turn bromine from reddish-brown to colourless?
A.$C_4H_{10}$.
B.$C_3H_8$.
C.$C_2H_4$.
D.$CH_4$.

24. Which one of the following hydroxides will dissolve in ammonia solution?
A.$Zn(OH)_2$.
B.$Al(OH)_3$.
C.$Pb(OH)_2$.
D.$Fe(OH)_3$.

25. Element M reacts with dilute acids and forms a brown precipitate when added to copper(II) sulphate solution. Which one of the following is the order of reactivity of M, hydrogen and copper, starting with the most reactive?
A.Hydrogen > M > copper.
B.M > copper > hydrogen.
C.Copper > hydrogen > M.
D.M > hydrogen > copper.

26. A hydrocarbon $C_xH_y$ burns in oxygen according to the following equation;

$$C_xH_y(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l).$$

Which one of the following are the values of x and y respectively?
A. 1 and 4.
B. 2 and 4.
C. 3 and 8.
D. 4 and 10.

27. Which one of the following cations will react with dilute sodium hydroxide to form a precipitate that does not dissolve in excess alkali?
A. $Al^{3+}$
B. $Mg^{2+}$
C. $Zn^{2+}$
D. $Pb^{2+}$

28. Phosphoric acid can react with sodium hydroxide according to the following equation.

$$3NaOH(aq) + H_3PO_4(aq) \rightarrow Na_3PO_4(aq) + 3H_2O(l)$$

The volume of a 0.1 M phosphoric acid required to react completely with 30cm$^3$ of a 0.2M sodium hydroxide solution is

A. $\left(\frac{30x0.1}{3x0.2}\right)cm^3$

B. $\left(\frac{30x0.2}{3x0.1}\right)cm^3$

C. $\left(\frac{30x0.2x1000}{3x0.1}\right)cm^3$

D. $\left(\frac{30x0.2}{3x0.1x1000}\right)cm^3$

29. Which one of the following substances when burnt in oxygen will form product(s) that dissolve in water to give a solution with pH greater than 7?
A. Carbon.
B. Ammonia.
C. Sulphur.
D. Calcium.

30. Zinc carbonate was heated and the residue allowed to cool. Which one of the following is the colour of the residue?
A. Black.
B. Yellow.
C. White.
D. Reddish-brown.

31. Ammonia reacts with lead(II) oxide according to the following equation.

$$2NH_3(g) + 3PbO(s) \rightarrow N_2(g) + 3Pb(s) + 3H_2O(l)$$

Which one of the following is the volume of ammonia measured at s.t.p. that would be required to react completely with 3.3g of lead(II) oxide?
[O = 16; Pb = 207, l mole of gas occupies 22.4dm$^3$ at room temperature.]

A. $\left(\frac{2x3.3x22.4x1000}{3x223}\right)cm^3$

B. $\left(\frac{3x22.4x1000}{2x223x3.3}\right)cm^3$

C. $\left(\frac{3x22.4x1000x3.3}{2x223}\right)cm^3$

D. $\left(\frac{3x22.3x3.3}{2x22.4x1000}\right)cm^3$

32. The atomic number of element X is 11. Which one of the following is not a property of the oxide of X?
A. it has a high melting point.
B. It conducts electricity in solid state.
C. It is soluble in water.
D. It is a basic oxide.

33. Butane burns in air according to the following equation;

$$2C_4H_{10}(g) + 13O_2(s) \rightarrow 8CO_2(g) + 10H_2O(l)$$

Which one of the following would be the mass of butane that would burn to produce 1150kJ of heat?

[H=1' C=12; Molar enthalpy of combustion of butane = -2877kJ mol$^{-1}$]

A. $\left(\frac{2877x1150}{58}\right)g.$

B. $\left(\frac{2877x58}{1150}\right)g.$

C. $\left(\frac{58x1150}{2877}\right)g.$

D. $\left(\frac{2877}{58x1150}\right)g.$

34. Which one of the following statements is correct about graphite and diamond? They both;
A. have giant structures.
B. have similar physical properties.
C. have different chemical properties.
D. are very hard substances.

35. Magnesium reacts with dilute hydrochloric acid according to the following equation.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

Which one of the following is the volume of a 1.5M hydrochloric acid than would react completely with 1.2g of magnesium? [Mg = 24.]

A. $\left(\frac{1000x1.5x1.20}{2x24}\right)cm^3.$

B. $\left(\frac{1000x2x1.5}{24x1.2}\right)cm^3.$

C. $\left(\frac{1000x1.2x2}{24x1.5}\right)cm^3.$

D. $\left(\frac{1000x1.2}{24x1.5}\right)cm^3.$

36. Sodium carbonate reacts with hydrochloric acid according to the following ionic equation.

$$CO_3^{-2}(aq) + 2Hl^+ \rightarrow CO_2(g) - H_2O(l)$$

If 25.0cm$^3$ of a 0.1M hydrochloric acid reacted complete with 17.8cm$^3$ of a sodium carbonate solution the concentration in moles per dm$^3$ of the sodium carbonate solution was;

A. $\left(\frac{25x0.1x2}{17.8}\right).$

B. $\left(\frac{25x0.1}{17.8x2}\right).$

C. $\left(\frac{25x0.1x17.8}{2}\right)$.

D. $\left(\frac{17.8x0.1x2}{25}\right)$.

37. Which one of the following substances is not formed when zinc nitrate is heated strongly?
A. $O_2$
B. ZnO
C. $NO_2$
D. No

38. Element Y has atomic number 13. The chemical bond in the sulphide of Y is?
A. ionic bond.
B. covalent bond.
C. dative bond.
D. metallic bond.

39. Sulphur dioxide when exploded with oxygen, reacts to form sulphur trioxide according to the following equation.

$$2SO_{2}(g) + O_{2}(g) \rightarrow 2SO_{3}(g)$$

If $10cm^3$ of sulphur dioxide were exploded with $15cm^3$ of oxygen and the resultant gas cooled to room temperature, the volume of the resultant gas would be?
A. $25cm^3$.
B. $15cm^3$.
C. $10cm^3$.
D. $5cm^3$.

40. Which one of the following ions will produce a white precipitate with acidified barium nitrate solution?
A. $Cl^-$.
B. $SO_4^{2-}$.
C. $CO_3^{2-}$.
D. $HCO_3^-$.

***Each of the questions 41 to 45 consists of an assertion (statement) on the left hand side and a reason on the right-hand side.***

Select:
A. if both the assertion and the reason are true statements and the reason is a correct explanation of the assertion.
B. if both the assertion and the reason are true statements but the reason is not a correct explanation of the assertion.
C. if the assertion is true but the reason is not a correct statement.
D. if the assertion is not correct but the reason is a correct statement.

**INSTRUCTIONS SUMMARIZED:**

| **Assertion** | **Reason** |
|---|---|
| A. True | True and is a correct explanation. |
| B. True | True but is not a correct explanation. |
| C. True | Incorrect. |
| D. Incorrect | Correct. |

| | | | |
|---|---|---|---|
| 41. | In the preparation of dry carbon dioxide, the gas is collected by upward displacement of air. | ***because*** | Carbon dioxide does not mix with air. |
| 42. | Sodium chloride dissolves in water | ***because*** | Sodium chloride is formed by transfer of electrons from sodium to chlorine atoms. |
| 43. | Elements in group II of the Periodic Table are more reactive than those in group I. | ***because*** | Group II elements need to lose two electrons in order to achieve stable noble gas structure. |
| 44. | Concentrated sulphuric acid is not used to dry ammonia. | ***because*** | Ammonia is oxidized by concentrated sulphuric acid to nitrogen dioxide. |
| 45. | Chlorine is used to prepare anhydrous iron(II) chloride. | ***because*** | Chlorine is an oxidizing agent. |

***Each of the questions 46 to 50 one or more of the answers given may be correct. Read each question carefully and then indicate the correct answer according to the following.***
A. If 1, 2 and 3 only are correct.
B. If 1 and 3 only are correct.
C. If 2 and 4 only are correct.
D. If 4 only is correct.

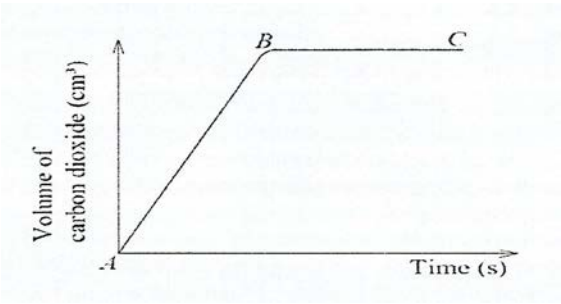
46. Which one of the following is/are true about electrolysis of dilute sulphuric acid?
1. Hydrogen is produced at the cathode.
2. The acidity at the cathode increases.
3. The volume of gas produced at the cathode is bigger than the one produced at the anode.
4. The anode decreases in size.

47. The full symbol of an element is $^{27}_{13}Z$. The ion of Z contains
1. 10 neutrons.
2. 10 electrons.
3. 14 protons.
4. 13 protons.

48. Which of the following is/are stages in sewage treatment?
1. Filtration.
2. Chlorination.
3. Use of aerobic bacteria.
4. Addition of alum.

49. Equal volumes of a 2M nitric acid and a 1M sulphuric acid.
1.turn methyl orange indicator yellow.
2.produce the same number of moles of hydrogen ions.
3.produce equal volume of carbon dioxide when reached with same amount of calcium carbonate.
4.react with alkalis to form one mole of water.

50. The graph below shows the variation in the volume of carbon dioxide evolved with time when hydrochloric acid was reacted with magnesium carbonate.




Which of the following conclusions can be made from the graph?
1.Reaction does not occur at the same rate throughout.
2.Rate of evolution of carbon dioxide is greatest at the beginning.
3.The portion B – C of the graph indicates the reaction is complete.
4.The rate of the reaction increases with time.

## CHEMISTRY P2
## 2018 / P2
## SECTION A (50 MARKS)

**1.** Sea water contains mainly dissolved sodium chloride and traces of potassium bromide.
(a) State one practicle method that can be used to obtain the following from sea water.
(i) Chlorine. ***(01 mark)***
……
……
……
(ii) A reasonably pure sample of sodium chloride . ***(01 mark)***
……
……
……..
(iii) Water free from ions. ***(01 mark)***
……
……
……
(b) A vessel containing a sample of the water in (a) (iii) was connected to an ammeter which in turn was connected to a direct current source.
(i) State what was observed. ***(01 mark)***
……
……
……
(iii) Give a reason for your observation in (b) (i).
……
……
……..
***(01 mark)***

**2.** (a) The atomic numbers hydrogen, magnesium and oxygen are 1,12 and 8 respectively. Write the electronic configurations of the atoms of the elements. ***(1½ marks)***
……
……
……
……
(b) Using outermost energy level electrons only, draw diagrams to show how oxygen forms compound with
(i) hydrogen. ***(01 mark)***
……
……
……
(ii) magnesium. ***(01 mark)***
……
……
……
(c)(i) Which of the following compounds in (b) when dissolved in water will conduct electric current? ***(½ mark)***
……
……..
(ii) Give a reason for your answer in (c)(i).
……
……
……***(01 mark)***

**3.**(a) State why ammonia is not dried using
(i) anhydrous calcium chloride. ***(01 mark)***
……
……
……
(ii) Concetrated sulphuric acid. ***(01 mark)***
……
……
……
(b) Name the substance normally used in the labaoratory for drying ammonia. ***(01 mark)***
……
……
……..
(c) Write equation for the reaction that can take place when copper (II) oxide is treated with ammonia. ***(1½ marks)***
……
……
……

**4.** State the condition(s) under which sulphuric acid can react with the following substances and in each case write equation for the reaction that would take place.
(a) Sugar ($C_{12}H_{22}O_{11}$).
(i) Condition(s). ***(01 mark)***

……
……
……
(ii) Equation. ***(1½ marks)***
……
……
……
(b) Magnesium .
(i) condition (s) ***(01 mark)***
……
……
……
(ii) Equation. ***(1½ marks)***
……
……
……

**5.** The table below show some test carried out on a solution of salt Z and the observations that were made.

| Test number | Test | Observation |
|---|---|---|
| I | Sodium hydroxide solution was added drop-wise to acqueous Z until in excess | A white precipitate soluble in excess sodium hydroxide. |
| II | Ammonia solution was added drop-wise to aqueous Z until in excess. | A white precipitate insoluble in excess ammonia. |
| III | Dilute hydrochloric acid was addedto aqueous Z and the mixture warmed. | A white precipitate soluble on warming. |

Use the observations from the table to answer the following questions.
(a) (i) Identify the caution in Z. ***(01 mark)***
……
……
……
(ii) Write the ionic equation for the reaction in test III.
***(1½ marks)***
……
……
……
(b) Briefly describe how the caution in Z can be confirmed. ***(1½ marks)***
……
……
……

**6.** Compound T, contains 40.0% carbon, 6.7% hydrogen and the rest being oxygen.
(a) (i) Calculate the empirical formula of T. (H=1; C=12; O=16). ***(03 marks)***
……
……
……
……
……
(ii) Determine the molecular formula of T.
(Relative formula mass of T=60) ***(01 marks)***
……
……
……
……
(b) T dissolved in water to form a solution which turned blue litmus paper red.
(i) State what would be observed when a few drops of T were added to sodium carbonate.
***(½ mark)***
……
……
(ii) Write an ionic equation for the reaction that takes place in (b) (i). ***(1½ marks)***
……
……
……

**7.** (a) State what is meant by the term hard water.
……
……
……***(01 mark)***
(b) Name two cations and two anions present in hard water.
(i) Cations. ***(01 mark)***
……
……
……..
(ii) Anions. ***(01 marks)***
……
……
……..
(c) When a solution of barium nitrate was added to a sample of hard water, followed by dilute nitric acid, a white precipitate was formed that did not dissolved in the acid. Write equation for the reaction that took place.
***(02 marks)***
……
……
……
……

**8.** When excess magnesium powder was added to 25cm$^3$ portions of equimolar solutions of compounds of elements Q,W,X,Y and Z, the temperature rise in each case was noted as indicated in the table below.

| Solution of compounds | Rise in temperature (°C) |
|---|---|
| X | 42 |
| W | 32 |
| Y | 0 |
| Q | 38 |
| Z | 14 |

(i) Arrange the elements , Mg,X,W,Y,Q, and Z in order of their reactivity, starting with the least reactive.
***(01 mark)***
……
……
……
(ii) State why there was no temperature rise when magnesium was added to the solution of the compound of Y. ***(01 mark)***
……
……
……

(b) Magnesium powder was added to copper(II) oxide and the mixture heated strongly.
(i) state what was observed. ***(01 mark)***
……
……
……
(ii) Write an equation for the reaction that took place.
***(1½ marks)***
……
……
……
**9.** (a) When a sample of copper(II) nitrate contaminated with zinc nitrate was dissolved in water and the solution was treated with excess sodium hydroxide solution and then filtered. Identify the cation in the
(i) filtrate. ***(01 mark)***
……
……
(ii) residue. ***(01 mark)***
……
……
(c) The residue from (b) was strongly heated.
(i) State what was observed. ***(01 mark)***
……
……
(ii) Write equation for the reaction that took place.
……
……
……..***(1½ marks)***
**10.** (a) State the difference endothermic and exothermic reaction. ***(01 mark)***
……
……
…… (b) Carbon burns in air according to following equation.
$C(s) + O_2(g) \longrightarrow CO_2(g) + heat$
When 4.00g of carbon was burnt in air, the heat produced raised the temperature of 550g of water by $56.8^0C$.
Calculate the molar heat of combustion of carbon.
***(3½ marks)***
(C=12; Specifichaet capacity of water =4.2 $Jg^{-1}$ $K^{-1}$)
……
……
……
……
……
(c) From the equation in (b), suggest one use of carbon.
***(½ mark)***
……
……
……

## SECTION B

**11.** (a) 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 peroxide to air. ***(01 mark)***
(ii) Write equation for the reaction that takes place.
***(1½ marks)***
(iii) State the role of iron (III) chloride in the reaction.
***(01 mark)***
(iv) Name another substance that can affect the production of the gas in the same way asiron (III) chloride.
***(01 mark)***
(b) The table below shows the variation in the concentration of hydrogen peroxide with time when a sample of hydrogen peroxide was mixed with iron (III) chloride at room temperature.

| Concentration of hydrogen peroxide *(mol $dm^{-3}$)* | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 |
|---|---|---|---|---|---|
| *Time, t(s)* | 53 | 26 | 17 | 13 | 10.5 |
| $\frac{1}{t}(s^{-1})$ | | | | | |

(i) Copy and complete the table above by computing and filling in the values of $\frac{1}{t}$.
***(2½ marks)***
(ii) Plot a graph of $\frac{1}{t}$ against concentration of hydrogen peroxide. ***(04 marks)***
(iii) Using your graph, deduce how the rate of the reaction varies with the concentration of hydrogen peroxide.
***(01 mark)***
(iv) Determine the slope of the graph. ***(02 marks)***
(v) State two ways by which the rate of the reaction in (b) could be made faster. ***(01 mark)***

**12.**(a) Explain how a dry sample of hydrogen chloride .(Your answer should include equation but no diagram is required). ***(6½ marks)***

(b) State what would be observed and write the equation for the reaction that would take place if hydrogen chloride was passed .
(i) over strongly heated iron wire. ***(2½ marks)***
(ii) through aqueous silver nitrate. ***(2½ marks)***

(c)Aqueous hydrogen chloride reacts with sodium carbonate solution to produce carbon dioxide according to the following equation:
$Na_2CO_3(aq) + 2HCl(aq) \longrightarrow 2\,NaCl(aq) + H_2O(l) + CO_2(g)$.
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 mol $dm^{-3}$ of hydrogen chloride.
(*1mole of gas occupies 24.0$dm^{-3}$ at room temperature*)
***(3½ marks)***

**13.** (a) (i) Describe how sodium hydroxide can be manufactured using the mercury-cathode cell. (Your answer should include equations of the reactions, but no diagram). ***(07 marks)***

(ii) State one use of the product formed at the anode and one use of the by product. ***(02 marks)***

(b) State how sodium hydroxide can react with the following substances, and in each case write equation for the reaction.
(i) Sulphuric acid. ***(2½ marks)***

(ii) Aluminium ion. ***(3½ marks)***

**14.** (a) (i) Draw a labeled diagram of the set-up of apparatus that can be used to prepare a dry sample of carbon dioxide. ***(3½ marks)***

(ii) Write equation for the reaction leading to formation of carbon dioxide. ***(1½ marks)***

(b) Explain the reason for your choice of the
(i) drying agent for carbon dioxide. ***(02 marks)***

(ii) method of collecting carbon dioxide as shown in your diagram in (a) (i). ***(1½ marks)***

(c)Write equation(s) to show the reaction of carbon dioxide with
(i) Water. ***(1½ marks)***
(ii) sodium hydroxide. ***(1½ marks)***

(d) State
(i) why carbon dioxide is used in making fire extinguishers. ***(01 mark)***
(ii) the effect of increased concentration of carbon dioxide on the environment. ***(01 mark)***

**545/1**
**CHEMISTRY**
**Paper 1**
**Oct./Nov.2019**
**1½**

1. The substance formed when little sodium chloride is stirred in plenty of water is called a
A. suspension. B. solvent.
C. solution. D. solute.

2. Which one of the following processes is used in the conversion of oil into fat?
A. Saponification. B. Dehydration.
C. Hydrogenation. D. Polymerisation.

3. Which one of the following substances when mixed with water conducts electricity?
A. Kerosene.
B. Hydrogen chloride.
C. Glucose.
D. Carbon tetrachloride.

4. Which one of the following alloys can be used for making surgical blades?
A. Brass. B. Bronze.
C. Solder. D. Steel.

5. A mixture of iron and sulphur was heated. Which one of the following is true about the product?
A.The product is soluble in water.
B.The product reacts with acids to produce hydrogen sulphide.
C.The product reacts with acids to produce hydrogen.

D.Components of the product can be separated using a magnet.

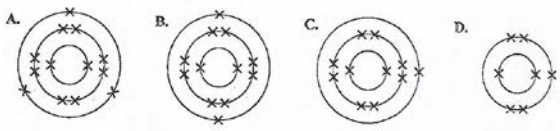
6. Which one of the following processes increases the amount of nitrogen in the atmosphere?
A. Photosynthesis. B. Haber process.
C. Respiration. D. Denitrification.

7. Which one of the following zinc salts is an insoluble salt?

A. $ZnCO_3$.
B. $ZnSO_4$.
C. $ZnCl_2$.
D. $Zn(NO_3)_2$.

8. The similarity between sulphur dioxide and carbon dioxide is that both
A.are reducing agents.
B.turn lime water milky.
C.dissolve in water to form acids.
D.turn potassium dichromate solution green.

9. The atomic number of element E is 5. The electronic structure of an element Q which belong to the same group in the Periodic Table is




10.
Which one of the following is used as a catalyst during the laboratory preparation of oxygen?
A. Iron.
B. Platinum.
C. Manganese(IV) oxide.
D. Vanadium(V) oxide.

11. Which one of the following acids, when in a dilute solution will have pH of about I?
A. Citric acid.B. Ethanoic acid.
C. Carbonic acid.
D. Hydrochloric acid.

12. Which one of the following statements is true about equal volumes of oxygen and carbon dioxide under the same temperature and pressure? The two gases
A. have equal number of molecules.
B. have equal masses.
C. have equal density.
D. move at the same speed.

13. The table below shows the atomic numbers, number of electrons and mass numbers of particles Q, R, X and Y.

Table 1

| Particle | Atomic number | Number of electrons | Mass number |
|---|---|---|---|
| Q | 19 | 18 | 39 |
| R | 8 | 8 | 16 |
| X | 9 | 10 | 18 |
| Y | 6 | 6 | 12 |

Which one of the particles is a cation?

A. R. B. X.
C. Q. D. Y.

14. The atomic number of an element Z is 12. What is the atomic number of element W which is immediately below Z in the same group in the Periodic Table?
A. 14. B. 11.
C. 13. D. 20.

15. Which one of the following gases is produced when iron(II) sulphide is treated with dilute hydrochloric acid?
A. Hydrogen chloride. B. Sulphur dioxide.
C. Hydrogen sulphide. D. Chlorine.

16. Which one of the following reactions takes place in the absorption tower during the manufacture of nitric acid?
A. $4NO_2(g) + 2H_2O(l) + O_2(g) \rightarrow 4HNO_3(aq)$.
B. $NH_3(g) + H_2O(l) \rightarrow NH_4OH(aq)$.
C. $2NO_2(g) + H_2O(l) \rightarrow HNO_3(aq) + HNO_2(aq)$
D. $4NO(g) + 2H_2O(l) + 3O_2(g) \rightarrow 4HNO_3(aq)$.

17. Lead(II) nitrate solution reacted with a colourless solution Q to form a yellow precipitate. Which one of the following is the anion in Q?
A. $I^-$. B. $Cl^-$.
C. $SO_4^{2-}$. D. $CO_3^{2-}$.

18. Which one of the following equations shows formation of hardness in water?
A. $Ca(HCO_3)_2(aq) \rightarrow CaCO_3(s) + CO_2(g) + H_2O(I)$.
B. $CO_2(g) + Mg(OH)_2(aq) \rightarrow MgCO_3(s) + H_2O(g)$.
C. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$.
D. $CO_2(aq) + MgCO_3(s) + H_2O(I) \rightarrow Mg(HCO_3)_2(aq)$.

19. The full symbol of the atom of an element X is ${}^{27}_{13}X$. What is the number of neutrons in the atom of X?
A. 13. B. 14.
C. 27. D. 40.

20. Which one of the following reactions, that occurs during the manufacture of sulphuric acid by the contact process requires a catalyst?

A. $H_2SO_4(I) + SO_3(g) \rightarrow H_2S_2O_7(I)$.
B. $H_2S_2O_7(I) + H_2O(I) \rightarrow 2H_2SO_4(aq)$.
C. $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$.
D. $S(s) + O_2(g) \rightarrow SO_2(g)$.

21. Which one of the compounds contains the highest percentage by mass of nitrogen?
(H = 1; C = 12; N = 14; O = 16; P = 31; S = 32)
A. $NH_4NO_3$. B. $(NH_4)_2CO_3$.
C. $(NH_4)_3PO_4$. D. $(NH_4)_2SO_4$.

22. Which one of the following nitrates when heated will decompose to form oxygen as the only gaseous product?
A. $AgNO_3$. B. $Zn(NO_3)_2$.
C. $Ca(NO_3)_2$. D. $KNO_3$.

23. A solution of hydrogen chloride in methylbenzene has no effect on litmus paper. This is because hydrogen chloride
A. forms a monobasic acid.
B. does not form ions in methylbenzene.
C. dissolves to form a dilute acid solution.
D. is immiscible with methylbenzene.

24. Magnesium carbonate reacts with dilute hydrochloric acid according to the following equation:
$MgCO_3(s) + 2HCI(aq) \rightarrow MgCI_2(aq) + H_2O(I) + CO_2(g)$
Which one of the following is the mass of magnesium carbonate that would react completely with $100cm^3$ of a 2 M hydrochloric acid?
(H = 1; C = 12; O = 16, Mg = 24; CI = 35.5)
A. $\left(\frac{2x100x2}{1000x84}\right)g$ B. $\left(\frac{100x84}{2x1000x2}\right)g$
C. $\left(\frac{2x100x84}{1000x2}\right)g$ D. $\left(\frac{2x1000x2}{100x84}\right)g$

25. Methanol ($CH_3OH$) burns in air according to the following equation

$$CH_3OH(I) + \tfrac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(I) \quad \Delta H = 726kJmol^{-1}$$

What would be the amount of heat produced when 20g of methanol is burnt?
A. $\left(\frac{726x2}{32}\right)$kJ. B. $\left(\frac{726x2}{20}\right)$kJ.
C. $\left(\frac{20x32}{726}\right)$kJ. D. (726 x 20 x 32) kJ

26. The full symbol of atoms of elements X, Y and ${}^{24}_{12}X$, ${}^{32}_{16}Y$, and ${}^{20}_{10}Y$, respectively.
Which one of the following pairs will combine to form a substance with ionic bond?
A. Y and Y. B. X and Z.
C. Y and Z. D. X and Y.

27. Element Y liberates hydrogen from cold water, whereas W does not. W liberates hydrogen from dilute hydrochloric acid, whereas X does not. Which one of the following is the correct order of the reactivity of the elements hydrogen, W, X and Y, starting with the most reactive?
A. Hydrogen, W, X, Y.
B. W, X, hydrogen, Y.
C. X, hydrogen, Y, W.
D. Y, W, Hydrogen, X.

28. Ammonia gas reacts with oxygen according to the following equation.

$$4NH_3(g)+3O_2(g)\rightarrow 2N_2(g)+6H_2O(l)$$

The volume of nitrogen gas formed when 60cm$^3$ of ammonia gas reacts completely with excess oxygen is

A. 20cm$^3$ B. 30cm$^3$
C. 120cm$^3$ D. 240cm$^3$

29. Which one of the following pairs of substances is used during laboratory preparation of carbon dioxide?
A.Lead(II) carbonate and dilute hydrochloric acid.
B.Lead(II) carbonate and dilute sulphuric acid.
C.Calcium carbonate and dilute hydrochloric acid.
D.Calcium carbonate and dilute sulphuric acid.

30. When a mixture of solid Y and concentrated sulphuric acid was heated, a gas that gave dense white fumes with ammonia was evolved. Which one of the following is the anion in Y?

A. $Cl^-$ B. $NO_3^-$.
C. $S^{2-}$. D. $CO_3^{2-}$.

31. Which one of the following substances is produced at the anode when copper(II) sulphate solution is electrolyzed using graphite electrodes?
A. Copper(II) ions.
B. Hydrogen.
C. Copper.
D. Oxygen.

32. A hydrocarbon burns in oxygen completely according to the following equation:

$$C_3H_8+xO_2(g)\rightarrow yCO_2(g)+zH_2O(l)$$

Which one of the following are the values of x, y and z respectively?

A. 4, 3 and 4.B. 5, 3 and 4.
C. 4, 5 and 3.D. 3, 4 and 5.

33. Which one of the following hydrocarbons is formed when a mixture of ethanol and concentrated sulphuric acid is heated?

A. $C_4H_6$. B. $C_4H_{10}$.
C. $C_3H_8$. D. $C_2H_4$.

34. In which one of the following test tubes would a burning splint continue to burn. The test tube containing water and

A. sodium peroxide.B. sodium sulphite.
C. sodium hydroxide.D. sodium oxide.

35. When calcium nitrate is strongly heated, it decomposes according to the following equation:

$$2Ca(NO_3)_2(s)\rightarrow 2CaO(s)+4NO_2(g)+O^2(g)$$

Which one of the following is the maximum volume of oxygen produced at room temperature when 2.4g of calcium nitrate is heated?

(N = 14; O = 16; Ca = 40; 1 mole of gas occupies 25dm$^3$ at room temperature).

A. $\left(\frac{164x2.4}{24}\right)$dm$^3$. B. $\left(\frac{2.4x24}{164x2}\right)$dm$^3$.
C. $\left(\frac{24x164}{2.4}\right)$dm$^3$. D. $\left(\frac{2x164x2.4}{24}\right)$dm$^3$.

36. Which one of the following would be formed when anhydrous copper(II) carbonate is heated?
A. A black solid.
B. A green solid.
C. A blue solid.
D. A brown solid.

37. Iron(III) oxide reacts with carbon monoxide according to the following equation.

$$Fe_2O_3(s)+3CO(g)\rightarrow 2Fe(s)+3CO_2(g)$$

Which one of the following is the mass of iron obtained when 100g of iron(III) oxide is reduced?
(C = 12; O = 16; Fe = 56)

A. $\left(\frac{56x160}{100}\right)$g. B. $\left(\frac{56x100}{160x2}\right)$g.
C. $\left(\frac{56x2x100}{160}\right)$g. D. $\left(\frac{100x56}{160}\right)$g.

38. Which one of the following cations forms a precipitate that is soluble in excess sodium hydroxide and aqueous ammonia?

A. $Al^{3+}$.
B. $Zn^{2+}$.
C. $Pb^{2+}$.
D. $Cu^{2+}$.

39. Which one of the following contains the same number of moles of hydrogen ions as the number of moles of sodium ions in 50cm$^3$ of a 0.2M $Na_2SO_4$.
A. 200 cm$^3$ of a 0.1M $HNO_3$.
B. 150 cm$^3$ of a 0.2M $H_2NO_4$.
C. 100 cm$^3$ of a 0.5M HCl.
D. 50 cm$^3$ of a 1M $H_3PO_4$.

40. Which one of the following salts when reacted with dilute hydrochloric acid can form a white precipitate that dissolves on heating?

A. $ZnSO_4$. B. $CuSO_4$.
C. $Ba(NO_3)_2$. D. $Pb(NO_3)_2$.

***Each of the questions 41 to 45 consists of an assertion (statement) on the left hand side and a reason on the right-hand side.***

**Select:**
A.if both the assertion and the reason are true statements and the reason is a correct explanation of the assertion.
B.if both the assertion and the reason are true statements but the reason is not a correct explanation of the assertion.
C. if the assertion is true but the reason is not a correct statement.

D.if the assertion is not correct but the reason is a correct statement.

**INSTRUCTIONS SUMMARIZED:**

| **Assertion** | **Reason** |
|---|---|
| A. True | True and is a correct explanation. |
| B. True | True but is not a correct explanation. |
| C. True | Incorrect. |
| D. Incorrect | Correct. |

| | | | |
|---|---|---|---|
| 41. | Diamond and graphite burn in excess oxygen to form carbon dioxide. | **because** | They are isotopes of carbon. |
| 42. | When dry ammonia is passed over heated copper(II) oxide, the oxide changes colour from black to brown. | **because** | Copper(II) oxide contain oxygen atoms. |
| 43. | Elements with atomic numbers 12 and 17 react to form a covalent compound. | **because** | The two elements are in the same period in the Periodic Table. |
| 44. | A white precipitate is formed when solutions of lead(II) nitrate and barium chloride are treated separately with sulphuric acid. | **because** | Metal sulphates do not dissolve in water. |
| 45. | Chlorine is used in treatment of water. | **because** | Chlorine is an oxidizing agent. |

***Each of the questions 46 to 50 one or more of the answers given may be correct. Read each question carefully and then indicate the correct answer according to the following.***

A. If 1, 2 and 3 only are correct.
B. If 1 and 3 only are correct.
C. If 2 and 4 only are correct.
D. If 4 only is correct.

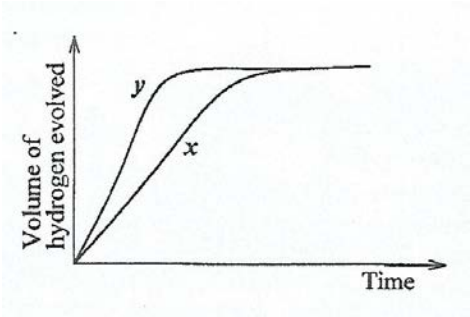
46. During the extraction of sodium from sodium chloride, calcium chloride is added to fused sodium chloride so at to

1. make sodium chloride non-corrosive.
2. make sodium insoluble in its molten sodium chloride.
3. lower the melting point of sodium chloride.
4. remove impurities from the sodium chloride.

47. An atom of element X contains 15 electrons and 16 neutrons. Which of the following statements is / are true about X?

1. The oxide of X is acidic.
2. The atomic number of X is 16.
3. X is in period 3 of the Periodic Table.
4. X is in group VI of the Periodic Table.

48. Curves x and y in figure 1 were obtained when a fixed mass of magnesium was reacted separately with a certain volume of dilute sulphuric acid.




The condition(s) under which y was obtained is/are by;

1. using magnesium ribbon.
2. increasing the concentration of the acid.
3. reducing the reaction temperature.
4. using magnesium powder.

49. Which of the following compounds decolourises bromine water?

1. CH4.
2. C3H8.
3. C4H10.
4. C2H4.

50. Which of the following is/are formed when nitric acid is reacted with a metal oxide.

1. Water.
2. Oxygen.
3. Nitrate of the metal.
4. Nitrogen dioxide gas.

**545/2**
**CHEMISTRY**
**Paper 2**
**Oct./Nov.2019**
**2 hours**

**SECTION A (50 MARKS)**
**Answer all questions in this section.**

1. (a) Write the chemical name of rust.
***(01 mark)***

……
……

(b) State the conditions necessary for rusting to occur.
***(02 marks)***

……
……

(c) Figure 1 shows a set-up of apparatus that was used to investigate a condition necessary for iron nails to rust.

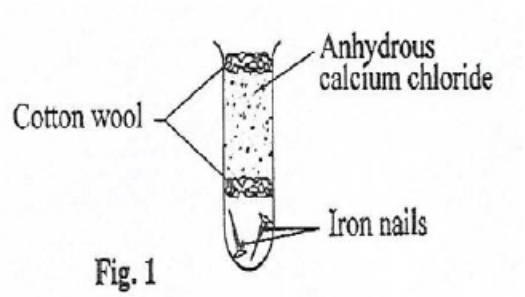


Fig. 1

State the condition that was being investigated

……
……

(d) State:

(i)one disadvantage of rust.
***(01 mark)***

……
……

(ii) one method of preventing rusting.
***(01 mark)***

……
……

2. Table 1 shows the mass numbers and atomic numbers of elements W, X and Y. Study the table and answer the questions that follow.

Table 1

| Element | Mass number | Atomic number |
|---|---|---|
| W | 24 | 12 |
| X | 14 | 7 |
| Y | 39 | 19 |

(a) State the number of;

(i) electrons in the atom of element Y.
***(01 mark)***

……
……

(ii) neutrons in the atom of element Y.
***(01 mark)***

……
……

(b) Write the electronic configuration of the ion that can be formed by the atom of element Y.
(01 mark)

……
……

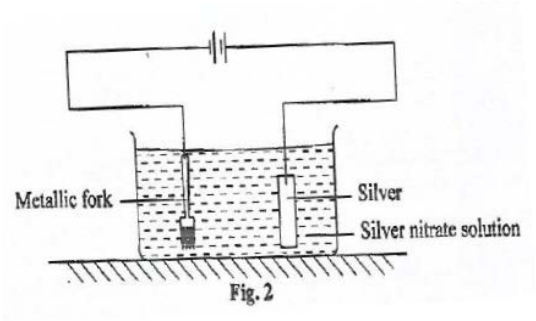


Fig. 2

(c) Identify the group in the Periodic Table to which element X belongs. ***(01 mark)***

……
……

(d) Element W reacted with element X to form a compound Z. State the type of bond in Z. (01 ***mark)***

……
……

3. (a) A metallic element T, reacts with nitrogen to form a compound with the formula $T_3N_2$. ***(01 mark)***

(i)State the valency of T. ***($\frac{1}{2}$ mark)***

……
……

(ii)Write equation for the reaction between T and chlorine.

……

(b) 3.2g of T reacted completely with 600cm$^3$ of nitrogen at s.t.p. Determine the atomic mass of T.(1 mole of a gas occupies 22.4dm$^3$; T reacts with nitrogen in the ratio 3.1)
***(02 marks)***

……
……

4. Clean zinc granules were added to a solution of copper(II) sulphate.

(a) State what was observed ***(01 mark)***

……
……

(b) Explain your observation in (a).
***(02 marks)***

……
……

(c) Write equation to support your answer in (b). (1 $\frac{1}{2}$ marks)

……
……

5. Ammonium sulphate dissolves in water according to the following equation:

(a) State what would be observed if aqueous sodium hydrogen carbonate was added to the resultant solution.
***(01 mark)***

……
……

(b) Briefly explain your answer in (a)

***(04 marks)***

……
……
……
……
……
……
……

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

(a) State what was observed

(i)metallic fork. ***(01 mark)***

……

(ii) Silver. ***(01 mark)***

……
……
……

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

(i)electrode with the fork. ***(01 mark)***

……
……

(ii) electrode with Silver. ***(01 mark)***

……
……

(c) (i) Name the process taking place at the electrode with the folk ***($\frac{1}{2}$ mark)***

……

(ii) State one use of the process in (c) (i) ***($\frac{1}{2}$ mark)***

……

7. Lead(II) carbonate was heated until there was no further change.

(a) State what was observed ***($1\frac{1}{2}$ marks)***

……
……

(b) Magnesium powder was added to the residue and the mixture heated strongly. Write equation for the reaction that took place. ($1\frac{1}{2}$ marks)

……

……
……..

(c) The experiment in (b) was repeated using copper turning instead of magnesium powder.

(i) State what was observed. ***(01 mark)***

……
……

(ii) Give a reason for your answer in (c) (i). ***(01 mark)***

……
……

8. When ammonium chloride was mixed with potassium hydroxide and the mixture heated strongly, ammonia was evolved.

(a) Write equation for the reaction leading to the formation of ammonia.

***($1\frac{1}{2}$ marks)***

……
……

(b) Ammonia was bubbled through zinc sulphate solution until there was no further change.

(i) State what was observed. ***($1\frac{1}{2}$ marks)***

……
……

(ii) Give reason(s) for your observation(s) in (b) (i). ***(02 marks)***

……
……

**9. (a)** What is meant by the term rate of reaction? ***(01 mark)***

……
……
……
……

(b) During an experiment to determine the rate of production of carbon dioxide from calcium carbonate at room temperature, the volume of carbon dioxide varied with time as shown in the graph in figure 3.

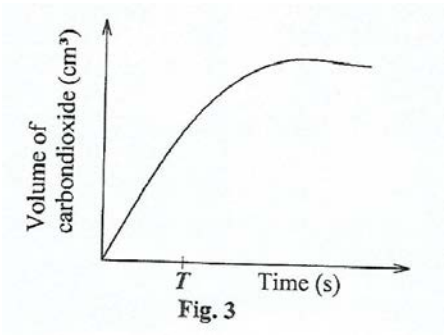


Fig. 3

Show how the rate of the reaction at time T can be determined. (02 marks)

……
……
……
……

(c) State two factors other than temperature that can affect the rate of a reaction. ***(02 marks)***

(i) ……

10. (a) Write equation for the complete combustion of carbon. ***($1\frac{1}{2}$ marks)***

……
……

(b) If 80kg of charcoal cost UGX.20,000. Calculate the cost of charcoal required to produce **163,750kJ** of heat energy.
(C = 12; The enthalpy of combustion of carbon = 393kJmol$^{-1}$) ***(03 marks)***

……
……
……
……

(c) State one use of charcoal other than fuel.

***($1\frac{1}{2}$ marks)***

……
……
……
……
……

**SECTION B (30 MARKS)**

***Answer any two questions from this section. Any additional question(s) answered will not be marked.***

**11. (a)** Differentiate between miscible and immiscible liquids. ***(02 marks)***

(b) (i) Name two compounds that can form a miscible liquid mixture and draw a diagram for the set-up of apparatus that can be used to separate the mixture.

(i) ……
……

(ii) ……
……

(ii) State one method that can be used to determine the purity of the components of the mixture in (b) (i)
***(01 mark)***

……
……

(c) Table 2 shows variation in temperature with time when a solid X was heated to boiling.

**Table 2**

| 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. (04 marks)
(ii) Explain the shape of the graph.
***(04 marks)***

12. (a) Chlorine can be prepared in the laboratory by oxidation of concentrated hydrochloric acid.

(i)Name one suitable substance that can be used for oxidising hydrochloric acid. ***(01 mark)***

……
……

(ii) Outline how a pure dry sample of chlorine can be prepared in the laboratory from the above reaction. (Diagram is not required) ***(06 marks)***

(b)State and write equation(s) to show how phosphorous reacts with chloride.
***(04 marks)***

(c)Explain the reaction of chloride with potassium bromide. ***(04 marks)***

**13. (a) (i)** State two ways by which water-bodies can be polluted. (02 marks)

(1)……
…
(2)……
….

(ii) Describe how polluted water can be treated on a large scale so that it is safe for use. (Diagram not required ***(***

……
……

(b)When soap solution was added to a sample of water, a white precipitate was formed. But when the soap solution was added to another portion of the water that had been boiled, no precipitation took place. Explain. (Your answer should include equation where possible.

***($6\frac{1}{2}$ marks)***

4. (a) Using equations only, outline the processes involved in the manufacture of nitric acid.

***($4\frac{1}{2}$ marks)***

(b) A mixture of concentrated nitric acid and sulphur was warmed.

(i) State what was observed. ***(04 marks)*** ***($1\frac{1}{2}$ marks)***

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

**(c)**Ammonium nitrate is among the most widely used fertilisers. Write equation for the reaction leading to the formation of ammonium nitrate from nitric acid.

***($1\frac{1}{2}$ marks)***

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

$$(NH_4NO_3(s) + H_2O(l) \rightarrow HNO_3(aq) + NH_4OH(aq)$$

Excessive use of ammonium nitrate as a fertiliser can cause the soil to become acidic. Explain.

($2\frac{1}{2}$ marks)

(e) Write equation to show the effect of heat on;

(i) Silver nitrate ***($1\frac{1}{2}$ marks)***

(ii) Potassium nitrate ***($1\frac{1}{2}$ marks)***

(f)State one use of nitric acid other than in the manufacture of fertilisers. ***($\frac{1}{2}$ mark)***