GOLDLITE ONLINE SERVICES

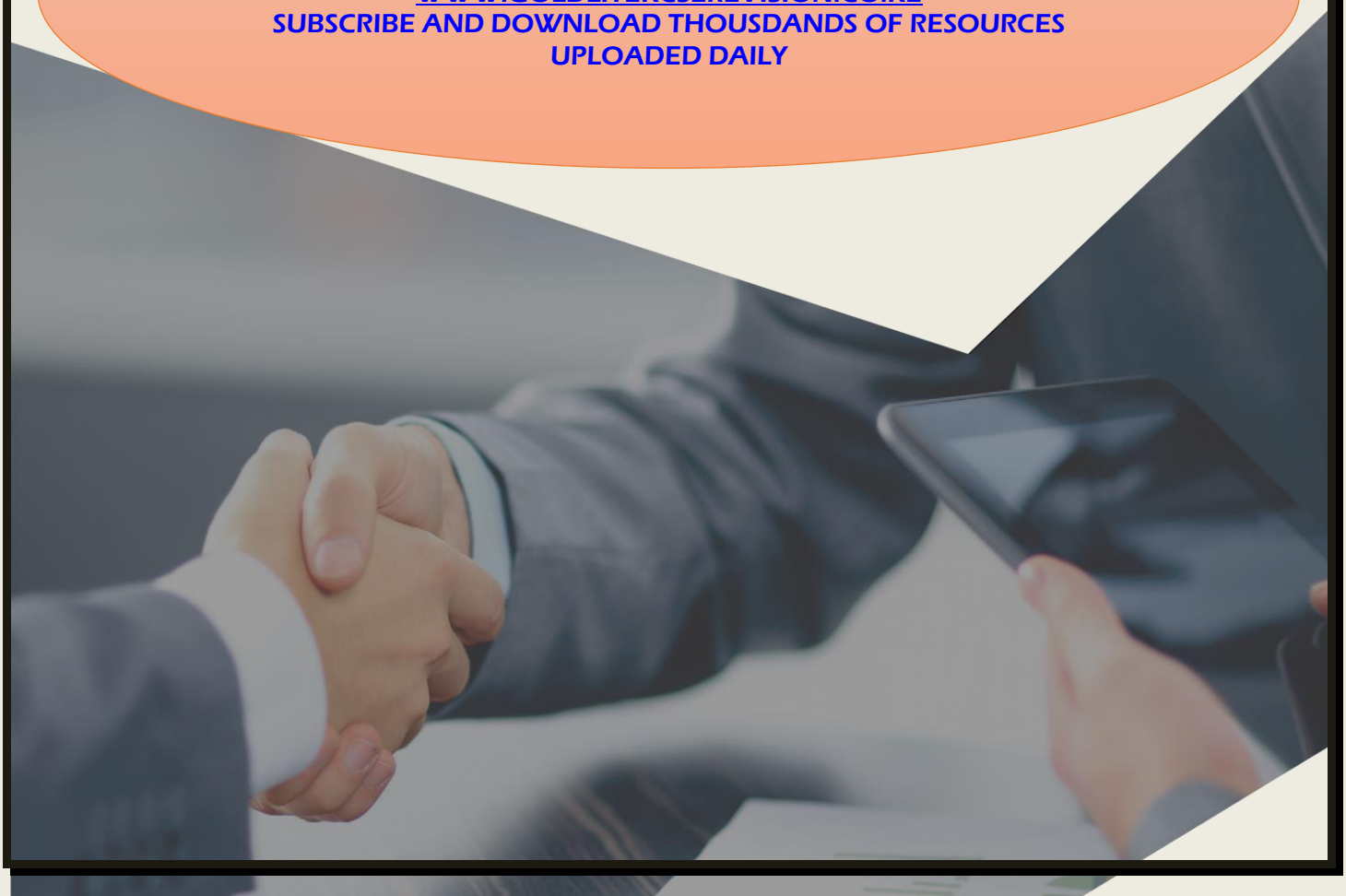
Kenya Certificate of Secondary Education

SMARTFOCUS QUICK REVISION SERIES 2025

CHEMISTRY PAPER 1

24 SERIES EXAMS

KNEC COMPLIANT



SERIES 1
ANSWER ALL THE QUESTIONS IN THE SPACES PROVIDED:

1. A school laboratory technician left a sample of concentrated sulphuric (VI) acid in an open boiling tube for 24 hours and she found out that the volume had increased slightly.

   a) What property of concentrated sulphuric (VI) acid was shown by the above observation? (1 mark)

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   b) Give one use of concentrated sulphuric (VI) acid based on the property named in (a) above. (1 mark)

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   c) Determine the oxidation state of Sulphur in $S_2O_7^{2-}$. (1 mark)

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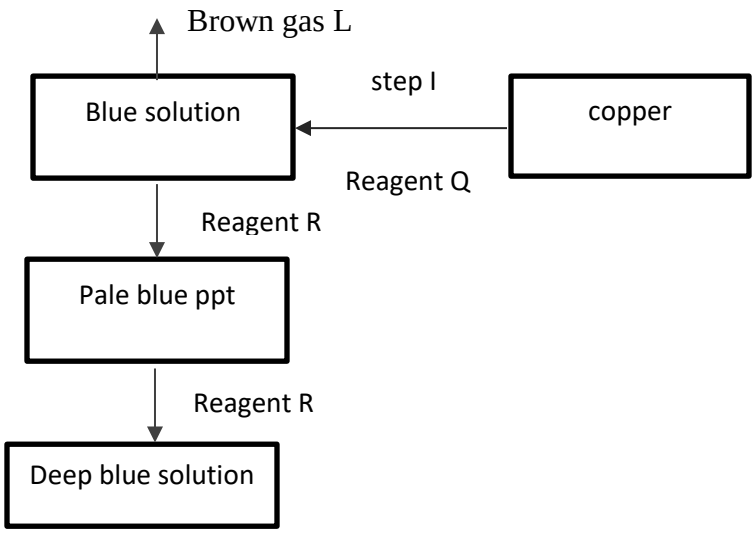
2. Study the flowchart below and use it to answer the questions that follow.



   (a) Give the identity of reagents Q and R (2 marks)

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   (b) Write equation leading the formation of the deep blue solution. (1 mark)

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3. (a) State Charles' Law. (1 mark)

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(b) The volume of gas Y at a temperature of 25 ^{o}C and 600 mmHg pressure is 9.6 x 10^{-2} m^3. Calculate the temperature at which the volume of the gas would be 6.4 x 10^{-2} m^3 pressure remains constant. (2 marks)

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4. A form three student from **KASSUMEC** High school was interested in determining the pigments present in amaranthus leaves that makes it have the green and yellow colourations

a) Identify the substances responsible for the green and the yellow colourations. (2 marks)

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b) State the two processes that make the separation of the pigments possible. (1 mark)

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5. The combustion of a hydrocarbon compound gave 4.4g carbon (IV) oxide and 2.25g water.

i) Calculate the mass of carbon and hydrogen in the hydrocarbon sample. (1 mark)

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ii) Calculate the empirical formula and hence determine the molecular formula of the hydrocarbon given that it has a molecular mass of 58. (C=12.0, H=1.0) (2 marks)

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6. a) Define hydrocarbons. (1 mark)

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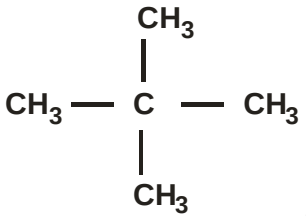
b) Name the following organic compounds. (2 marks)



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$CH_3(CH_2)_3CH\,CH_2$ ……..

7. State **one** role of Chemistry in the society. (1 mark)

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8. Use the bond enthalpies given below (at 298K) to answer the questions that follow.

$$N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$$

Bond	**Bond energy kJ /mol**
H – H	436
N - H	388
N ≡ N	944

a) Work out the enthalpy change for the reaction above. (2 marks)

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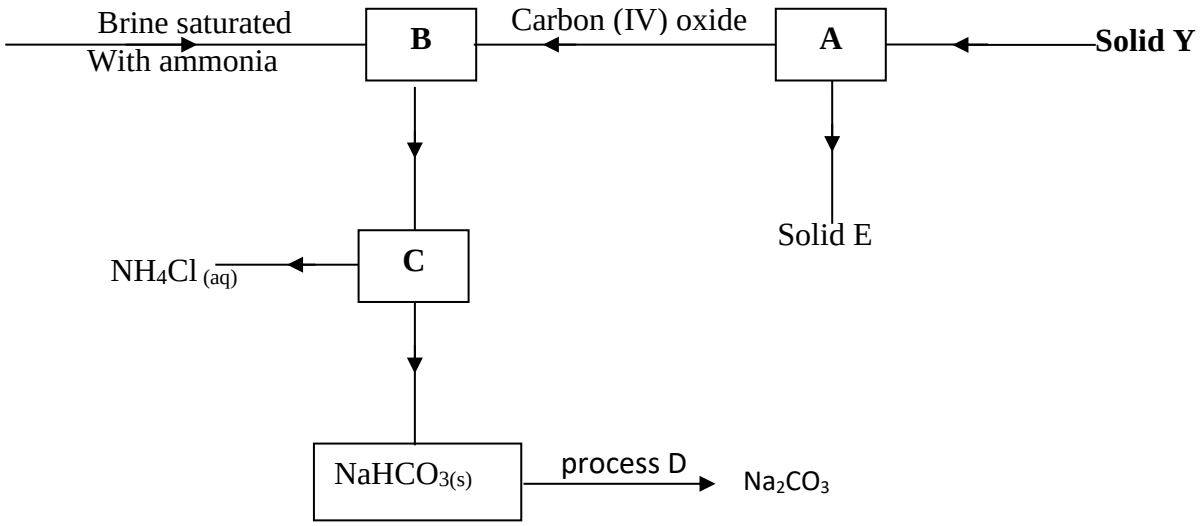
b) Draw an energy level diagram showing the activation energy for the above reaction. (2 marks)

9. The diagram below shows part of the Solvay process.



a) Name process D …… (1 mark)

b) State the process taking place in chamber C (1 mark)

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c) State two uses of sodium carbonate. (2 marks)

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10. One of the methods of removing water hardness is by use of ion exchange.

a) Explain how the method can be used to remove water hardness. (2 marks)

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b) After continuous use the ion exchanger column gradually loses the ability to remove water hardness. How can its ability be regenerated? (1 mark)

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c) Give one disadvantage of hard water. (1 mark)

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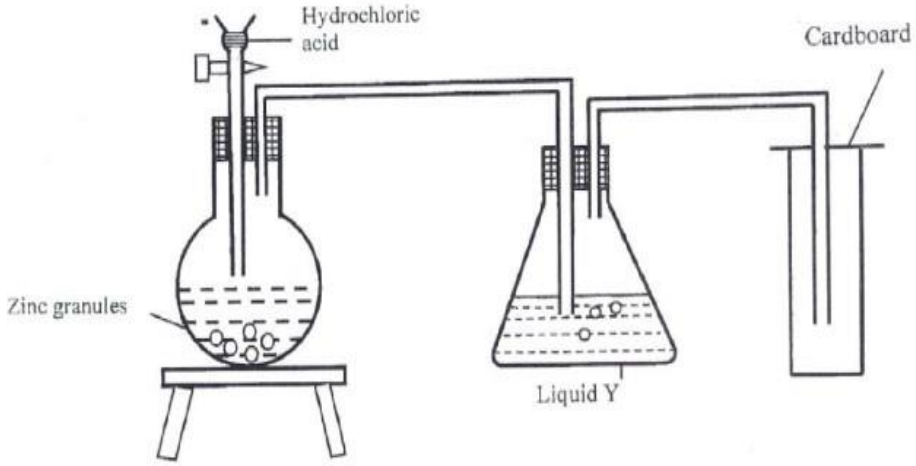
11. The set up below was used by a form one student in an attempt to prepare and collect sample of a dry sample of hydrogen gas.



a) Give a reason why the aim of the experiment was not achieved. (1 mark)

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b) Identify the catalyst that can be used in the reaction in the round bottomed flask. (1 mark)

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12. Use the data given in the table below to determine the molar enthalpy of formation of ethanol (3 marks)

Combustion of:	Molar enthalpy in $kJmol^{-1}$
Carbon	-394
Hydrogen	-286
Ethanol	-1386

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13. Using dots (●) and crosses (x) diagrams to represent electrons, show bonding in:
(i) the compound formed when fluorine and nitrogen combine. (1mark)
(atomic numbers N =7. fluorine = 9)

(ii) potassium oxide. (1 mark)
(Atomic numbers K = 19, O=8)

14. a) Define the term rust. (1 mark)

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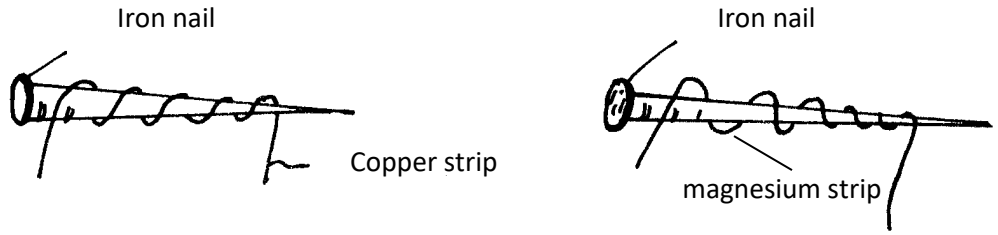
b) Use the diagram below to answer the question that follows



X **Y**

State the observations made in X and Y if the set- ups are exposed to air for long.
(2 marks)

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15. A dynamic equilibrium between chromate (VI) and chromium (III) ions is as shown below

$Cr_2O_7^{2-}{}_{(aq)} + 14H^+{}_{(aq)} \rightleftharpoons 2Cr^{3+}{}_{(aq)} + 7H_2O_{(i)}$
(Orange) (Green)

State and explain the observation made when dilute sodium hydroxide solution is added to the equilibrium mixture. (2 marks)

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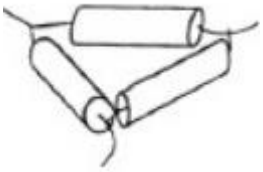
16. Name and give the uses of the following pieces of apparatuses



a)

Name……(½ mark)

Use…… (½ mark)

b)

Name……..(½ mark)

Use…….. (½ mark)

17. "JIK" is common house hold bleach which contains sodium hypochlorite as the active ingredient.

a) Write down an equation to show how the active ingredient in "JIK" bleaches a colored dye.

(1mark)

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b) Name the process by which "JIK" bleaches a coloured dye. (1 mark)

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c) Suggest why it is better to use "JIK" as bleach when washing clothes instead of using chlorine water. (1 mark)

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18. a) P grams of a radioactive isotope sample takes 160 days to disintegrate to 7g. The half-life of the isotope is 40days. Find the initial mass P. (2 marks)

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b) State one danger associated with radioactivity. (1 mark)

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19. Starting with recycled copper, describe how copper (II) sulphate crystals can be prepared in the laboratory. (3 marks)

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20. Ethanedioic acid, $(COOH)_2$, was used to prepare carbon (II) oxide instead of methanoic acid, HCOOH, in the laboratory. It gave equal volumes of carbon (II) oxide and carbon (IV) oxide.

a) Write an equation for the dehydration of ethanedioic acid. (1 mark)

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b) Explain how pure carbon (II) oxide can be obtained from the mixture of the two gases? (1 mark)

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c) State two physical properties of carbon (II) oxide which make it be referred to as a "silent killer." (1 mark)

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21. a) What are isotopes? (1 mark)

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b) Element W has two isotopes ^{36}W and ^{40}W which occur in the ratio K:4. Given that R.A.M of W is 37.25. find the value of K. (2 marks)

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a) What is meant by an acid-base indicator? (1 mark)

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b) Give **two** disadvantages of using flower extract as acid-base indicator compared to commercial indicators. (2marks)

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22. The data below was recorded when metal M was completely burnt in air (M is not the actual symbol of the element, R.A.M; M=207, O = 16)
Mass of the empty crucible and lid =10.2 g
Mass of crucible, lid and metal M = 16.41g
Mass of crucible, lid and metal oxide =17.37 g

a) Determine the mass of:

i) Metal M (½ mark)

ii) Oxygen (½ mark)

b) Determine the empirical formula of the metal oxide. (2 marks)

23. The products formed by the action of heat on the nitrates of elements K, M and N are given in the table below.

Nitrate	Products formed
K	**metal + nitrogen (IV) oxide + oxygen**
M	**metal oxide+ nitrogen (IV) oxide + oxygen**
N	**metal nitrite + oxygen**

a) Which element forms a soluble carbonate. (1 mark)

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b) Arrange the metal elements in increasing order of reactivity. (1 mark)

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c) Give one example of K. (1 mark)

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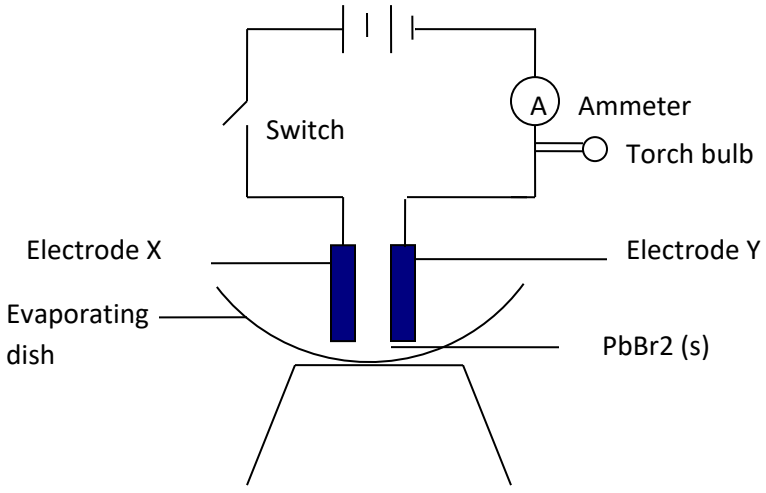
24. The set-up below illustrates an experiment to investigate conduction of electric of lead (II) bromide. Study it and answer the questions that follow.



a) State the mistake in the set-up. (1 mark)

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b) If the experiment was properly carried out, state the observations made at the cathode at the end of the experiment and write a half-reaction equation for the reaction. (2 marks)

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25. The following are reduction potentials of some elements.

Half reaction	E^{θ} volts
$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$	-0.76
$Al^{3+}_{(aq)} + 3e^- \rightarrow Al_{(s)}$	-1.66
$Fe^{2+}_{(aq)} + 2e^- \rightarrow Fe_{(s)}$	-0.44

Using the information above, **explain** whether it is advisable or not to store iron (II) sulphate solution in aluminium containers. (2 marks)

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26. The table below shows organic compounds A, B, C, D and E. Use the information given to answer the questions that follow.

Substance	A	B	C	D	E
Symbol	$R\text{-}COO^-Na^+$	CH_2OH | $CHOH$ | CH_2OH	$\left(-CH_2 - CH_2-\right)_n$	$R\text{-}COOCH_2$ | $R\text{-}COOCH$ | $R\text{-}COOCH_2$	$R\text{-}OSO_3^-Na^+$

a) Identify

I. A soapless detergent. (1 mark)

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II. An ester (1 mark)

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b) Give **one** disadvantage of continued use of substance C. (1 mark)

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27. (a) Both water gas (carbon (II) oxide and hydrogen) and producer gas (carbon (II) oxide and nitrogen) can be used as fuels. Explain why water gas is a better fuel. (2 marks)

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b) Give the abbreviation of "dichlorodiphenyltrichloroethane" (1 mark)

SERIES 2

1(a) State the condition under which a Bunsen burner produces a non-luminous flame. (1mk)

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(b) Write an equation for the reaction that takes place in a luminous flame assuming the laboratory gas is butane. (1mk)

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(c) One of the regions in the non-luminous flame is the unburnt gas region. Describe how the presence of this region can be shown using a piece of paper. (1mk)

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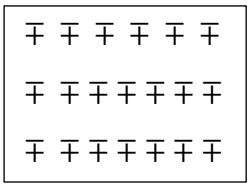
2. The diagram below is a section of a model of the structure of element T.



KEY

+ Nuclear Charge

− An Electron

a) State the type of bonding that exist in T. (1mk)

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b) In which group of the periodic table does element T belong? Give a reason. (2mks)

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3. A radioactive isotope of lead undergoes radioactive decay in two stages as shown below:

$^{216}_{85}Pb$ (i) $^{212}_{83}X$ (ii) $^{212}_{84}Y$

(a) Identify the particle emitted at each stage. (2mks)

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(b) State one use of radioactive isotopes. (1mk)

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4(i) State the observations made when Hydrogen Sulphide gas is bubbled through aqueous Lead (II) Nitrate solution. (1mk)

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(ii) Write an ionic equation for the reaction above. (1mk)

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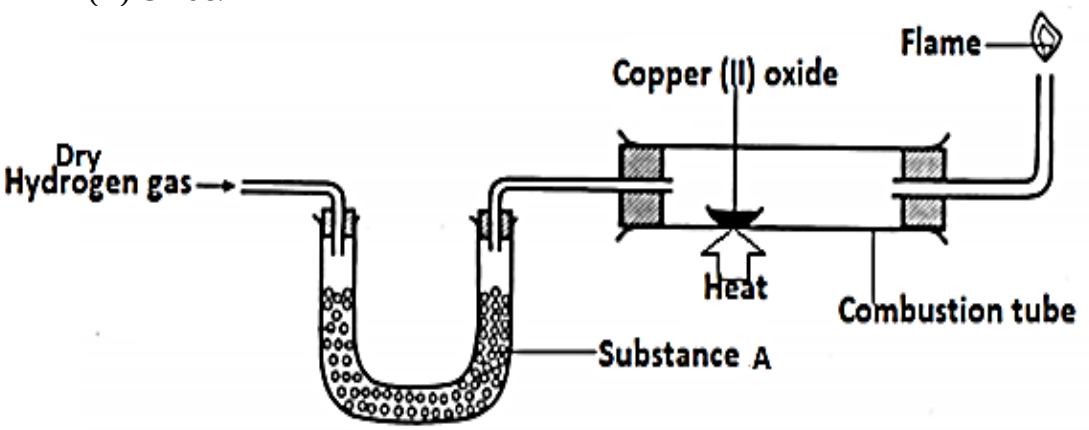
5. The set up below was used to investigate the reaction between dry hydrogen gas and Copper (II) Oxide.



(a) Name substance A. (1mk)

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(b) State the observation made in the combustion tube. (1mk)

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(c) Explain the observation in (b) above. (1mk)

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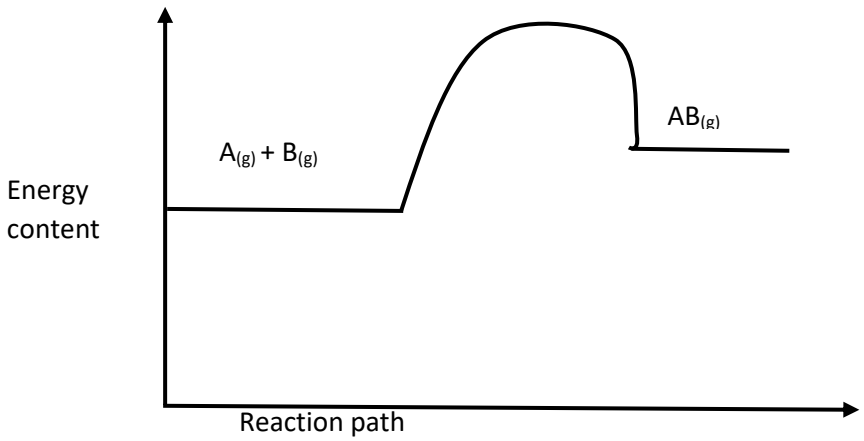
6(a) Consider the following equation. $A_{(g)} + B_{(g)} \longrightarrow AB_{(g)}$



On the same axis, sketch the graph when a catalyst is added. (1mk)

H H

(b) Hydrazine H – N – N – H is used as a fuel in rockets. Using the bond energies in the table below. Calculate the enthalpy change for combustion of hydrazine. (3mks)

$N_2H_4(l) + O_2(g) \longrightarrow N_2(g) + 2H_2O(g)$

Bond	Bond energy kJ/mol
N – H	388
N – N	163
O = O	496
N ≡ N	944
O – H	463

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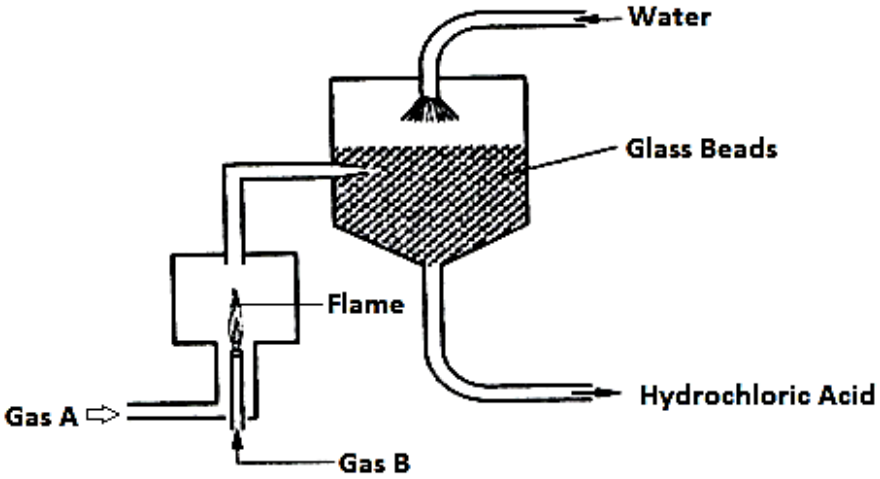
7. The diagram below represents large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:



(a) Identify

(i) Gas A (1mk)

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(ii) Gas B (1mk)

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(b) Write the chemical equation for the reaction between gas A and gas B. (1mk)

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(c) State the role of glass beads in the process. (1mk)

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8. Use the following information on substances S, T, V and Hydrogen to answer the question that follow.

(i) T displaces V from a solution containing V ions.

(ii) Hydrogen reacts with the heated oxide of S but has no effect on heated oxide of F.

a) Arrange substances S, T, V and Hydrogen in order of increasing reactivity. (2mks)

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b) If T and V are divalent metals, write an ionic equation for the reaction in (i) above. (1mk)

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9. Describe how the PH of anti-acid (Actal tablet) can be determined in the laboratory. (3mks)

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10(a) A student electroplated a spoon with copper metal. Write an equation for the reaction at the cathode. (1mk)

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(b) Calculate the time in minutes required to deposit 1.184 grams of Copper if a current of 2A was used. (1 Faraday = 96500 coulombs, Cu = 63.5) (2mks)

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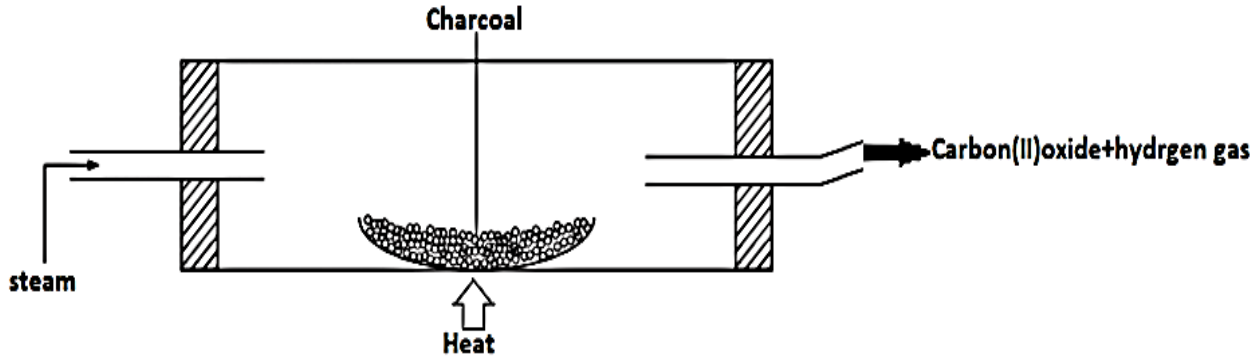
11. When steam was passed over heated charcoal as shown in the diagram below, hydrogen gas and Carbon (II) oxide were formed.



a) Write a balanced equation for the reaction which takes place in the combustion tube. (1mk)

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b) Name two uses of Carbon (II) oxide gas, which are also the uses of hydrogen gas. (2mks)

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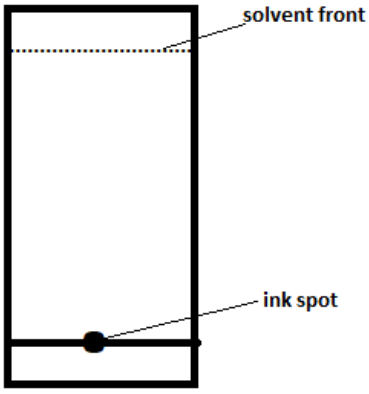
A12. A given sample of ink is a mixture of red dye, blue dye and orange dye. The blue dye is least absorbed than the rest and the red dye is the most sticky.

a) Complete the paper chromatogram below showing their separation. (1½mks)



(b) The above dyes are soluble in water. Describe how a pure sample of blue dye can be obtained. (1mk)

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c) Name the solvent used in paper chromatography. (½ mk)

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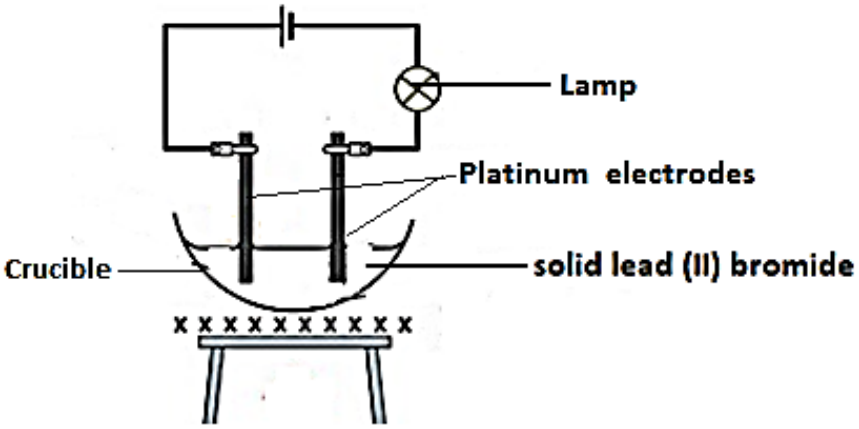
13. In an experiment to investigate the conductivity of substances, a student used the set up shown below.



The student noted that the bulb did not light.

a) What had been omitted in the set up. (1mk)

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b) Explain why the bulb lights when the omission is corrected? (2mks)

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14. The results of an experiment to determine the solubility of potassium chlorate in water at 30^{o}C were as follows.

Mass of dish = 15.86g

Mass of dish + saturated solution at 30^{o}C = 26.8g

Mass of dish + solid potassiumchlorate after evaporation to dryness = 16.68g

Calculate the mass of saturated solution containing 60g of water at 30^{o}C. (3mks)

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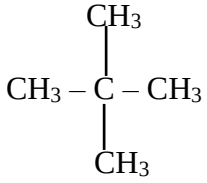
15(a) Give the systematic names of the following compounds. (2mks)

(i) 

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(ii) $CH_3C\equiv CCH_2CH_3$

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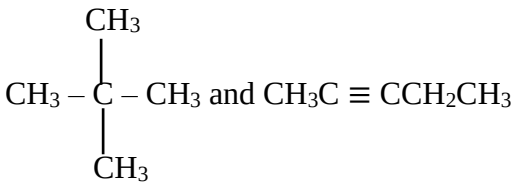
(b) Describe a chemical test that can be carried out inorder to distinguish between.



(2mks)

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16(a) Draw a labelled diagram showing the atomic structure of $^{23}_{11}Na$ (2mks)

(b) The atomic number of phosphorous is 15. Draw a dot (·) and cross (x) diagram for the compound formed when phosphorous react with chlorine. (1mk)

17(i) State Gay-Lussaic's Law. (1mk)

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ii) $15cm^3$ of a gaseous hydrocarbon reacted completely with $45cm^3$ of Oxygen gas. $30cm^3$ of carbon (IV) oxide were formed. Determine the formula of the hydrocarbon given that all volume of gases were measured under same conditions of temperature and pressure. (2mks)

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18. Consider the following reactions

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

The enthalpy is -92.4kJ per mole of nitrogen.

a) Give the enthalpy change per mole of ammonia. (1mk)

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b) State and explain how each of the following affects the yield of ammonia: .

(i) Increase in temperature. (1mk)

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(ii) Finely divided iron. (1mk)

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19. Excess iron was allowed to rust in cm^3 of moist air remaining was measured at 1 atmospheric pressure each day. The results were as follows.

Day	0	1	3	4	5	6	7	8
Volume (cm^3)	2000	1900	1720	1660	1620	1600	1600	1600

(i) Write an equation for the formation of rust. (1mk)

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(ii) On which day was the reaction complete. Explain. (1mk)

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(iii) What is the percentage volume of oxygen in air. Show your working. (1mk)

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20. Element P^{3+} and Q^{2-} belong to period three of the periodic table.

(i) Write the electronic arrangement of their atoms. (2mks)

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ii) Write the formula of the compound formed by P and Q. (1mk)

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21(i) Give the IUPAC name of the following:

$CH_3CH_2COOCH_2CH_3$ (1mk)

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ii) Give the chemical name to which the compound you have named in (i) above belongs.(1mk)

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iii) Name the two substances used in the formation of the compound in (i) above. (1mk)

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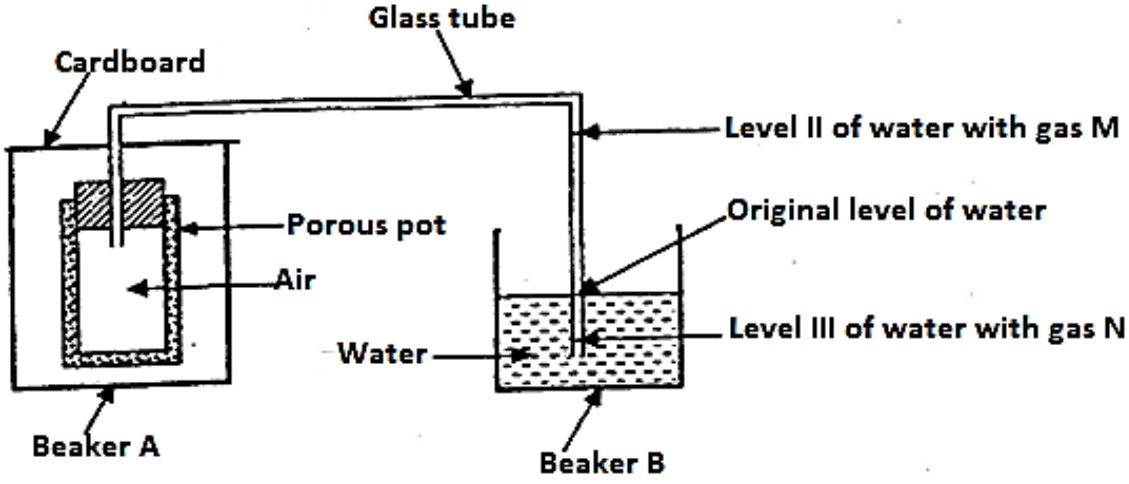
22. The set up below was used to investigate some properties of two gases M and N.



When beaker A was filled with gas M, the level of water in the glass tube rose to point II. When the experiment was repeated using gas N, the level of water dropped to point III. Explain these observations. (2mks)

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23. Nitric (V) acid may be prepared in the laboratory by the action of concentrated sulphuric (VI) acid on a suitable nitrate and distilling off the nitric V acid.

(a) Why is the apparatus used in the preparation of nitric (V) acid made of glass. (1mk)

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(b) Pure nitric (V) acid is colourless but the products in the laboratory preparation is usually yellow. Explain. (2mks)

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24. Starting with copper metal, describe how a pure sample of Copper (II) carbonate can be prepared. (3mks)

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25. Aluminum is both malleable and ductile.

(a) Differentiate between malleable and ductile. (2mks)

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(b) State one use of aluminium based on:

(i) Malleability (1mk)

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(ii) Ductility (1mk)

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26. Sulphur (IV) oxide and nitrogen (IV) oxide reacts as shown in the equation below.

$SO_2(g) + NO_2(g) \longrightarrow SO_3(g) + NO(g)$

(i) Using the oxidation numbers of either sulphur or nitrogen, show that this is redox reaction. (2mks)

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(ii) Identify the reducing agent. (1mk)

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SERIES 3

1. a) What is meant by allotropy? (1 mark)

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   b) Name the allotrope of Sulphur that is stable below 96 ^{o}C. (1 mark)

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   c) Temperature of 96 ^{o}C is the transition temperature of Sulphur allotropes. Define the term transitional temperature? (1 mark)

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2. Define the following terms as used in Chemistry

   i) Flame (1 mark)

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   ii) Optimum conditions (1 mark)

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   iii) End point of a reaction (1 mark)

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3. Why is solid carbon (IV) Oxide (Dry ice) preferred in cool boxes than the normal ice (solid water)? (2mks)

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   ……..……
   ……..……

4. 30cm^3 of ethene gas was exploded in 60cm^3 of oxygen gas. Write a balanced chemical equation of the reaction that will take place and hence determine the volume of the residue gas at room temperature. (3mks)

   ……

5. When solid M is dissolved in water, it dissolves and forms a blue solution. Addition of ammonia solution to this solution forms a blue precipitate which dissolves in excess to form a deep blue solution. Write the formula and name of the ion responsible for the deep blue solution. (2mks)

   ……
   ……
   ……
   ……

6. The solubility of Iron (II) Sulphate crystals at 22^{o}C is 15.65g per 100g of water.

Calculate the mass of iron (II) sulphate crystals in 45g of saturated solution at the same temperature. (2mks)

……

……

……

……...

7. The table below gives bond energies of some covalent compound

Bond	**Bond energy KJ mol^{-1}**
C – H	413
O=O	497
C=O	804
H-O	464

Calculate the enthalpy change for the combustion of methane in excess oxygen gas. (3mks)

……

……

……

……

8 .Study the following equilibrium equation.

$2X_2(g) + Y_{2(g)} \rightleftharpoons 2X_2Y_{(g)} \Delta H = -197kJ/mol$

Suggest two ways of increasing the yield of X_2Y. (2mark)

……

……

……

9. A student burnt magnesium ribbon in a gas jar full of Sulphur (IV) oxide gas.

(i) State two observations made in the gas jar. (2 marks)

……

……

……

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

……..

10. Iron is extracted from its ore by the blast furnace process

a) Name the chief ore from which iron is extracted from. (1 mark)

……..

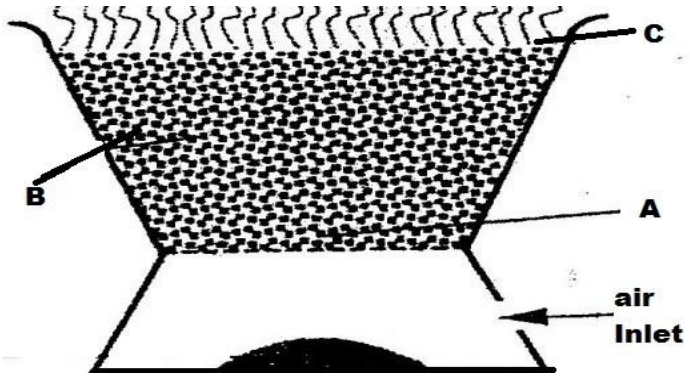
b) An ore is suspected to contain mainly iron. Describe a method that can be used to confirm the presence of iron in the ore. (2 marks)

……

……

……

……
..……..……
11. The diagram below shows a stove that uses charcoal as a fuel in a well-ventilated room. Study it and answer the questions that follow.



a) Write the chemical equation for the reaction that takes place at
   i) Region A (1mark)

.....

   ii) Region C(1 mark)

   .....

b) State the reason why the stove above should be used in a well ventilated room. (1 mk)

   .....

12. During electrolysis of dilute sulphuric (VI) acid, a current of 0.63 A was passed through the electrolyte for 74 minutes. Calculate the volume of gas produced at the anode.
(1 Faraday = 96500 coulombs; MGV 24dm^3 at room temperature) (3marks)

.....

.....

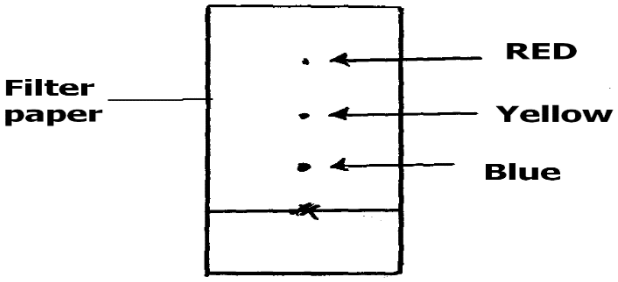
13. The table below gives the rate of decay for a radioactive element K;

Number of days	Mass (g)
O	12.8
280	0.8

Determine the half – life of the radioactive element K.(2mks)

……

14. The chromatogram below shows the constituents of ink sample M using methylated spirit as solvent.



State two factors that allow separation of the pigment above. 2mks

……

……

……

……

15. Starting with magnesium sulphate solution, describe how a solid sample of magnesium oxide can be prepared in the laboratory. (3mks)

……

……

16. When solid F was added into a beaker containing distilled water, it dissolved to form a colourless solution F. When two drops ofacidified barium chloride solution was added to the sample solution F, a white precipitate was formed. There was effervescence when solid sodium carbonate was added to another sample of solution F.

a) Identify the cation and the anion present in solid F (1 mark)

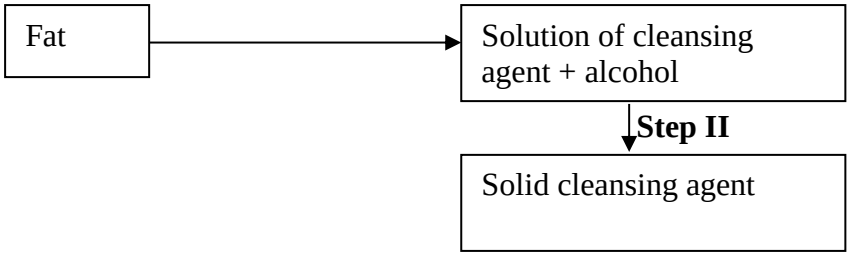
Cation …….

Anion …….

b) Write ionic equation for formation of white precipitate formed upon adding acidified barium (ii) chloride (1 mark)

……

17. The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



i) What name is given to the type of cleansing agent prepared by the method shown in the scheme? …… (1mk)

ii) Name onechemical substance added in step II (1mk)

……

(iii) What is the purpose of adding the chemical substance named in (ii) above.(1mk)

……

……

18 (a) Identify the acid and base in the forward reaction given by the equation below:

$HSO_{4\,(aq)}^{-} + H_2O_{(l)} \leftrightharpoons H_2SO_{4\,(aq)} + OH_{(aq)}^{-}$(1mark)

Acid ……..…….…

Base ……..

b) Using the above equation and your answer in (a) above, define the term acid.

……(1 marks)

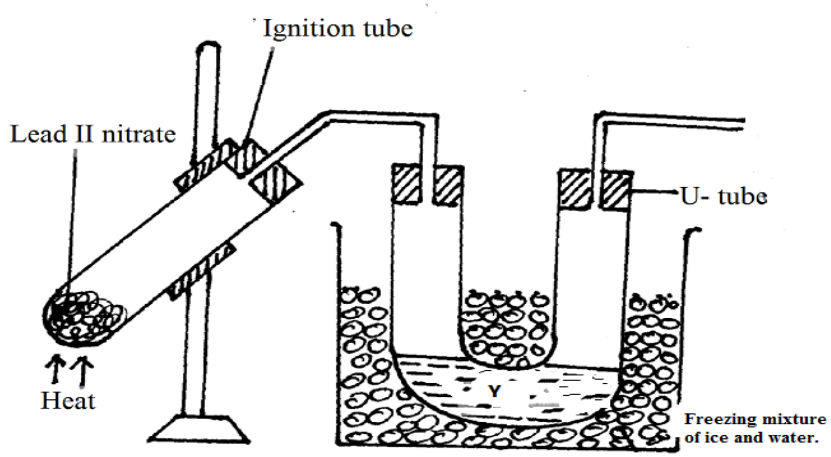
19. i) Name the compound formed when chlorine gas reacts with hot concentrated sodium hydroxide solution. (1mk)

…….

ii) Name use of the compound in (i) above other than bleaching.(1mk)

……

20. Study the set- up below and answer the questions that follow that was used to prepare oxygen gas in the laboratory.



a) i) Identify:-

Liquid Y……... (½ mark)

ii) What colour is liquid Y (½ mark)

……..……

b) Write the chemical equation for the reaction taking place in the Ignition tube. (1mark)

…….

c) Complete the diagram to show how oxygen was collected (1mark)

21. Write the electronic configuration of Sulphur in;

ii) SO_3^{2-} (1mark)

iii) H_2S(1mark)

22. (a) State Graham's law of diffusion. (1 mark)

……

(b)60cm³ of oxygen gas diffused through a porous hole in 50 seconds. How long will it take 80cm³ of Sulphur (IV) oxide to diffuse through the same hole under the same conditions? (S = 32, O = 16). (2 marks)

……

……

23. A mixture of magnesium powder and copper powder was reacted with dilute hydrochloric acid. The solution was then filtered, name;

(a) (i) The residue (1mark)

……..

(ii) The filtrate (1mark)

……

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

……

24. Name the following processes;

a) When anhydrous calcium chloride is left in an open beaker overnight a solution was formed. (1mk)

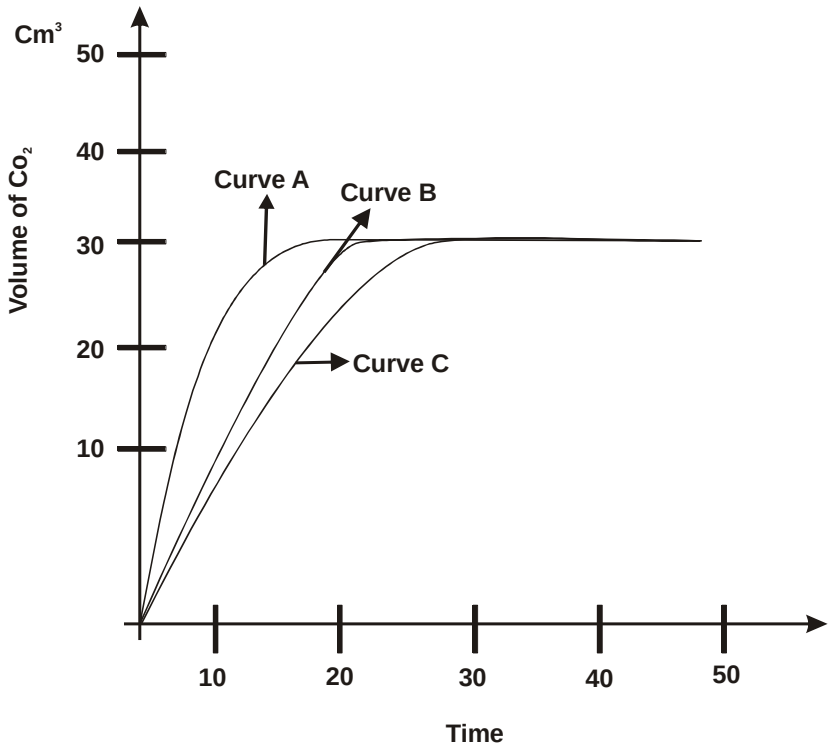
……

b) When sodium carbonate decahydrate crystals are left in an open beaker for some days it turned into a powder. (1mk)

25. Compare the atomic sizes of sodium and magnesium. Explain. (2mks)

……

26. The graphs below were drawn when15 g of marble chips in different physical states were reacted with 50cm^3 of 2M Hydrochloric acid. They are drawn by measuring the volume of carbon (iv) oxide produced with time.



a) Which curves corresponds to the reactions involving powdered calcium carbonate andlarge sized marble chips with the dilute acid?

i) Powdered calcium carbonate (1mark)

.....

ii) Large sized calcium carbonate (1mark)

.....

b) All the graphs eventually flatten out at the same level but at different time. Why do the graphs flatten out at the same level? 1 mark

.....

.....

27. Draw a well labelled diagram to show the set-up that can be used to separate mixture of iodine and sodium chloride.(2marks)

28. Give the structural formula and name the compound formed when methanol and ethanoic acid are reacted in presences of few drops of concentrated sulphuric (VI) acid. (2 marks)

……

SERIES 4

1. The electronic configuration of two particles $_{a}{}^{27}X$ and $_{b}{}^{32}Y$ are 2.8 and 2.8.8 respectively.

   a) Write the values of

      a ……. (½ mark)

      b…….. (½ mark)

   b) Identify the period and group of the periodic table to which element Y belong.

      Period…….. (½ mark)

      Group……. (½ mark)

2. You are provided with the following; thermometer, boiling tube, beaker, Bunsen burner, pure solid X, whose boiling point is about 80^{o}C, water and any other apparatus that may be required. Draw a labeled diagram for an experiment that would be used to determine the melting point of X. (3marks)

……

……

……

3. (a) Other than sulphur, name an element that shows allotropy. (1mark)

   (b) Draw the structure of the allotrope of sulphur that is stable below 96^{o}C. (1mark)

   (c) State any one use of sulphur apart from manufacture of sulphuric (VI) acid. (1mark)

4. Study the organic compounds below and answer the questions that follow.

   I. C_3H_8O

   II. CH_3CHCH_2

   III. $CH_3CH_2CH_2COOH$

   IV. $CH_3(CH_2)_2CH_3$

   V. CH_2CH_2

   Select,

   (a) One compound which is a saturated hydrocarbon. (1mark)

……..

(b) Two compounds which are members of the same homologous series. (1mark)

……

……

(c) Two compounds that will react together to produce a pleasant smelling compound. (1mark)

……

……

5. Explain the following observations.

(a) When air is bubbled into distilled water, the p^H of the water drops from 7.0 to 6.0. (1mark)

……

……

(b) A bee keeper stung by a bee applies baking powder onto the stung surface for relief. (1mark)

……

……

6. (a) Explain why calcium oxide is not used to dry hydrogen chloride gas. (2marks)

……

……

……

(b)Name one suitable drying agent for hydrogen chloride. (1mark)

……

7. The table below gives the boiling points of three liquids.

Liquid	**Boiling point(^oC)**
Hexane	69.0
Butan-1-ol	99.5

water	100

(a) Describe how the following mixtures can be separated.

(i) Hexane and Butan – 1 – ol (1½ marks)

……

……

……

(ii) Hexane and Water (1½ mks)

……

……

……

8. In an experiment, 2.4g of sulphur was ontained by reacting hydrogen sulphide and chlorine as shown in the equation below.

$$H_2S\ (g) + Cl_2(g) \longrightarrow S\ (s) + 2\ HCl(g)$$

(a) State the chemical property of chlorine shown in the reaction above. (1mark)

……

(b) Given that the yield of sulphur in the above reaction is 75%, calculate the volume of hydrogen sulphide gas used. (molar gas volume = $24dm^3$, H=1, S= 32). (2marks)

……

……

(a) Write the equation for the reaction when a piece of graphite is completely burnt in air.

(1mark)

……

(b) Give one use of graphite and diamond and relate the use to properties of each. (2marks)

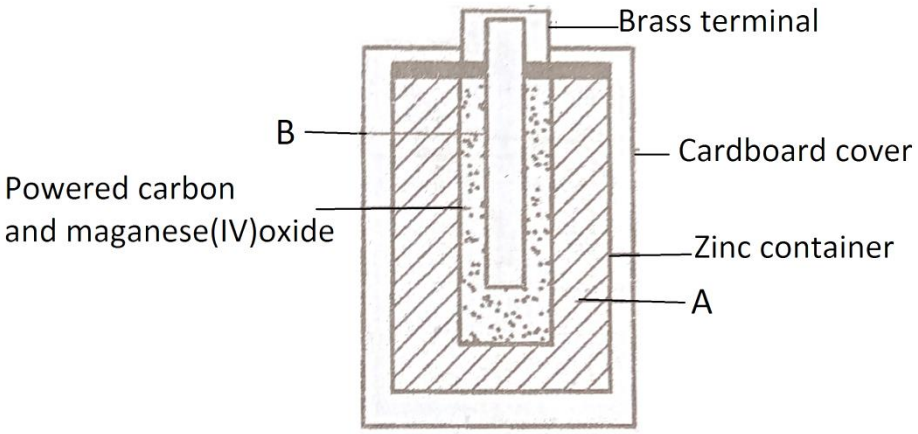
I. Graphite : Use……

Property ……..

II. Diamond: Use……..

Property…….

9. The diagram below shows a section of a dry cell. Study it and answer the questions that follow.



(a) Name the part labeled B. (1mark)

…….

(b) The part labeled A is a paste. Give a reason why it is not used in dry form. (1mark)

……

……

……

(c) (i) What is the purpose of zinc container. (1mark)

……

……

(ii)Apart from the use in c(i) above, state any other use of zinc. (1mark)

……

……

10. (a) A student electroplated a spoon with copper metal. Write the equation for the reaction on the surface of the spoon. (1mark)

……

……

(b)Calculate the amount of steady current that was passed for 30 minutes if 1.184g of copper was deposited. (1 Faraday = 96500C,Cu = 63.5) (2marks)

……

……

……

11. (a) State Gay Lussac's Law. (1mark)

……

……

……

(b) $60cm^3$ of methane was mixed with $200cm^3$ of oxygen. The mixture was sparked to complete reaction. If the final volumes were measured at room temperature, determine the volume of the resultant gaseous mixture. (2marks)

……

……

……

12. (a) State Le Chatelier's principle. (1mark)

(b)State and explain the observation made when drops of 2M sodium hydroxide solution were added to the system in equilibrium shown below. (2marks)

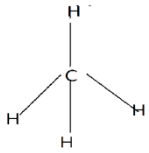
$$2CrO_4^{2-}(aq) + 2H^+(aq) \longrightarrow Cr_2O_7^{2-}(aq) + H_2O(l)$$

……

……

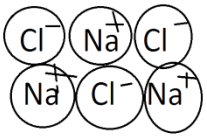
……

13. Study the structures given in the diagrams below to answer the questions that follow.

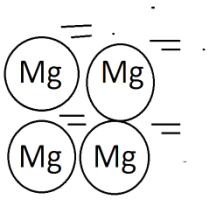


A

B



C



D

(a) Identify the structure with:

(i) Simple molecular structure. (1mark)

……

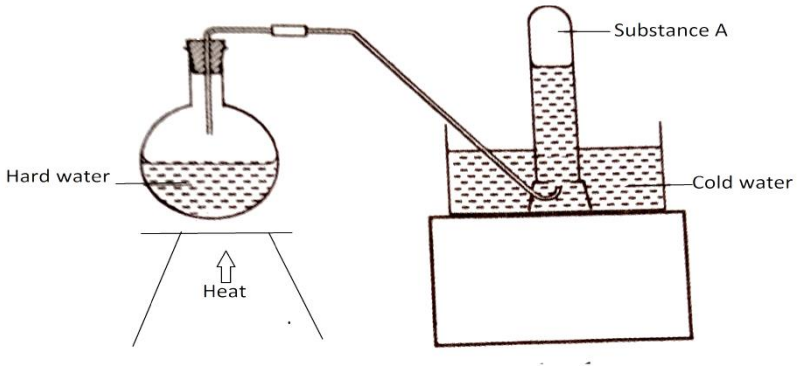
(ii) Giant atomic structure (1mark)

……

(b) Which structure conducts electric current both in solid and molten state. (1mark)

……

14. The set up below was used to demonstrate the effect of heat on hard water.



(a) Name substance A. (1mark)

(b) Explain why heating of hard water produced substance A. (2marks)

……

……

……

15. (a) Distinguish between deliquescent and efflorescent salts. (2marks)

……

……

……

(b)You are provided with the following; Potassium carbonate, Lead (II) sulphate, Sodium hydroxide, nitric (V) acid and Copper (II) carbonate. Select any: (1mark)

(i) Two that would produce neutralization reaction.

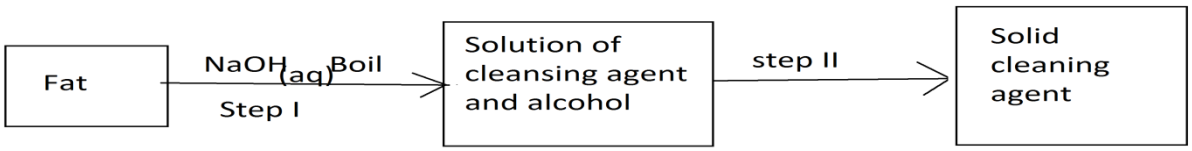
……

……

(ii) One that would decompose on heating to produce carbon (IV) oxide,

……

16. The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



Name;

(a) The cleansing agent. (1mark)

……

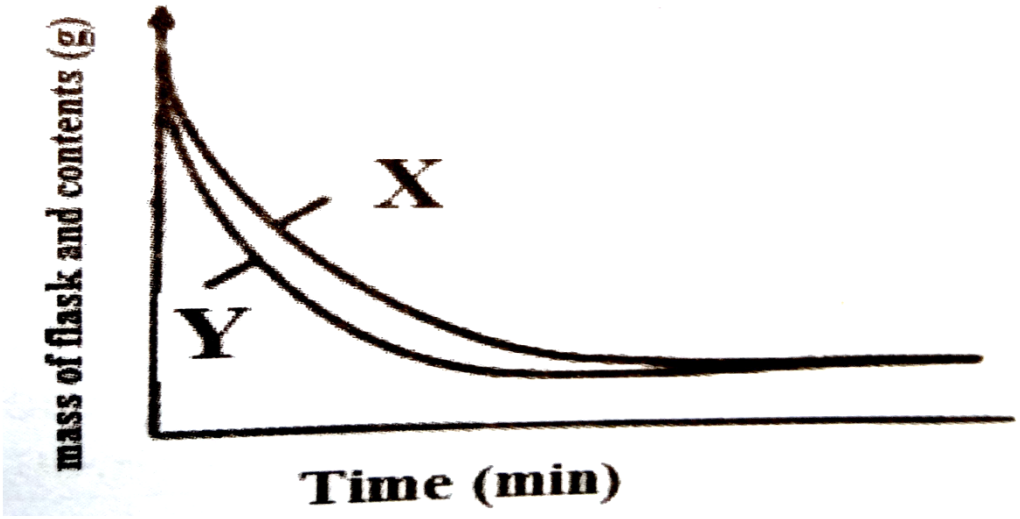
(b) Process in step I. (1mark)

……..

(c) Chemical substance added in step II. (1mark)

……..

17. The curves below represent the change in mass when equal amounts of powdered zinc and zinc granules were reacted with excess 2M hydrochloric acid. Use the graph to answer the questions that follow.



(a) Identify the curve for zinc granules. Explain. (2marks)

……

……

……

(b) Other than the factor demonstrated above, state one factor that may be varied to affect the rate of the above reaction. (1mark)

……

……

18. A white solid Q was heated. It produced a brown gas Y and a colourless gas Z that relights a glowing splint. The residue left was yellow after cooling.

(a) Identify: (1mark)

(i) Gas Y…….

(ii) The residue……..

(b) Write the equation for the decomposition of solid Q. (1mark)

……

……..

19. A crystalline sample of sodium carbonate, Na_2CO_3. XH_2O was heated until there was no further change. The mass of the residue reduced by 14.5%. Determine the value of X in the formula. (3marks)

……

……

……

20. In an experiment to identify the compound in an aqueous solution, three properties of the solution in test tubes were tested and the results obtained were recorded in the table below. Study it to answer the questions that follow.

Portion	**Test**	**Observation**
1	Add a few drops of dilute nitric (V) acid.	Effervescence. Forms a white precipitate with lime water.
2	Add aqueous sodium hydroxide drop wise until excess.	A white precipitate soluble in excess.
3	Add aqueous ammonia drop wise until excess.	A white precipitate soluble in excess.

(a) Identify the:

(i) Cation in the compound. (1mark)

……..

(ii) Anion in the compound. (1mark)

……

(b) Write the formula of the colorless solution formed in portion 3. (1mark)

……

21. Excess zinc powder was added to $50cm^3$ of 2M copper (II) sulphate solution and the reaction allowed to complete. The highest temperature change was 15^oC.

(a) State the observations made in the above reaction. (1mark)

……

……

(b) If the molar enthalpy of displacement is $-63kJmol^-$. Calculate the concentration in moles per liter of the copper (II) sulphate solution. (3marks)

……

……

……

22. Draw a well labeled diagram of a set up that can be used to prepare and collect dry sample of chlorine gas using manganese (IV) oxide and concentrated hydrochloric acid. (3marks)

23. An oxide of K has the formula K_2O_5.

(a) Determine the oxidation number of element K. (1mark)

……

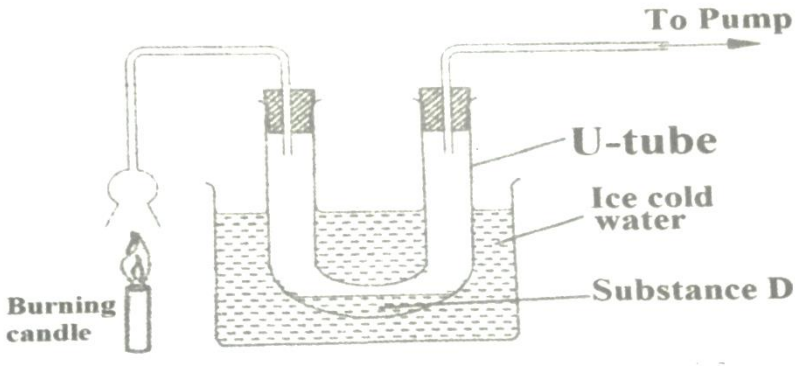
……

(b) Which group of the periodic table does element K belong. (1mark)

……

……

24. An experiment was set up as shown in the diagram below.



(a) Suggest the aim of the experiment. (1mark)

……

……

(b) Identify substance D. (1mark)

……..

(c) Describe how the other product of the burning candle could be prevented from getting into the environment. (1mark)

……

……

25. Calculate the values x and y in the following nuclear equation.

$$^{239}_{92}U \longrightarrow {}^{x}_{y}Th + 2\alpha + 2\beta$$ (2marks)

……

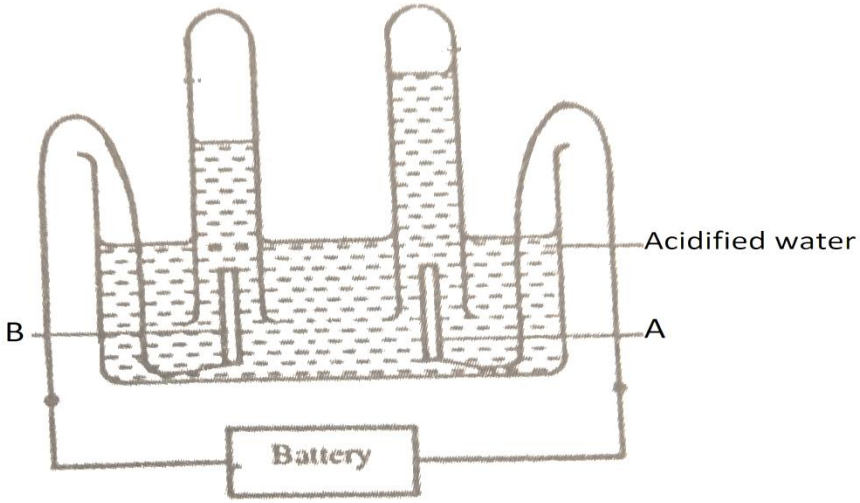
……

……

26. Given the following substances; soap, potassium chloride and aluminium chloride, classify the substances as acidic, basic or neutral. (2marks)

Acidic	**Basic**	**Neutral**

27. The diagram below represents the set up used for electrolysis of acidified water.



(a) Name the electrode B. (1mark)

……..

(b) Why is water acidified. (1mark)

……

……

(c) Write the equation for the reaction on the surface of electrode A. (1mark)

……

……

SERIES 5

1. (a) Using dot(.) and crosses(x) to represent electrons draw the structure of **$POCl_3$** (2 marks)

(P=15,0=8, Cl=17)

……..
……..
……..
……..
……..

(b) Explain why a molecule of H_2O can form a bond with H^+ to form H_3O^+ (1mark)

……
……

2.A hydrocarbon contains 80% carbon by mass. Given that 1dm^3 of the compound at **s.t.p** has a mass of 1.34g. Calculate the molecular formula of the compound. (Molar gas volume at s.t.p. = 22.4dm^3, C = 12, H = 1)

(3marks)

……..
……..
……..
……..
……..
……..

3.Write the chemical equation to show the reaction between Lead (II) oxide and the following substances.

(i) Sodium hydroxide. (1mark)

……...

(ii) Dilute hydrochloric acid (1mark)

……

(b) State the property of Lead (II) oxide demonstrated above. (1mark)

……

4. Sulphur (IV) oxide reacts with potassium dichromate (VI) according to the equation below.

$$3SO_{2(g)} + Cr_2O_7^{2-}{}_{(aq)} + 2H^+_{(aq)} \rightarrow 3SO_4^{2-}{}_{(aq)} + 2Cr^{3+}{}_{(aq)} + H_2O_{(I)}$$

(i) What is the oxidation number of chromium ion in $Cr_2O_7^{2-}$. (1mark)

……
……

(ii) State and explain the observation made in the above reaction (2marks)

……
……
……

5.Nitrogen(I)oxide is a colourless gas with pleasant smell and causes insensitivity when inhaled, but it is not reactive at room temperature. However, it relights a glowing splint

(a) Explain why the gas relights a glowing splint (1mark)

……
……..

(b) One of the uses of nitric(V) acid is purification of metals such as Gold, explain why Nitric(V) acid is used in purification of metals (1mark)

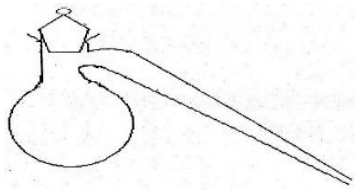
……...

……

(c) To a sample of a salt in a test tube, add $2cm^3$ of freshly prepared Iron (II) sulphate solution. Slant the test tube and slowly add concentrated sulphuric (VI) acid. Which ion does this test aim to confirm? (1 mark)

……..

6. Name the apparatus drawn below and give its use



(a) Name (1mark)

……

(b) Use (1mark)

……..

7.When a current of 0.82A was passed for 5 hours through an aqueous solution of metal Z, 2.65g of the metal was deposited. Determine the charge on the ion of metal Z. (1 Faraday = 96500 coulombs, Relative atomic mass of Z = 52) (3marks)

……..

……..

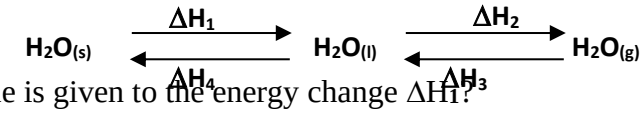
……...

……...

……...

8.The scheme below shows the energy changes that take place between ice, water and steam.

Study it and answer the questions that follow: -



(a) What name is given to the energy change ΔH_1? (1mark)

……

(b) What is the sign ΔH_3, give a reason (2marks)

……..

……..

……..

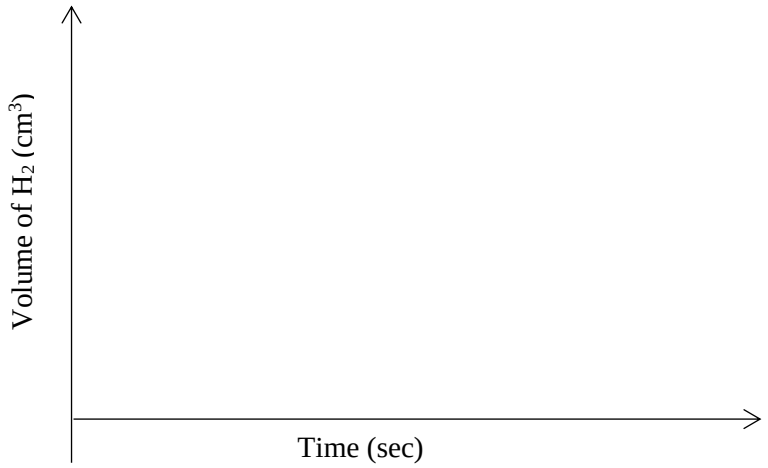
9. The table below gives three experiments on the reaction of excess hydrochloric acid and 1.8g of zinc done under different conditions. In each the volume of gas was recorded at different time internals

Experiment	Form of Zinc	Hydrochloric acid solution
I	Powder	1.0M
II	Granules	1.0 M

III	Powder	2.0 M

On the axis below draw and label three curves that could be obtained from such results.

(3 marks)



10. The solubility of copper (II)sulphate at 75 ^{0}C is 55g/100g of water and 19g/100g of water at 15^{0}C. What mass of crystals would be deposited if a saturated solution was made by dissolving X g of Copper (II) sulphate in 150g of water at 75^{o}C then cooled to 15^{0}C (3marks)

……..
……..
……..
……..
……
……..
……..

11.Potassium is isotopic and has a relative atomic mass (R.A.M) of 39.5, work out the percentage abundance of each isotope. The three isotopes are ^{39}K, ^{40}K and ^{38}K (0.01%) (3marks)

……
……...
……
……...
……

12.A green solid D was heated until there was no further change. The following observations were made.

(i) A colourless liquid condensed on the cooler parts of the test tube

(ii) A colourless gas which changes acidified potassium dichromate (VI) to green was formed

(iii) Brown residue S was left

(a) Give the identity of solid D (1mark)

……

(b) How can you chemically test the colourless liquid (1mark)

……

(c) Name the residue S (1mark)

……..

13.(i) State the most effective method of preventing rusting? (1mark)

……

……...

(ii) Explain why galvanizing rather than tinning is a better method of prevention of rusting. (1mark)

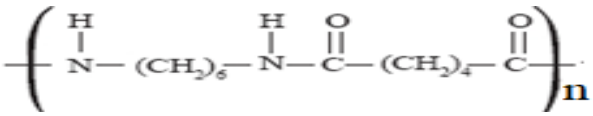
……

……...

(ii) Write an equation for the formation of rust (1mark)

……

14.Nylon polymer has the structure below.



(i) Determine the structure of the monomers (2marks)

……

……...

……

(ii) State the type of polymerization. (1mark)

……

15.(a) State and explain the function of tartaric acid in baking powder. (2marks)

……

……...

……

(b) By which process does silica gel protect electronic equipment from damage due to moisture. (1mark)

……

16.A mixture contains Lead (II) chloride, Iron fillings and Silver chloride. Describe how each of the substance can be obtained from the mixture. (3marks)

……

……

……

……

17.In the industrial extraction of lead metal, the ore is first roasted in a furnace. The solid mixture obtained is then fed into another furnace together with coke, limestone and scrap Iron. State the function of each of the following in this process.

(a) Coke (1 mark)

……

……..

(b) Limestone (1 mark)

……

……...

(c) Scrap Iron (1 mark)

……
……...

18.Complete the table below (3 marks)

Binary electrolyte	Cathode equation	Anode equation	Observation at the anode
Lead (II)Iodide	$Pb^{2+}_{(l)} + 2e^{-} \longrightarrow Pb_{(s)}$		Purple vapour
Copper (II)Oxide		$2O^{2-}_{(l)} \longrightarrow O_{2(g)} + 4e^{-}$	

19.The table below shows atomic and ionic radii of some elements represented by letters R, S, T and U. (Not actual symbols). Study it and answer the questions that follow.

Element	Atomic radius (nm)	Ionic radius (nm)
R	0.174	0.099
S	0.203	0.133
T	0.099	0.181
U	0.136	0.065

(a) Classify element U as a metal or non-metal. Explain. (1 mark)

……

(b) Which of the elements is the strongest reducing agent? (1 mark)

……

……...

(c) Which element forms an anion? (1 mark)

……

……...

20.In an experiment, sulphur (IV) oxide gas was bubbled into water followed by hydrogen peroxide. The resulting colourless solution gave a white precipitate when mixed with barium chloride solution. Explain these observations. (3 marks)

……

……...

……

……...

……

21. (a) When an electric current was passed through molten substances P and Q in different containers the observations below were made:

Molten **P** – Conduct electricity and is not decomposed.

Molten **Q** – Conduct electric current and a gas is formed at one of the electrodes.

(a) Suggest the type of bonding present in (1 mark)

(i) Substance P……

(ii) Substance Q……

(b) The cell convention for an electrochemical cell is shown below.

$Zn_{(s)} / Zn^{2+}_{(aq)} \quad // Pb^{2+}_{(aq)} / Pb_{(s)}$

(i) Name one substance that can be used as electrolyte in the above cell. (1 mark)

……

……

(ii) Which of the electrodes is the anode? (1mark)

……

……

22. Radioactive polonium (Po)mass number 212 and atomic number 84 was detected in a sample of water. The water had an activity of 1000 counts per second.

(a) If the water is boiled, explain whether the activity would be affected or not. (1 mark)

……

……

(b) Given that polonium resulted from Bismuth (Bi) following emission of a beta (β) particle, write a nuclear equation for the decay. (1 mark)

……

……

(c) State one application of radioactivity in the paper industry. (1 mark)

……

……

23.A mixture of magnesium powder and copper powder was reacted with dilute hydrochloric acid. The solution was the filtered.

Name:

(a)(i) The residue (1mark)

……

(ii) The filtrate (1mark)

……

(b) Write an ionic equation for the reaction that takes place (1mark)

……

24.Element A has atomic mass 23 and element B has atomic mass 7 and also have 12 neutrons and 4 neutrons respectively.

(a) Write the electron arrangement of A and B (1mark)

……

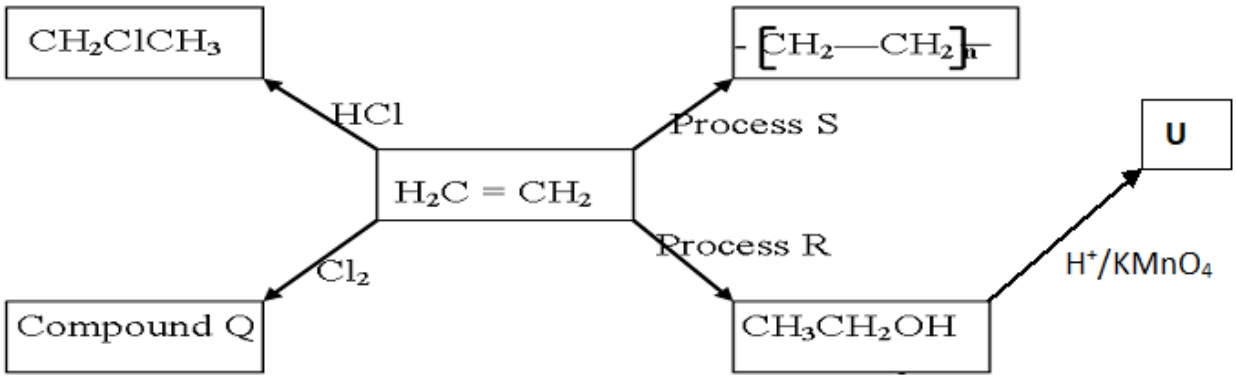
……

(b)Which element has higher ionization energy? Explain (2marks)

……

……

25.Study the scheme below and answer the questions that follow



State;

(i)The conditions for process R (1mark)

……

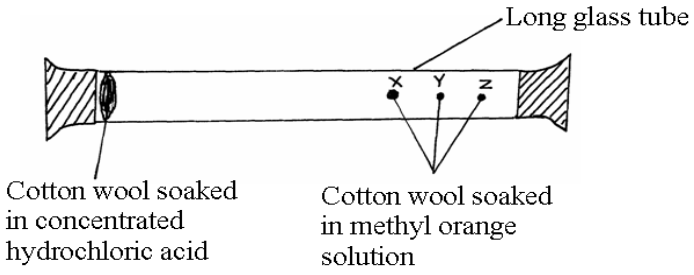
(ii)The type of the reaction represented by process S (1mark)

……

(iii) Name of compound U (1mark)

……

26.Study the set-up below and answer the questions that follow.



After sometimes, the cotton wools X, Y and Z changed colour in turn.

(a) What were the colour changes? (1mark)

……..

(b)Which cotton wool changed colour first? (1 mark)

……

(c) Explain why the cotton wools did not change colour at the same time. (1 mark)

……..

……..

27.A sample of unknown compound gas X is shown by analysis to contain Sulphur and oxygen. The gas requires 28.3 seconds to diffuse through a small aperture into a vacuum. An identical number of oxygen molecules pass through the same aperture in 20 seconds. Determine the molecular mass of gas X. (O =16, S = 32) (3marks)

……

……...

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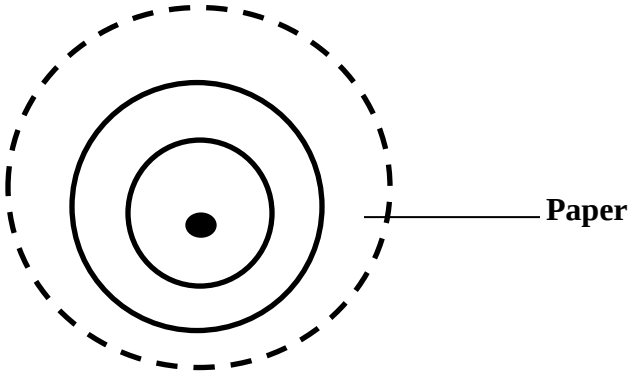
……...

SERIES 6

1. An extract colouring matter was placed at the centre of a filter paper and allowed to dry. Drops of ethanol were added to the centre and eventually the following was observed.



(a) Name a process by which dilute extract can be made more concentrated. **(1mk)**

……

(b) Give the name of the process by which the circles were produced. **(1mk)**

……

(c) Explain why water is not suitable for this process. **(1mk)**

……

2. Study the table below and answer the questions that follow.

Solution	**N**	**P**	**K**	**L**	**Q**
P^H	**1.0**	**14.0**	**6.5**	**7.0**	**8.0**

(i) Which of the solutions would be suitable for use in the manufacture of anti-acid tablets? **(1mk)**

……

(ii) Give a pair of the above solutions for which zinc oxide can dissolve. Give a reason. **(2mks)**

……

……

3. In an experiment to prepare oxygen gas, black **solid B** was added to hydrogen peroxide solution. The oxygen produced was then used to produce **gas D** which changes orange acidified potassium dichromate (VI) to green. Gas D was prepared by heating a yellow **solid A** in oxygen.

(i) Identify

Solid B **($\frac{1}{2}$mk)**

……

Gas D **($\frac{1}{2}$mk)**

……

(ii) Write an equation for formation of oxygen gas from the above experiment. **(1mk)**

……

(iii) What volume of oxygen gas would be produced at r.t.p of 20 cm^3 of 2M hydrogen peroxide was used in the experiment? (M.G.V at r.t.p = 24000 cm^3) **(2mks)**

……

……

……

4. Given:

ΔH_{1att} LiCl = 891 $kJmol^{-1}$

ΔH_{hyd} $Li^{+}_{(g)}$ = 484 $kJmol^{-1}$

ΔH_{hyd} $2Cl^{-}_{(g)}$ = 800 $kJmol^{-1}$

(i) Determine the enthalpy of solution of lithium chloride. **(2mks)**

……

……

……

(ii) Draw an energy level diagram to represent the above information **(2mks)**

5. 65 g of a solution contains 5 g of solute. The solubility of the salt is 25 g per $100cm^3$ of water at 20 ^{0}C. 30 g of the salt was added to the solution at 20 ^{0}C. Determine the mass of the salt that remained undissolved. **(3mks)**

……

……

……

6. Using dots (.) and crosses (X) to represent electrons show bounding in phosphonium ion (PH_4^+) **(2mks)**

7. (a) Describe how you can prepare a dry sample of ammonia ($Na_2CO_3.NaHCO_3.2H_2O$) in the laboratory, starting with sodium carbonate solid. **(2mks)**

……

……

……

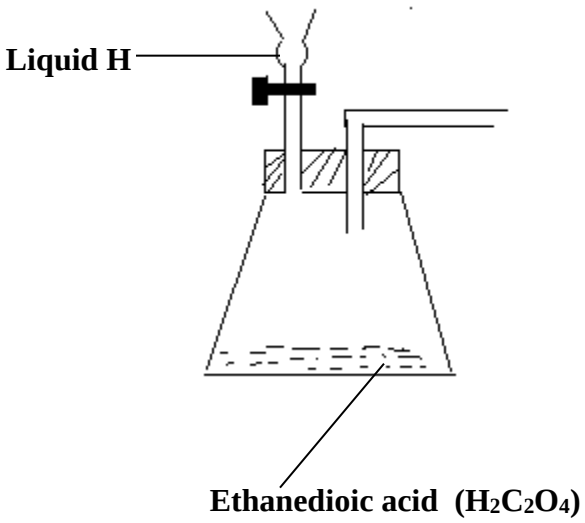
……

(b) If the crystals prepared above are left exposed overnight. It is observed that it turns into a white powder. Explain. **(1mk)**

……

……

8. The set-up below was used in the laboratory preparation of carbon (II) oxide.



(i) Complete the set up to show how carbon (II) oxide was collected. (**2mks)**

(ii) Identify liquid **H** and state its function **(1mk)**

……

(iii) Write an equation for the reaction producing carbon (II) oxide gas. **(1mk)**

……

9. A student electrolyzed magnesium sulphate solution graphite electrodes.

(i) Calculate the amount of current required to liberate $1.2dm^3$ of the gas produced at the anode at r.t.p. (M.G.V at r.t.p = $24dm^3$, 1F = 96500C). **(3mks)**

……

……

……

(ii) Explain the changes in concentration of the electrolyte as the electrolysis progresses. **(1mk)**

……

……

10. (i) State Graham's law of diffusion **(1mk)**

……

……

……

(ii) 100 cm^3 of ozone (O_3) diffused through a certain apparatus in 96 seconds. Calculate the time taken by 100 cm^3 of carbon (IV) oxide to diffuse through the same apparatus under same conditions. (O = 16.0 C = 12.0) **(3mks)**

……
……

11. In an experiment to confirm the presence of nitrate ions in a solution, a student added a certain solid M followed by sodium hydroxide solution the warming. He then tested the gases produced using litmus papers.

(i) Identify solid M **(1mk)**

……

(ii) Complete the table below by listing down the observations that lead to the conclusion that nitrate ions were present.

Observation	**Inference**
…… …….. …… **(2mks)**	NO_3^- present

12. A certain metal carbonate, QCO_3 , reacts completely with 20 cm3 of 1M hydrochloric acid according to the equation below.

$$QCO_{3(s)} + 2\,HCl_{(aq)} \longrightarrow QCl_{2(aq)} + CO_{2(aq)} + H_2O_{(l)}$$

Determine the relative atomic mass of Q is 1g of the carbonate reacted completely.
(C=12, O = 16) **(3mks)**

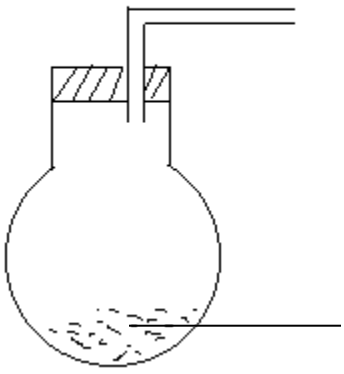
……

……

……

13. (a) Draw and name all the possible isomers of butene. **(2mks)**

(b) The diagram below shows an incomplete set-up of the laboratory and collection of propane.



Solid X + sodium hydroxide solid + calcium oxide

(i) Complete the set-up to show how the gas is collected. **(2mks)**

(ii) Identify solid X **(1mk)**

……

(iii) What is the role of calcium oxide in the mixture? **(1mk)**

……

14. (a) An element P consist of three isotopes with mass number 39, 40, 41 with percentage abundance of P-40 being 60%. If the R.A.M of P is 39.8, determine the percentage abundances of the other two isotopes. **(2mks)**

……

……

……

(b) If the atomic number of P is 9, illustrate the structure of an ion of P-39. **(2mks)**

15. Hydrogen sulphide gas reacts with chlorine gas according to the following equation.

$H_2S_{(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)} + S(s)$

Use oxidation numbers to identify the reducing agent in the equation. **(2mks)**

……

……

16. (i) Write a balanced chemical equation for the reaction between chlorine gas and hot concentrated sodium hydroxide solution. **(1mk)**

……

(ii) Give one use of the major product formed in (i) above. **(1mk)**

……

(i) Write PTFE in full. **(1mk)**

……

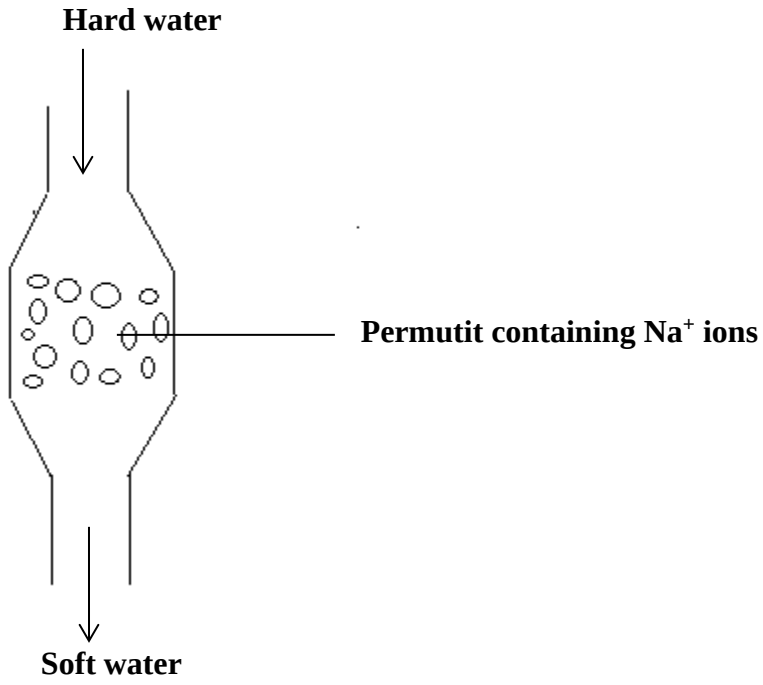
17. (a) Identify the acid in the backward reaction. Give a reason for your answer.

$NH_4^+{}_{(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+_{(aq)}$ **(2mks)**

……

……

18. The column below was used to soften hard water.



(i) Briefly explain how the resin works. **(1mk)**

……

……

(ii) How is the resin re-activated after some time? **(1mk)**

……

19. Hydrogen chloride gas dissolved in water conducts electric current while hydrogen chloride gas dissolved in methylbenzene does not. Explain. **(2mks**)

……

……

……

20. (a) Name the chief one from which lead is extracted. **(1mk)**

……

(b) State two uses of copper metal. **(2mks)**

……

……

21. Describe the process of preparation of soap. **(2mks)**

……

……

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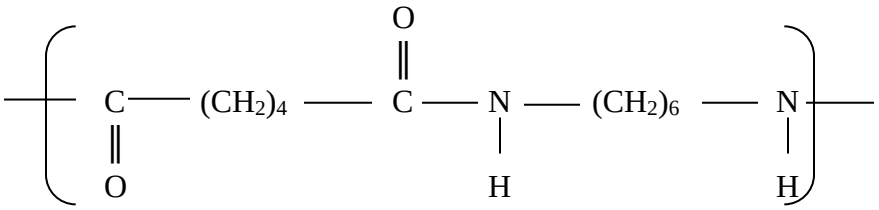
……

22. (i) Name the type of polymerization by which the polymer nylon– 6, 6 below is formed.



……**(1mk)**

(ii) Write the equation for the process taking place in (b) above. **(1mk)**

23. (a) Distinguish between nuclear fusion and nuclear fission. **(1mk)**

……

……

……

(b) $^{Z1}_{92}U + {}^{1}_{0}n \longrightarrow {}^{94}_{38}Sr + {}^{140}_{Z_2}Sr + 2\,{}^{1}_{0}n$

Find the value of Z1 and Z2 in the nuclear equation above. **(1mk)**

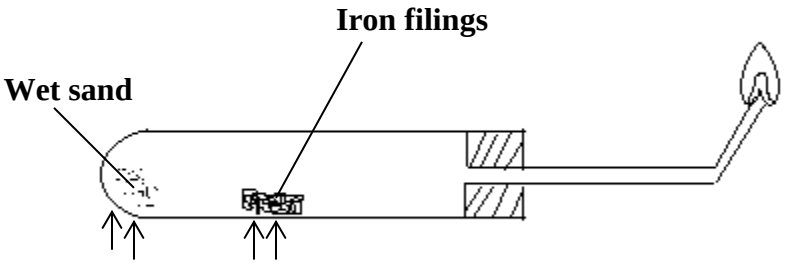
(c) 100g of radioactive $^{231}_{91}$ Pa was reduced to 12.5g after 81 days. Determine the half-life of Pa (2mks)

……

……

……

24. Study the set-up below and use it to answer the questions that follow.



(i) Why is it necessary to heat the wet sand before heating the iron filings? **(1mk)**

……

(ii) Write down an equation for the reaction involving the iron filings. **((1mk)**

……

(iii) What precaution is necessary during the reaction? **(1mk)**

……

25. A student was provided with two solutions of sodium chloride and aluminium chloride in an experiment. He accidentally removed the labels from the beakers containing the solutions. Describe how he can use potassium hydrogen carbonate to distinguish between the two solutions. **(2mks)**

……

……

……

……

26. One mole of hydrazine gas (NxHy) reacts completely with oxygen to from 40 cm^3 of nitrogen gas and 80 cm^3 of steam.

(i) Determine the volume of oxygen gas used in the reaction. (**2mks)**

……

……

(i) Write the equation for the reaction. **(1mk)**

……

27. A student accidentally added potassium chloride into a mixture of zinc oxide and iron (III) chloride. Describe how you can help him obtain pure potassium chloride from the mixture. (3mks).

……

……

……

……

28. Draw and name an apparatus used to support a crucible while heating in the laboratory. (1mk)

END.

SERIES 7

1.Two miscible liquids K and H have boiling points of 58^{o}C and 93^{o}C.If the liquids are mixed accidentally,

a) Suggest a method used to separate the mixture. (1mark)

……

……

b) Which liquid will be collected first? Explain. (1mark)

……

……

……

c) State two industrial applications of the method identified in (**a**) (1mark)

……

……

……

2. Element **J** whose atomic number is 31 has two isotopes. The table below shows the mass numbers and the relative abundance for each isotope.

Mass	Relative abundance %
69	60.4
71	39.6

a) Determine the number of neutrons in the isotope with mass number 69 (1mark)

……

……

b) Calculate the relative atomic mass of element J (2marks)

…..……..…

……

……

……

3. Two ions P^{2+} and Q^{3-} have an electron arrangement of 2.8.8.

a) Write the electron arrangement of:

P…….(1mark)

Q…….(1mark)

b) The mass number of element Q is 31. Draw the structure of the atom of Q. (2mark)

c) Write the formula of the compound formed when P is burnt in chlorine gas. (1mark)

……

4. The table below shows characteristics of selected hydrocarbons. Study the information and answer the questions that follow.

Number of carbon atoms per molecule	Relative molecular mas of hydrocarbon
4	56
5	70
6	84

a) Compound T is the second member of the homologous series represented in the table above. Calculate the relative molecular mass of compound T. (1mark)

……

……

b) The compound T in (ii) above undergoes polymerization to form a polymer V with relative molecular mass of 32760. Determine the number of monomers used to produce the polymer V. (C = 12; H = 1) (2marks)

……

……

……

……

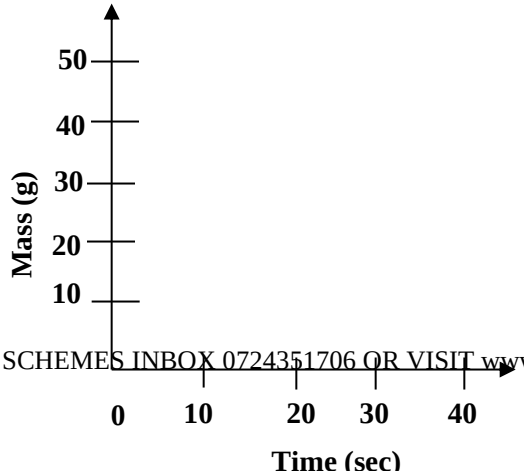
5. a) Define half-life. (1mark)

……

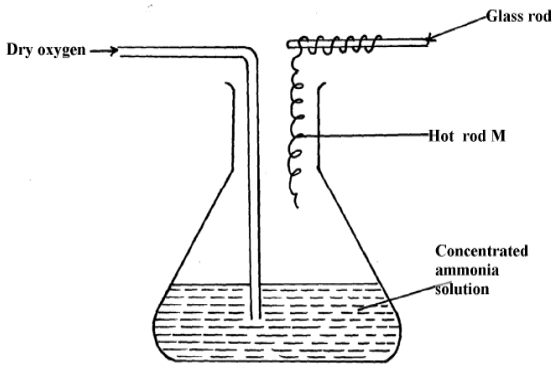
……

b) A radioactive element with a mass 50g has a half-life of 10 seconds. Sketch a graph of mass against time to show how the element mass varies with time if it decays for 20 seconds.

(2marks)



6. The set- up below was used to study one of the chemical properties of ammonia. Study it and answer the questions that follow.



a) Identify metal M (1mark)

……

b) State **two** observations that would be made during the experiment above. (1mark)

……

……

c) Write an equation for the reaction that occurs. (1mark)

……

7. Starting with **50 cm^3** of **2M** sodium hydroxide describe how crystals of sodium sulphate can be prepared in the laboratory. (3marks)

……

……

……

……

……

8. Below are PH values of some solutions.

Solution	A	B	C	D
PH	6.5	13.5	2.2	7.2

a) Which solution is likely to be

I Rain water

……..(1mark)

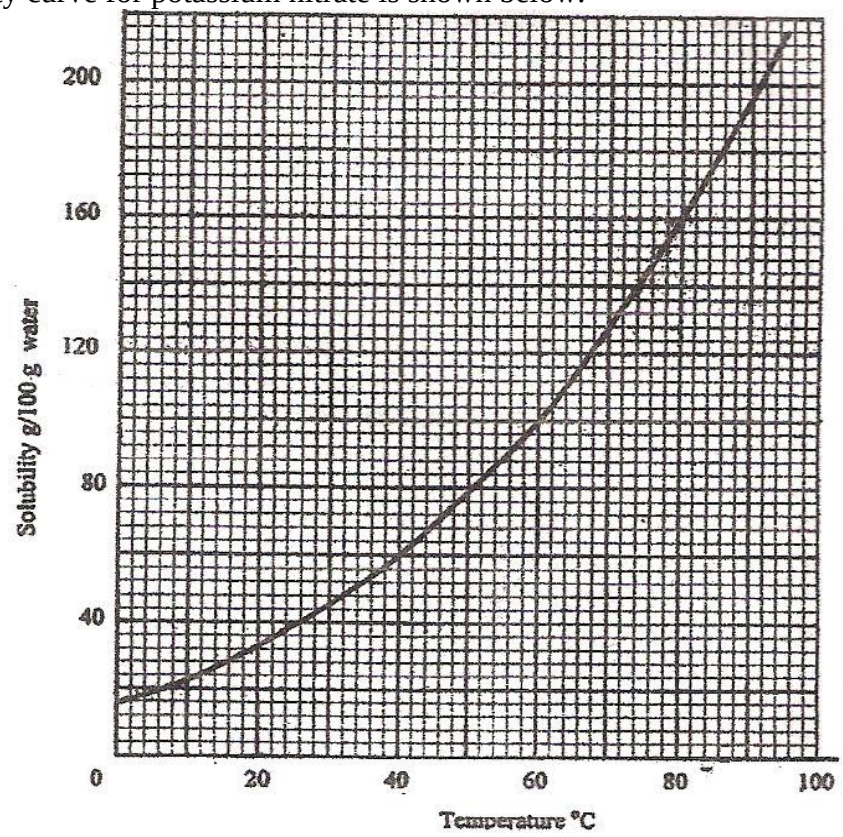
II Potassium hydroxide

…….(1mark)

b) A basic substance V reacted with both solutions B and C. What is the nature of V.

……(1mark)

9. The solubility curve for potassium nitrate is shown below.



a) Define the term solubility. (1mk)

……

……

……

b) Determine the molarity of saturated potassium nitrate solution at 50ºC. (2mks)
(K=39.0, O=16.0, N=14.0 and density of water 1g/cm^3).

……

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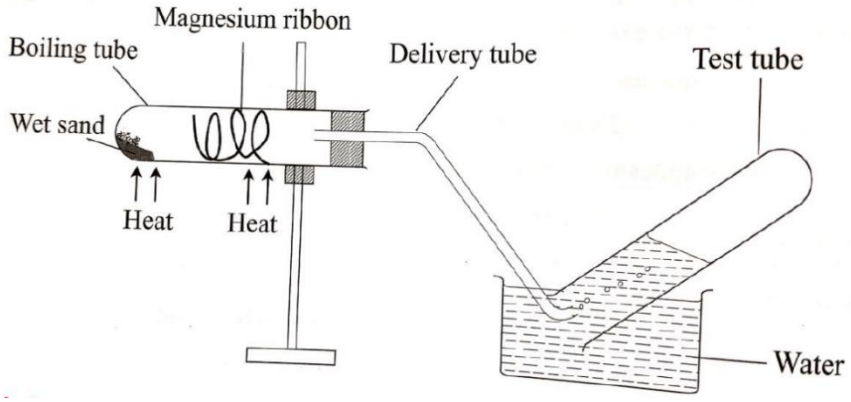
……

10. Study the set-up below and use it to answer the questions that follow:



a) Write a balanced chemical equation for the reaction that takes place in the flask (1mark)

……

b) Give a reason why the magnesium ribbon was coiled. (1mark)

……

c) State and explain the precaution that should be taken at the end of the experiment. (1mark)

……

……

……

11. Alkanes are used as fuels. Methane undergoes complete combustion to produce a lot of heat.

a) Write a balanced chemical equation for the reaction that takes place. (1mark)

……

……

b) Use the bond energies in the table below to calculate the enthalpy change for complete combustion of methane. (3marks)

BOND	BOND ENERGY kJ/mol
O = O	496
O – H	463
C-H	412
C=O	743

……

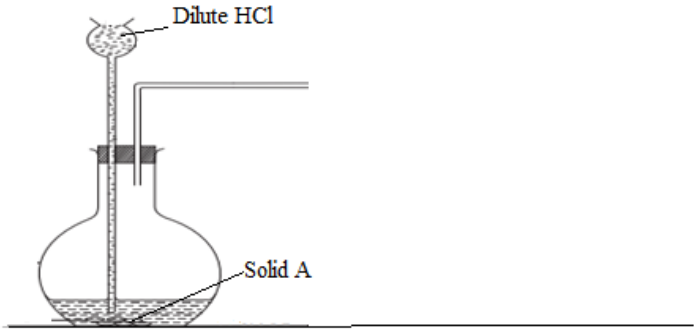
……

……

……

……

12. The set up below was used to prepare and collect hydrogen sulphide gas



a) Complete the set up to show how the gas is collected (2marks)

b) State the observation made when hydrogen sulphide gas is bubbled into a solution of Lead (II) nitrate. Explain (2 marks)

……

……

……

13. A piece of phosphorus was burnt in excess air and the product obtained was shaken with a small amount of hot water to make a solution.

a) Write an equation for the burning of phosphorus in excess air. (1mark)

……

……

b) State the observation that would be made when both red and blue litmus papers are dipped into the resulting solution (1mark)

……..

……

14. Study the information in the table below and use it to answer the questions that follow:

Elements	Na	Mg	Al	Si	P	S	Cl
Atomic numbers	11	12	13	14	15	16	17
Atomic radii (nm)	0.157	0.136	0.125	0.117	0.110	0.104	0.099

a) Compare the atomic radius of sodium and aluminium, Explain. (2marks)

……

……

……

b) Explain how the oxide of aluminium differs from the oxides of other metals in the period.

(2 marks)

……

……

15. The equation below represents the reaction between marble chips and dilute hydrochloric acid.

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

The rate of reaction between marble chips and hydrochloric can be increased by using calcium carbonate powder instead of marble chips. State two other ways in which the rate of the reaction above can be increased. (2mark)

……

……

16. a) State the condition required for a Bunsen burner to produce a non-luminous flame. (1mark)

……

b) Describe an experiment that can be used to identify the hottest region of the non-luminous flame. (2marks)

……

……

……

……

……

17. In the manufacture of sodium carbonate by solvay process, ammoniated brine trickles down the carbonator while carbon (IV) oxide rise up.

(a) What is ammoniated brine. (1 mark)

……

……

(b) What is the main source of carbon (IV) oxide in the above process. (1 mark)

……

……

c) State **one** use of carbon (IV) oxide and state the property of the gas which the use depends on (1mark)

……

……

18.a) State Gay Lussacs law. (1mark)

……

……

……

……

(b) 48 cm^3 of methane gas was exploded with 212cm^3 of oxygen and the mixture allowed to cool. Calculate the volume of the gaseous residue obtained if the reaction was carried out at room temperature and pressure. (2marks)

……

……

……

……

19.Name of a suitable method that can be used to extract potassium from its ore. Explain (1mark)

……

20. Study the table below and answer the questions that follow.

Substance		A	B	C	D	E	F	
Melting point (^oc)		801	113 119	39	-101	1356		
Boiling point ^oc		1410	445	457	54	-36	2860	
Electrical	Solid	poor	Poor	Good	Poor	Poor	Poor	
Conductivity	Liquid	Good	Poor	Good	Poor	Poor	Poor	

i) Identify the substance that has a metallic structure. Explain. (1mark)

……

……

……

ii) Substance A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current. (2marks)

……

……

……

21. When excess chlorine gas is bubbled through cold dilute sodium hydroxide solution the resulting solution act as a bleaching agent.

(a) Write an equation for the reaction between chlorine gas and cold dilute sodium hydroxide solution.

(1mark)

……

(b) Explain how the resulting solution act as a bleaching agent (1mark)

……

……

……

(c) Other than bleaching state one use of chlorine (1mark)

……

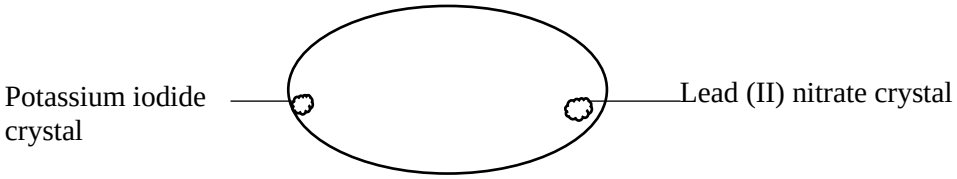
22. Describe how you can distinguish between dilute sulphuric (VI) acid and ethanoic acid. (2marks)

……

……

……

23. Crystals of lead (II) nitrate and potassium iodide were placed on opposite ends of a petri dish with water as shown below.



a) State the observation that would be made after some time (1mark)

…….

b) On the diagram above indicate with an **X** the likely position of the observation made in (i) above. (Pb = 207 , I = 127) (1mark)

…….

c) Explain your observation in (b) above. (1mark)

……

……

24. Describe an experiment that can be used to determine the percentage of air used for rusting. (3marks)

……

25. Study the table below and answer the questions that follow.

Element	**Atomic radii (nm)**	**Ionic radii (nm)**
X	0.071	0.136
Y	0.099	0.181
Z	0.114	0.195

a) Do the elements represent a metallic or non-metallic group? Explain. (1mark)

……

……

b) Compare atomic and ionic radii of the elements. Explain. (1mark)

……

……

c) Identify the strongest oxidizing agent. (1mark)

……

26. Alkanol is one of the homologous series of organic compounds

a) Give the name and structural formula of the fourth member of this series

I) name; …… (1mark)

II) structural formula (1mark)

……

……..……

b) Write an equation for the complete combustion of the fourth member of this series (1mark)

……

……

27.a) The table below shows how solubility of some substances in water varies with temperature

Substance	Change of solubility with temperature (g/100g of water)			
	0^oC	20^oC	40^oC	60^oC
W	0.334	0.16	0.097	0.0058
X	27.603	34.0	40.0	45.5
Y	35.70	36.0	36.6	37.3

Which of the above substances is likely to be a gas? Explain (2 marks)

……

b) Explain the following observation. A chloride dissolves in water to form an electrolyte while the same chloride dissolves in methylbenzene to form a non-electrolyte. (1 marks)

SERIES 8

1 [a] State Boyle's law [1mk]

……

……

[b] At 400^0C,850cm^3 of a gas exert a pressure of 560mmHg. What volume of the same gas would exert a pressure of 640mmHg at the same temperature? [3mks]

……

……

……

……

2. When burning magnesium is lowered into a gas jar containing nitrogen(I) oxide, it continues to burn forming a white solid

[a] Name the white solid 1mk]

……

……

[b] Write a chemical equation of the reaction that occurred [1mk]

……

……

3. Carbon {IV} oxide is one of the gases used in fire extinguishers

[a] State any other possible use of carbon {IV} oxide [1mk]

……

……

[b] Name any two reagents that can be reacted together ti generate carbon {IV} oxide [2mks]

……

……

4. Rusting is a process that causes massive destruction of iron structures

[a] State one condition that accelerates rusting [1mk]

……

……

[b] State one advantage of rusting [1mk]

……

……

5. At 60^0C,38 grams of lead{II} nitrate saturate 56cm^3 of water. Determine the solubility of lead{II} nitrate at this temperature [2mks]

……

……

……

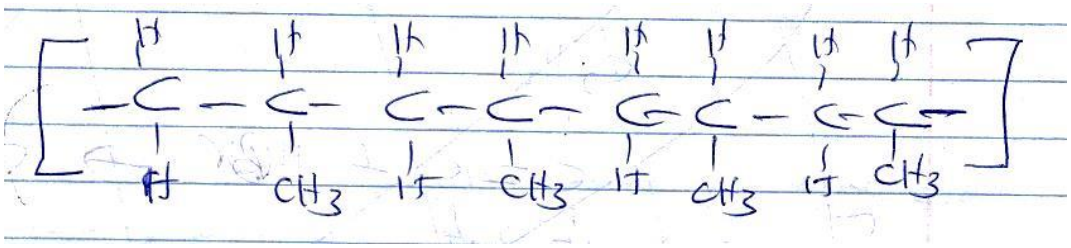
6. Explain why molten sodium chloride conducts electricity, but solid sodium chloride does not [2mks]

……

……

……

7. A polymer can be represented as



[a] Name and draw the structure of the monomer [2mks]

……

……

……

……

……

[b] What type of polymerization occurs in the above case? [1mk]

……

……

[c] Given that the molecular mass of the polymer is 25620, how many units of the monomer make the polymer [2mks]

……

……

……

……

8. A reaction can be represented as;

$C_2H_{4[g]} + HBr_{[g]} \longrightarrow C_2H_5Br_{[g]}$

Given the bond energies of C-H, C=C, C-C, C-Br, and H –Br as 20kJ/mol,580Kj/mole,446Kj/mole,438KJ/mole and 396kJ/mole respectively.Determine the heat of formation of C_2H_5Br

[3mks]

……

……

……

……

……

9 [a] Define the term, dynamic equilibrium [1mks]

……

……

[b] A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2}_{[aq]} + H_2O_{\{l\}}$

Yellow orange

State and explain the observation made when;

[i] NaOH is added to the equilibrium mixture [2mks]

……

……

……

[ii] HCl is added to the equilibrium mixture [2mks]

……

……

……

10. During the electrolysis of dilute copper {II} chloride using carbon electrodes, a current of 1.5A was passed through the solution for 2 hours and 30 minutes

[a] Write the ionic equation of the reaction that occurred at the cathode [1mk]

……

……

……

[b] Given R.A.M of copper=64 and 1F=96500C, calculate the change in mass of the cathode [3mks]

……

……

……

……

……

……

11. [a] Define the term half-life [1mk]

……

……

[b] Name two particles likely to be emitted when a radioactive nuclide undergoes radioactivity [2mks]

……

……

[c] The half-life of a radioactive nuclide is 3 hours. Given that its initial mass is 288g, determine the remaining mass after 12 hours. [2mks]

……

……

……

……

12. Thereduction potentials of elements M and N are;

$M^{2+}_{[aq]} + 2e^- \rightleftharpoons M_{[s]}, E^{\theta} = +0.44V$

$N^{+}_{[aq]}\ e^- \rightleftharpoons N_{[s]}, E^{\theta} = -1.64V$

Using the above reduction potentials, predict whether a reaction would occur between $N^{+}_{[aq]}$ and $M_{[[s]}$ [3mks]

……

……

……

13. An hydrocarbon can be represented as: C_2H_2

[a] Name the hydrocarbon [1mk]

……

……

[b] State two reagents that can be reacted together to generate the hydrocarbon [2mks]

……

……

[c] Identify the group of hydrocarbons into which C_2H_2 belongs to [1mk]

……

……

14. [a] Name two allotropes of sulphur [2mks]

……

……

[b] In an experiment to investigate a certain property of sulphur, Maina added few drops of conc HNO_3 to sulphur in a test tube and warmed the mixture

[i]State one observation made [1mk]

……

……

[ii]Write a chemical equation of the reaction that occurred [1mk]

……

……

15. Chlorine is commonly used in the manufacture of $Ca(OCl)_2$

[i] State one use of the above compound of chlorine [1mk]

……

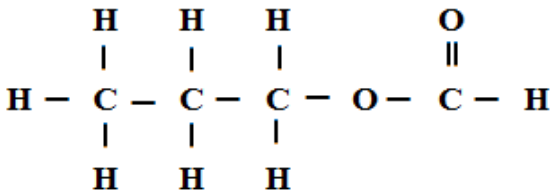
……

[ii] Write a chemical equation leading to the production of $Ca(OCl)_2$ [1mk]

……

……

16. A compound can be represented as



[a] What name is given to the above class of compounds [1mk]

……

……

[b] Name two reagents that can be reacted together to generate the above compound [2mks]

……

……

……

[c] State two conditions necessary for the reaction leading to formation of the above compound to occur [2mks]

……

……

……

17. Using dots and crosses, show bonding in carbon{II} oxide [2mks]

18. When 20g of a compound containing carbon, hydrogen and oxygen was burnt in the air,29.3g of carbon{IV} oxide and 11.7g of water were produced. Determine its empirical formulae. {C=12, H=1 , O=16}[3mks]

……

……

……

19. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

{a} State one observation made [1mk]

……

……

{b} Write an ionic equation of the reaction that occurred in the test tube [1mk]

……

……

20. In the industrial manufacture of Ammonia one of the raw materialsis nitrogen gas

{a} Name one other raw material [1mk]

……

……

{b} Name two possible sources of the raw material you have named in {a} above [2mks]

……

……

……

{c} Name two substances that can be used as catalyst in this process [2mks]

……

……

……

{d} State one use of ammonia [1mk]

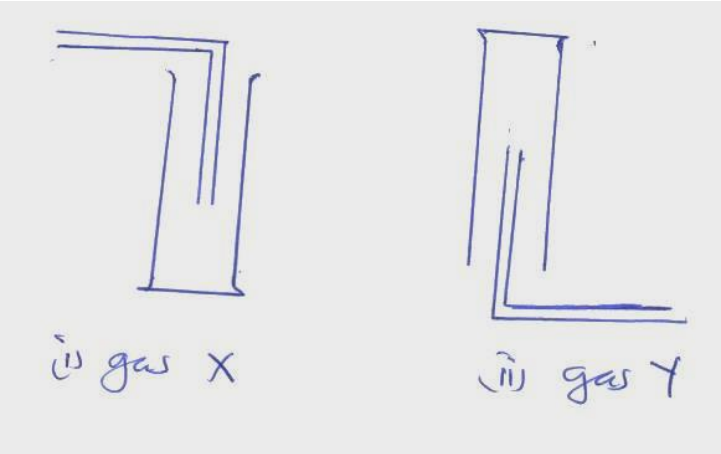
……

……

……

……

21. Gas X and Y can be collected as shown below



[a] Name the method used to collect gas Y [1mk]

……

……

[b] How do densities of gas X and gas Y compare?[1mk]

……

……

[a] Give an example of a gas that can be collected using the same method as gas Y [1mk]

……

22. Element W has two isotopes W – 36 and W-40 which occur in the ratio x:4. Given that R.A.M of W is 37.25, find the value of x [2mks]

……

……

……

23. Describe an experiment that can be used to determine whether a given sample of a liquid is pure [2mks]

……

……

……

24. A given mass of gas T diffuses through a porous plug in 48 seconds while a similar mass of gas R diffuse in 70 seconds. Given that the density of gas T is 0.6g/cm3, find the density of gas R [2mks]

……

……

……

25. The electron configuration of elements A,B,C, D and E are as given below

Element	Electron configuration
A	2, 8, 1
B	2, 8
C	2, 7
D	2, 8, 6
E	2, 8, 3

{a} Which element has the highest electrical conductivity [1mk]

……

{b} Which letter represents the most reactive metal [1mk]

……

{c} Which letter represents the most reactive non-metal [1mk]

……

SERIES 9

1. Air is a mixture of different components. Identify;
   i) A compound that turn lime water to a white precipitate [1 mk]

_____

   ii) A compound that changes cobalt(ii)chloride from blue to pink [1 mk]

_____

   iii) A diatomic gas that has triple bond [1 mk]

_____

2. A mixture contains potassium chloride and lead(ii)sulphate. Describe how you would obtain crystals of potassium chloride from this mixture [3 mks]

_____

_____

_____

_____

3. Oxygen is prepared in the laboratory through catalytic decomposition of hydrogen peroxide.
   a) Name the catalyst in this experiment [1 mk]

_____

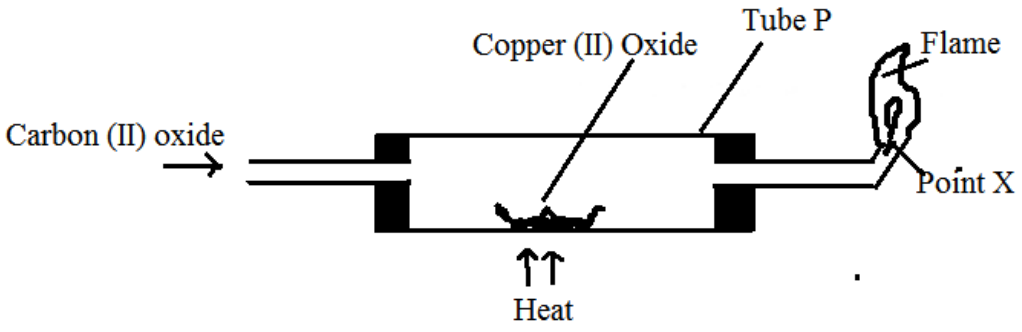
   b) What mass of hydrogen peroxide would be needed to produce $120cm^3$ of oxygen gas at r.t.p in this experiment? (Molar gas volume at RTP = $24000cm^3$, H = 1, O = 16) [3 mks]

_____

_____

_____

4. Carbon(iv)oxide gas was passed over heated copper(ii)oxides shown in the diagram below.



a) State the observation made in the tube P [1 mk]

_____

_____

_____

b) Write an equation for the reaction which took place in tube P [1 mk]

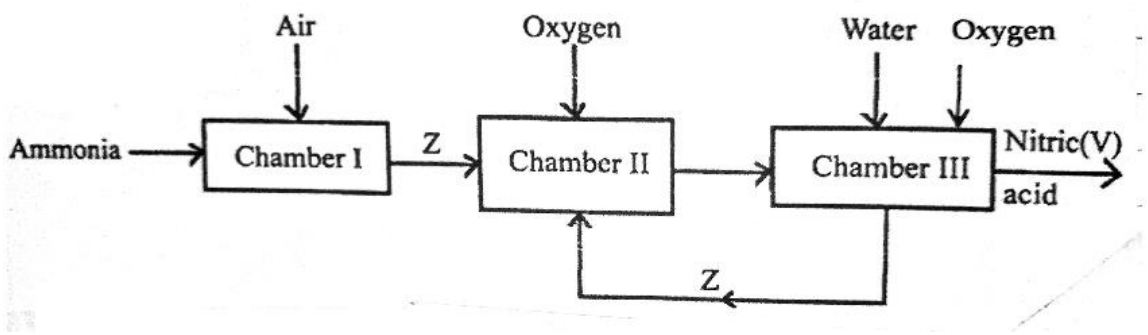
_____

_____

c) Name the gas burning at point X [1 mk]

_____

5. The diagram below illustrates the steps involved in the industrial manufacture of of nitric(v)acid. Use it to answer the questions that follow.



a) Identify the chamber in which a catalyst is used. [1 mk]

_____

b) Name substance Z [1 mk]

_____

c) Write an equation for the reaction that takes place in chamber III [1 mk]

_____

6. Draw a well labelled setup for the laboratory preparation and collection of dry sample of hydrogen chloride gas [3 mks]

7. Account for the following observations made when a piece of sodium is placed in a trough half filled with water.

a) Hissing sound [1 mk]

_____

_____

b) Darts on the water surface [1 mk]

_____

_____

_____

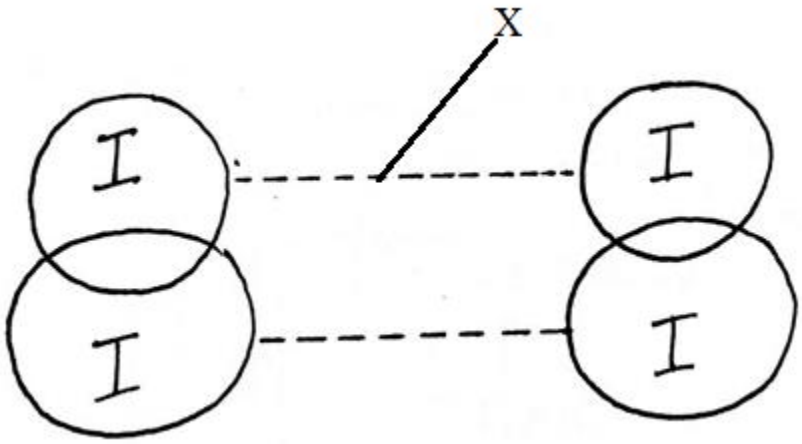
c) Solution formed turns red litmus paper blue [1 mk]

_____

_____

_____

8. The diagram below shows the structure of iodine



a) Name;

i) Part X [1 mk]

_____

ii) Type of bond in the solid [1 mk]

_____

iii) Explain why iodine has very low melting point [1 mk]

9. 20g of salt X dissolves in 80g of water to form a saturated solution at 45^{o}C. calculate the solubility of salt X at 45^{o}C [2 mks]

10. When excess chlorine gas is bubbled through dilute sodium hydroxide solution, the resulting solution acts as bleaching agent.
    a) Write an equation for the reaction between chlorine gas and sodium hydroxide [1 mk]

    b) Explain how the resulting solution acts as a bleaching agent [2 mks]

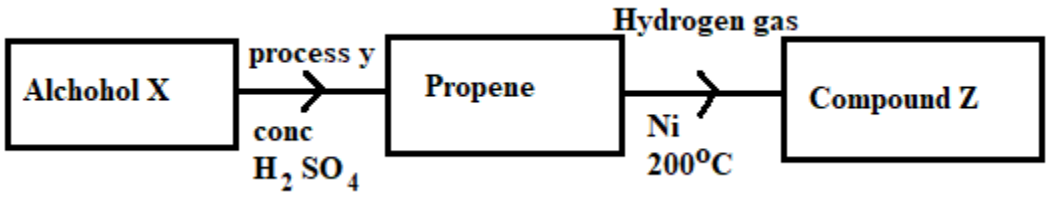
11. Element Z has initial mass of 80g. After 5 years the remaining mass was 5g.
    a) What is meant by the term half-life [1 mk]

    b) Calculate the half-life of element Z [2mks]

12. Complete the table below [3 mks]

Metal	Aluminum	Lead	Sodium
Chief ore	Bauxite	_____	Rock salt
Chemical formulae	_____	_____	_____
Method of extraction	_____	reduction	_____

13. Use the reaction scheme below to answer the questions that follow.



a) Draw the structure of alcohol X [1 mk]

b) Name process Y [1 mk]

---

c) Write the molecular formulae of the 5th member of the homologous series in which propene belongs

[1 mk]

14. Calculate the enthalpy for the reaction:

$C_2H_{4(g)} + H_{2(g)} \longrightarrow C_2H_6$ [3 mks]

Give the following bond energies

C – C	347 kJ/mol
C = C	612 kJ/mol
C – H	413 kJ/mol
H – H	436 kJ/mol

15. Study the reactions below and answer the questions that follow.

Reaction	Equation
J	$Ba^{2+}_{(aq)} + SO^{2-}_{3(aq)} \longrightarrow BaSO_{3(S)}$
K	$Br_{2(g)} + 2I^{-}_{(aq)} \longrightarrow 2Br^{-}_{(aq)} + I_{2(g)}$
l	$HSO^{-}_{4(aq)} + OH^{-}_{(aq)} \longrightarrow SO^{2-}_{4(aq)} + H_2O_{(l)}$

Which of these reactions indicate: [3 mks]

i) A precipitation reaction

---

ii) A displacement reaction

---

iii) Neutralization reaction

---

16. An atom of element A has mass number 39 and 19 protons. (A is not the actual symbol of the element)

a) Using crosses (**x**) to represent electrons, draw the atomic structure of element A [1 mk]

b) State the group and period to which element A belongs [1 mk]

Group

Period

---

c) Name the type of structure adopted by element A [1 mk]

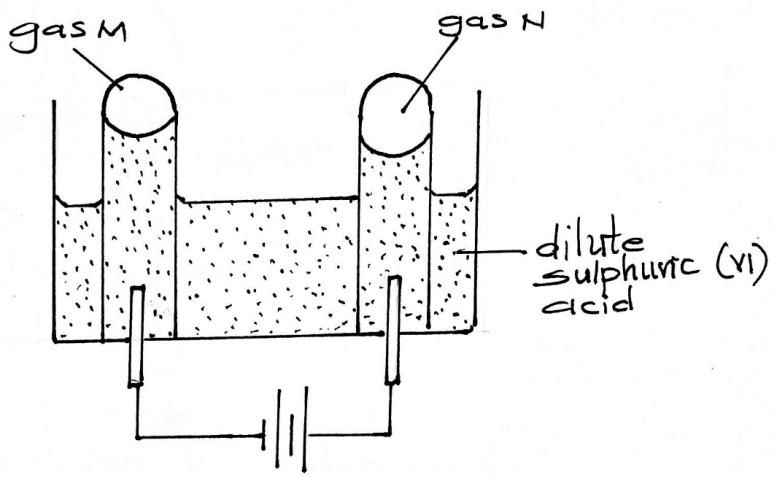
---

17. a) State Graham's law of rate of diffusion of gasses [1 mk]

---

b) It take 44 seconds for nitrogen(iv)oxide to diffuse through a porous pot. Calculate how long it will take an equal volume of chlorine gas to diffuse through the same porous pot under the same conditions.(N = 4, O = 16, Cl = 35.5) [2 mks]

18. The setup below represents electrolysis of dilute sulphuric (vi) acid.



a) Name gas: [2mks]
M - _____
N - _____

b) At what electrode does oxidation take place? [1 mk]

19. Dichromate (vi) ions are orange in colour while chromate (vi) ions are yellow. Consider the following equation at equilibrium

$Cr_2O^{2-}_{7(aq)}$ (aq) + $2OH^-_{(aq)}$ ⇌ $2CrO^{2-}_{4(aq)}$ + $H_2O_{(l)}$

State and explain the observation which would be made if a few drops of dilute sulphuric(vi)acid were added to the equilibrium mixture [2 mks]

20. An element has an electron configuration of 2.8.6

a) Name the element [1 mk]

_____

b) This element forms a puckered ring. Draw the ring [1 mk]

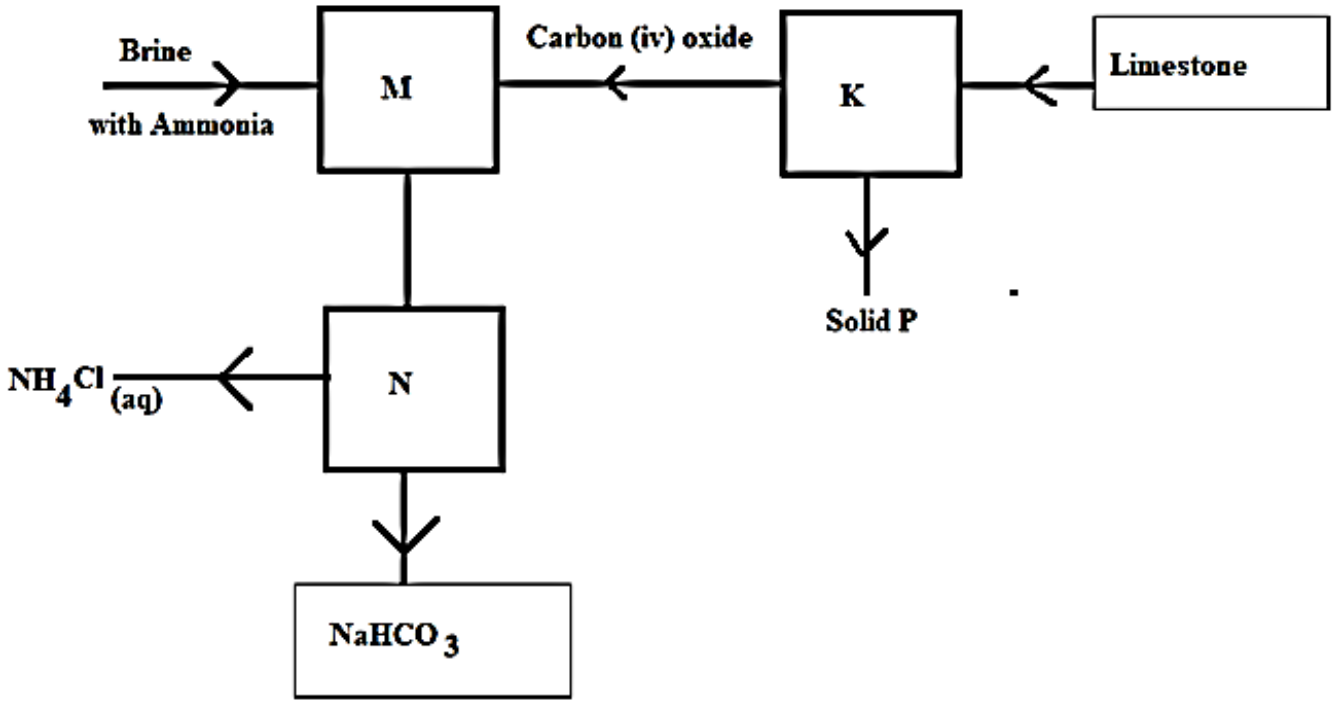
c) Write the formulae of the puckered ring [1 mk]

_____

21. The melting point of sodium oxide is 1193^{o}C while that of sulphure(iv)oxide is -72^{o}C. In terms of the structure and bonding, explain why there is a large difference in the melting points of the two oxides [2 mks]

_____
_____
_____
_____
_____

22. The diagram below illustrates some steps involved in manufacturing sodium carbonate. Use it to answer the questions that follow



a) Name the industrial process illustrated by the above flowchart [1 mk]

_____

b) Write an equation for the reaction that takes place in chamber M [1 mk]

_____

_____

c) Name the process which takes place in chamber N [1 mk]

_____

d) How is sodium carbonate obtained in this process [1 mk]

_____

_____

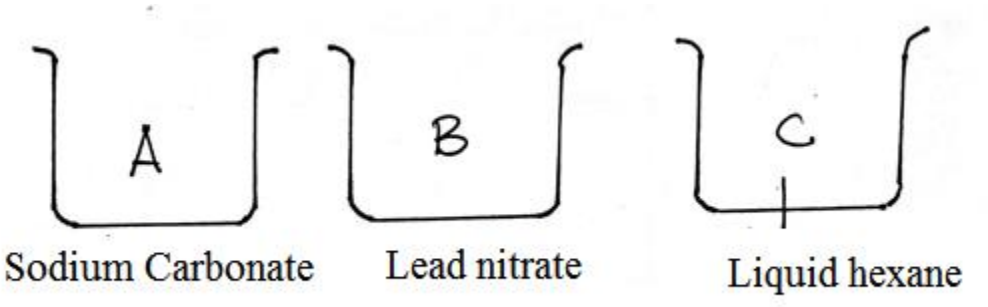
23. Explain why potassium is kept under paraffin while phosphorous is kept under water. [2 mks]

_____

_____

_____

24. Dilute sulphuric (vi) acid was added to each of the three beakers containing the substances shown below



State the observation made in each beaker [3 mks]

A - _____

B - _____

C - _____

25. Hydrogen chloride gas was separately dissolved in water and methylbenzene and the solutions labelled B and A respectively. A piece of magnesium ribbon was placed in each of the solutions.

There was a lot of bubbles in solution A but no bubbling occurred in solution B. Explain the observations [3 mks]

_____

_____

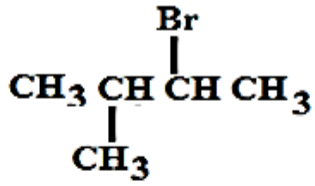
_____

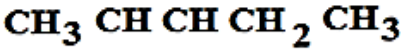
_____

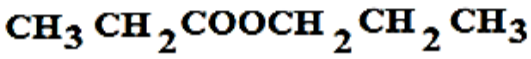
_____

_____

26. Give the IUPAC names of the following compounds [3 mks]

(A) 

(B) 

(C) 

A_____

B_____

C_____

27. A solution contains 40.32g per litre of compound XOH. 25cm^3 of this solution was exactly neutralized by 30cm^3 of 0.3M sulphuric(vi)acid. Determine the relative atomic mass of X(O = 16, H = 1) [4 mks]

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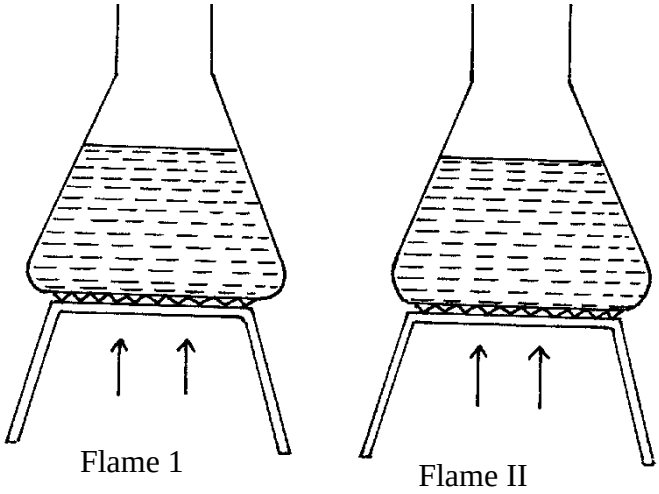
SERIES 10

1. The samples of equal volumes of water were put in 100cm^3 conical flasks and heated for 5 minutes on a Bunsen flame. It was observed that sample 1 registered a low temperature than sample II



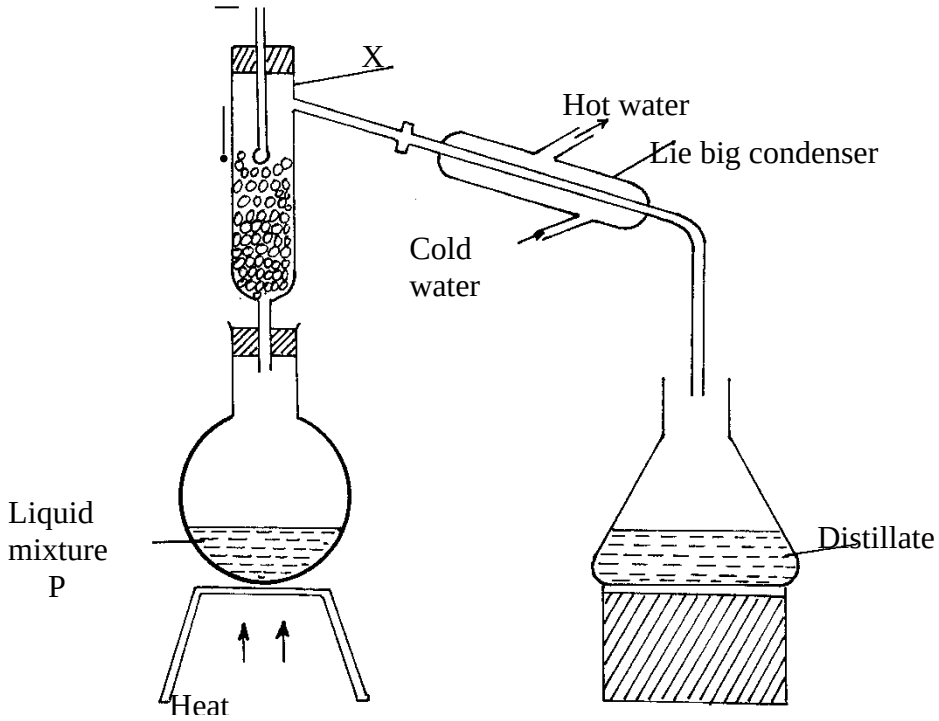
(a) Name flame I (1mk)

……..

(b) State one disadvantage of using flame I for heating (1mk)

……..

2. Study the diagram below and answer the questions that follow.
The diagram shows the method used to separate component of mixture P



(a) Name X . (½mk)

……..

(b) What is the name given to the method used in separation of mixture P (½mk)

……

(c) What would happen if the inlet and outlet of water were interchanged (1mk)

……

……

(d) Which physical property is used to separate mixture P (1mk)

……..

3. The table below shows the solubility of three solids P, Q, and R.

SOLID	COLD WATER	HOT WATER
P	Soluble	soluble
Q	insoluble	insoluble
R	insoluble	soluble

How would you obtain pure samples of R,P and Q (2mks)

……

……

……

……

……

4. State one physical property that would suggest the presence of each of the following gases from a leaking gas cylinder:

a) H_2S (1mk)

……

b) N_2O (1mk)

……

c) Cl_2 (1mk)

……

5. The P^H values of some solutions are given below

P^H	14.0	1.0	8.0	6.5	7.0
Solution	M	L	N	P	Z

(a) Identify the solution with the lowest concentration of hydrogen ion. Give reason for your answer (1mk)

……

……

(b) Which solution would be used as an anti-acid for treating stomach upset. Give reason for your answer (1mk)

……

……

6. The data below gives the electronic configuration of some selected atoms and ions

Atom/ion	A^{2+}	B	C^{2-}	D^{2+}	E	F^-	G^+	H
Electronic configuration	2	2.4	2.8	2.8.8	2.8	2.8.8	0	2.8.2

(a) Select an atom that is a noble gas (1mk)

……..

(b) What is the atomic number of C and A (1mk)

……

……

(c) Select an element that belong to group 2 and period four (1mk)

……

……..

7. Helium is used instead of hydrogen in balloons for metrological research. Explain (1mk)

8. Zinc metal and hydrochloric acid reacts according to the following equation

$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2\,(aq)} + H_{2\,(g)}$

1.96g of Zinc metal were reacted with 100cm^3 of 0.2M hydrochloric acid

a) Determine the reagent that was in excess (2mks)

Zn=65.2; Molar gas volume at s.t.p 22.4 liters

……

……

……

……

(b) Calculate the total volume of hydrogen gas that was liberated at s.t.p (1mk)

……

……

……

9. Give the IUPAC names of the following compounds (1mk)

(i) .$CH_3CH_2CH_2CH\ CH_3$

CH_3 ……

(ii) $CH_3CH{=}CHCl$ …… (1mk)

10. 0.9g of potassium chloride and potassium carbonate mixture completely reacted with 25cm^3 of 0.2M hydrochloric acid

(i) Write an equation of the reaction which takes place (1mk)

……

(ii) Determine the number of moles of the acid used (1mk)

……

……

(iii) Calculate the mass of potassium chloride in the mixture (K=39.0; C=12.0; O=16.0) (1mk)

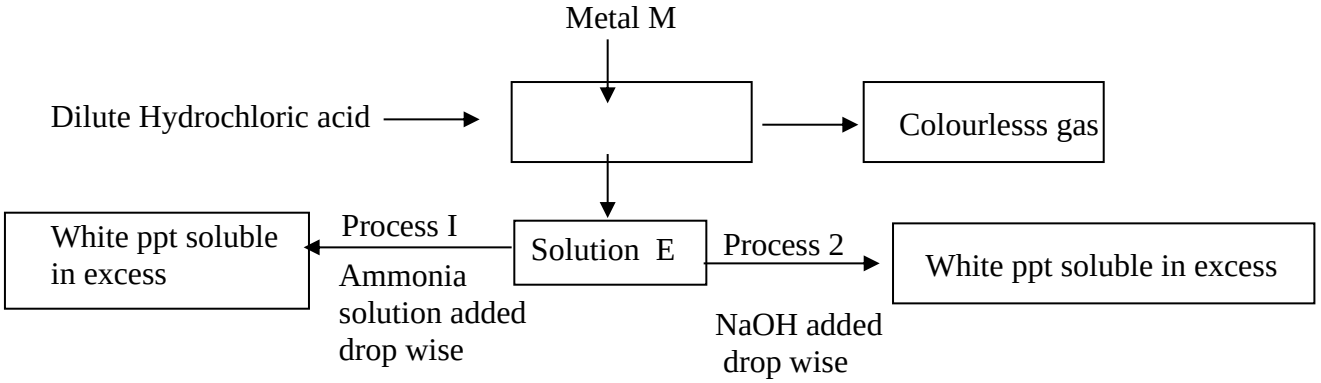
……

……

……

……

11. Study the flow chart below and answer the questions that follow



(i) Identify metal M: …… (1mk)

(ii) Colourless gas: …… (1mk)

(iii) Write an equation that leads to the formation of white precipitate in process (1mk)

……

……

12. a) Define the term dynamic equilibrium (1mk)

……
……
……..

b) A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2}{}_{[}{}^{-}{}_{aq]} + H_2O_{\{l\}}$

Yellow orange

State and explain the observation made when NaOH is added to the equilibrium mixture (2mks)

……
……
……
……

13. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

a) State one observation made (1mk)

……

b) Write an ionic equation of the reaction that occurred in the test tube (1mk)

……

14. A compound of carbon, hydrogen and oxygen contains 57.15% carbon, 4.76% hydrogen and the rest oxygen. If its relative molecular mass is 126, find its molecular formula. (C = 12, H = 1, O = 16) (3mks)

……
……

a) State Grahams law of diffusion. (1mark)

……
……

b) The rate of diffusion of sulphur(IV)oxide gas through a porous material is $40cm3s^{-1}$.
Calculate the rate of diffusion of carbon(IV)oxide gas through the same porous material *(S=32,O=16,C=12)* (2 marks)

……
……
……

15. a) Distinguish between strong and concentrated acid (1mk)

……
……
……
……

b). A solution of ammonia in methylbenzene has no effects on red litmus paper while a solution of ammonia in water turns red litmus paper blue. Explain (2mks)

……
……
……

16. Name the process which takes place when

i. Iodine changes directly from solid to gas (1mk)

……..

ii. $Fe^{2+}{}_{(aq)}$ changes to $Fe^{3+}{}_{(aq)}$ (1mk)

……

iii. White sugar changes to black when mixed with concentrated sulphuric (VI) acid (1mk)

……

17. In the last stage of the solvay process, a mixture of sodium hydrogen carbonate and ammonium chloride is formed

a) State the method of separation used (1mk)

……..

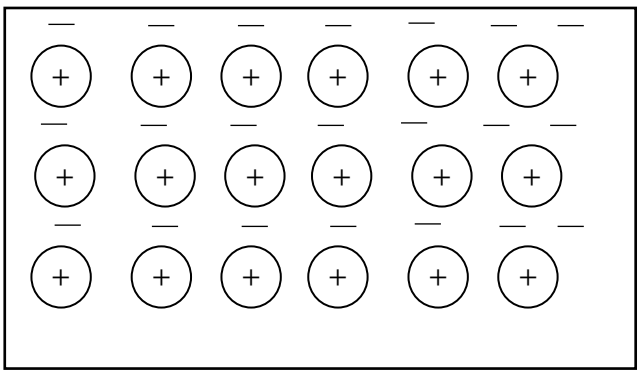
b) Write an equation showing how lime is slaked (1mk)

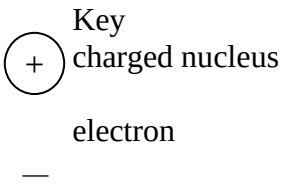
……..

c) Name the product recycled in the above process (1mk)

……..

18. The diagram below is a section of a model of the structure of element K





a) State the type of bonding that exist in K (1mk)

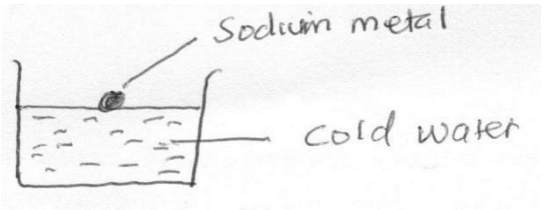
……

b) In which group of the periodic table does element K belong. Give a reason (2mks)

……

……

19. Study the diagram below and answer the questions that follow



a) State two observations made in the above experiment when sodium react with water (2 mks)

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

……

……

20. (a) Explain why permanent hardness in water cannot be removed by boiling (2mks)

……

……

……

(b) Name two methods that can be used to remove permanent hardness from water (1mk)

……

……

22. Write an equation to show the effect of heat on the nitrate of: - (2mks)

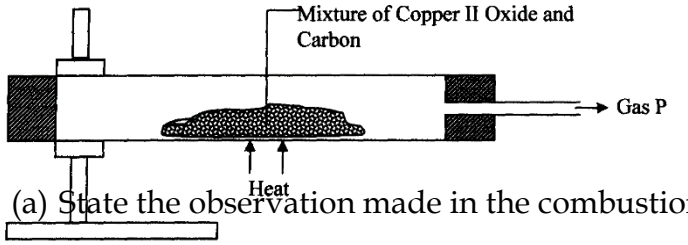
i) Potassium

……..

(ii) Silver

……

23. Study the diagram below and use it to answer the questions that follow.



(a) State the observation made in the combustion tube. (1mk)

……

……

(b) Write an equation for the reaction that took place in the combustion tube. (1mk)

……

(c) Name gas **P** (1mk)

……

24. Sulphur exists in two crystalline forms.

a) Name **one** crystalline form of Sulphur. (1mk)

……

b) State **two** uses of Sulphur. (2mks)

……

……

25. Bond energies for some bonds are tabulated below: -

BOND	BOND ENERGY KJ/mol
H – H	436
C = C	610
C- H	410
C – C	345

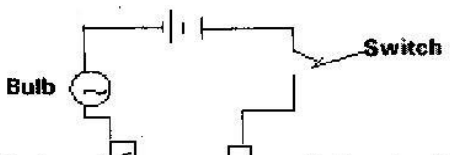
Use the bond energies to estimate the enthalpy for the reaction. (3mks)

$C_2H_{4(g)} + H_{2(g)} \longrightarrow C_2H_{6(g)}$

……

……

26. Study the set up below and answer the questions that flows



State all the observations that would be made when the circuit is completed (3mks)

……..……..……..……..

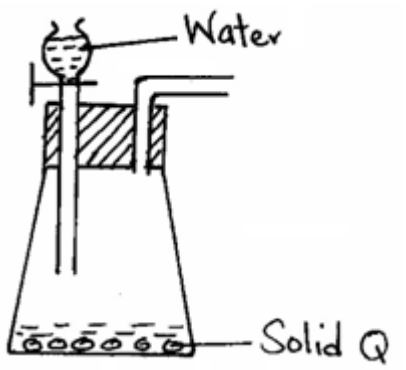
……..

27. Describe how solid samples of salts can be obtained from a mixture of lead (II) chloride, sodium chloride and ammonium chloride. (3mks)

……

……

28. The diagram below represents a set-up used to prepare oxygen gas.



(a) Name substance Q. (1mk)

……

(b) Complete the set-up to show how oxygen gas is collected. (1mk

(c) Write the equation for the reaction that occur. (1mk)

……

29. Two reagents that can be used to prepare chlorine gas are potassium manganate (VII) and hydrochloric acid.

(a) Write an equation for the reaction. (1mk)

……..

c) Give the formula of another reagent that can be used instead of potassium manganate (VII). (1mk)

……..

(c) Using an equation illustrate how chlorine bleach coloured substances. (2mks)

……

SERIES 11

1. Element A has atomic mass 23 and element B has atomic mass 7 and also have 12 neutrons and 4 neutrons respectively.

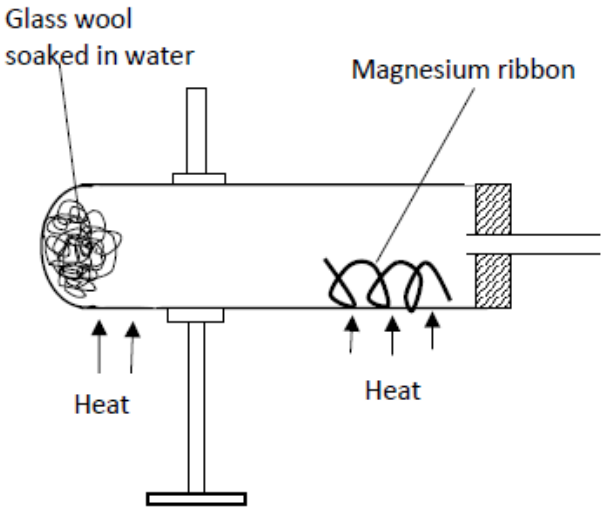
   a. Write the electronic arrangement of **A** and **B**. (1mk)

   ……
   ……

   b. Which element has higher ionization energy? Explain (2mks)

   ……
   ……
   ……
   ……

2. a. A student used the reaction between steam and heated magnesium metal to collect a dry sample of hydrogen gas. Complete the diagram to show how the gas is collected (2mks)



b. Write the equation for the reaction producing the hydrogen gas in the above reaction. (1mk)

……
……

3. During an experiment on the reduction of an oxide of copper, the following data was obtained.
   Mass of empty boat = 25.0g
   Mass of empty boat + oxide of copper = 29.0g
   Mass of boat + copper (after reaction) = 28.2g
   Determine its empirical formula. (Cu = 64, O = 16) (3mks)

……

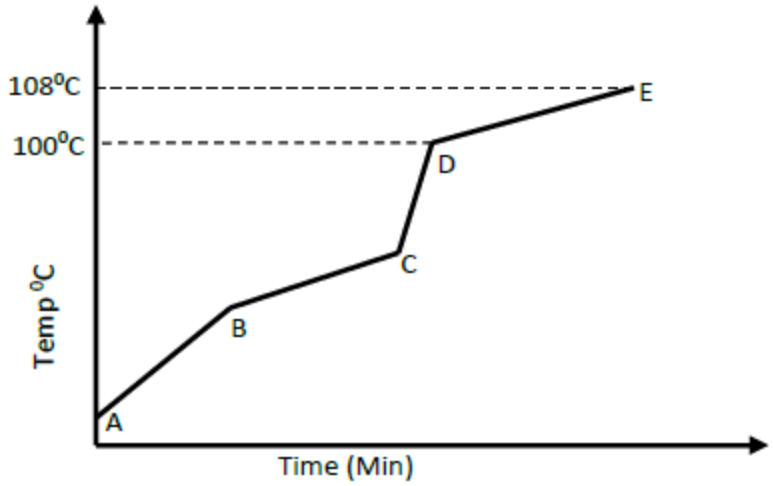
4. Lead (II) nitrate was heated completely.
   a) Write an equation for heating lead (II) nitrate. (1mk)

   ……..
   ……..

   b) Calculate the mass of the oxide formed given that 0.2 moles of the nitrate was heated. **(Pb = 207, O = 16)** (2mks)

   ……...

5. Study the diagram shown below to answer the questions that follow. The curve shows the heating curve of water in the laboratory.



a. At what temperature does the water boil? (1mk)

……

……

b. Give two effects of impurities on the boiling point of water (2mks)

……

……

6. Which type of Sulphur is formed under the following conditions?

i. Above 96^0C (½ mark)

……

……

ii. Pouring boiling Sulphur into cold water (½ mark)

……

……

iii. Rapidly cooling Sulphur vapour (½mark)

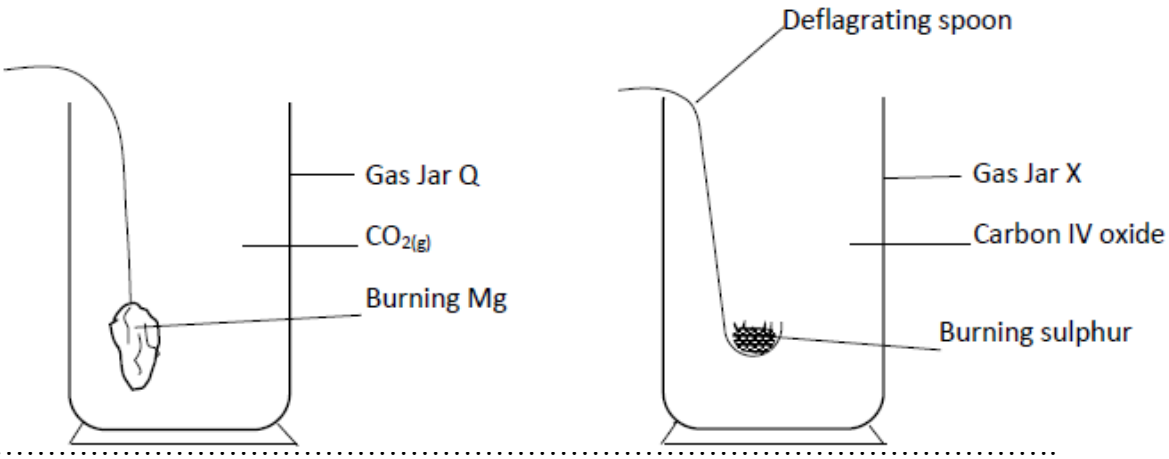
……

……

iv. Mixing sodium thiosulphate with dilute hydrochloric acid (½ mark)

……

7. The diagrams below show the apparatus used to investigate the properties of carbon (IV) oxide gas.



……

……

8. **(a)** State Graham's Law of diffusion. (1mk)

……
……

(b) 100cm^3 of Carbon (IV) oxide diffuses through a porous plate in 30 seconds. How long will it take 150cm^3 of nitrogen (IV) oxide to diffuse across the same plate under similar conditions? **(C=12, N=14, O=16)** (2mks)

……
……
……
……

9. Aqueous ammonia solution is passed through a colourless solution **Y**. A white precipitate which dissolves in excess ammonia to form a colourless solution **P**.

a) Identify the cation present. (1mk)

……
……

b) Write down the formula of;

i) White precipitate. (1mk)

……
……

ii) Complex ion in solution P. (1mk)

……
……

10. When 0.6g of element M was completely burned in oxygen, all the heat evolved was used to heat 500cm^3 of water, the temperature of the water rose from 23.0^{0}C to 32^{0}C. Calculate the relative atomic mass of element M given that the specific heat capacity of water is 4.2Jg-1K-1, density of water is 1.0gcm-^{3} and molar heat of combustion of M is 380kJ/mol. (3mks)

……
……
……
……

11. Hydrogen and bromine gas react to produce hydrogen bromide gas.

a) Write the equation for this reaction (1mk)

……..
……..

b) Use the bond energies given below to calculate the heat of formation of hydrogen bromide. (2mks)

Bond	**Energy (KJ/mol)**	
H – H	436	……..
Br – Br	192	……..
H – Br	368	…….
		…….

12. Explain the following:

a) Solid Aluminium carbonate does not exist. (2mks)

……..
……..

……..

b) Hydrochloric acid is not used to acidify potassium manganite (VII) (1mks)

……

……

13. Naturally occurring magnesium consists of three isotopes: 78.6% ^{24}Mg, 10% ^{25}Mg, and ^{26}Mg. calculate to one decimal place, the relative atomic mass of magnesium. (3mks)

……..

……..

……..

……..

14. Study the table below and answer the questions that follow

substance	M.pt °C	B.pt °C	Electrical conductivity in solid state	Electrical conductivity in molten state
J	365	463	Nil	Nil
K	1323	2773	Good	Good
L	1046	1680	Nil	Good
M	2156	2776	Nil	Nil

Place J, K, L and M in the appropriate categories from the following:

a) Metallic solid …… (1mk)

b) Covalent network solid …….. (1mk)

c) Ionic Solid …… (1mk)

15. A pupil analyzed a commercial vinegar solution by titration and found that 24.5cm^3 of 0.09M sodium hydroxide solution was required for titration of 1cm^3 of vinegar. Calculate the molarity of ethanoic acid CH_3COOH in vinegar. (3mks)

……

……....

……

……

16. A sample of water from a river was divided into equal Portions and each mixed with equal volume of soap solution. The observations made are tabulated below:

Sample of water	Treatment before adding soap	Observations made on shaking with soap
I	Boiled	Lather form immediately
II	No treatment	Slight lather form slowly
III	Treatment with washing soda	Lather formed immediately

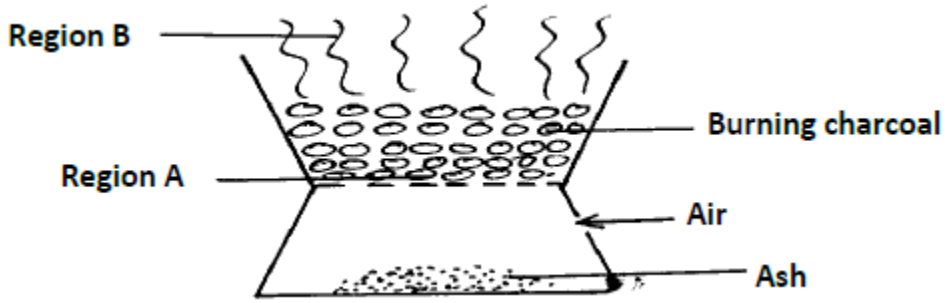
a) What type of hardness is present in the water? Explain (2mks)

……
……
……

b) State one advantage of hard water. (1mk)

……..
……..

17. The diagram below shows a 'jiko' when in use. Study it and answer the questions that follow.



a. Identify the gas formed at region **B** (1mk)

…….
…….

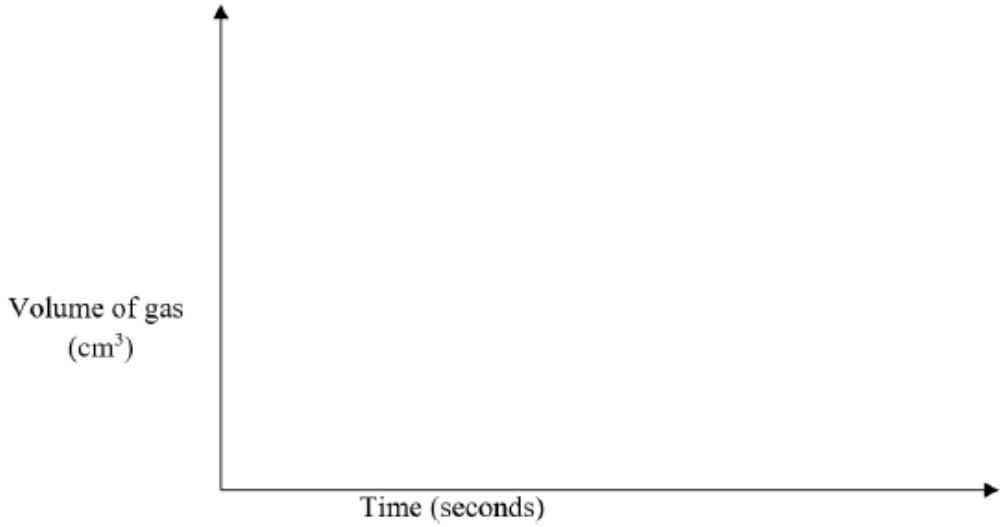
b. Using an equation, explain what happens at region **A** (2mks)

……..
……..
……..
……..

18. The table below gives three experiments on the reaction of excess sulphuric (VI) acid and 0.5g of zinc done under different conditions. In each the volume of gas was recorded at different time intervals.

Experiment	Form of zinc	Sulphuric (VI) acid solution
I	Powder	0.8M
II	Powder	1.0M

a)



uid are

a) Write an equation for the reaction. (1mk)

……..

……..

b) Identify the oxidizing agent in the reaction above. (1mk)

……..

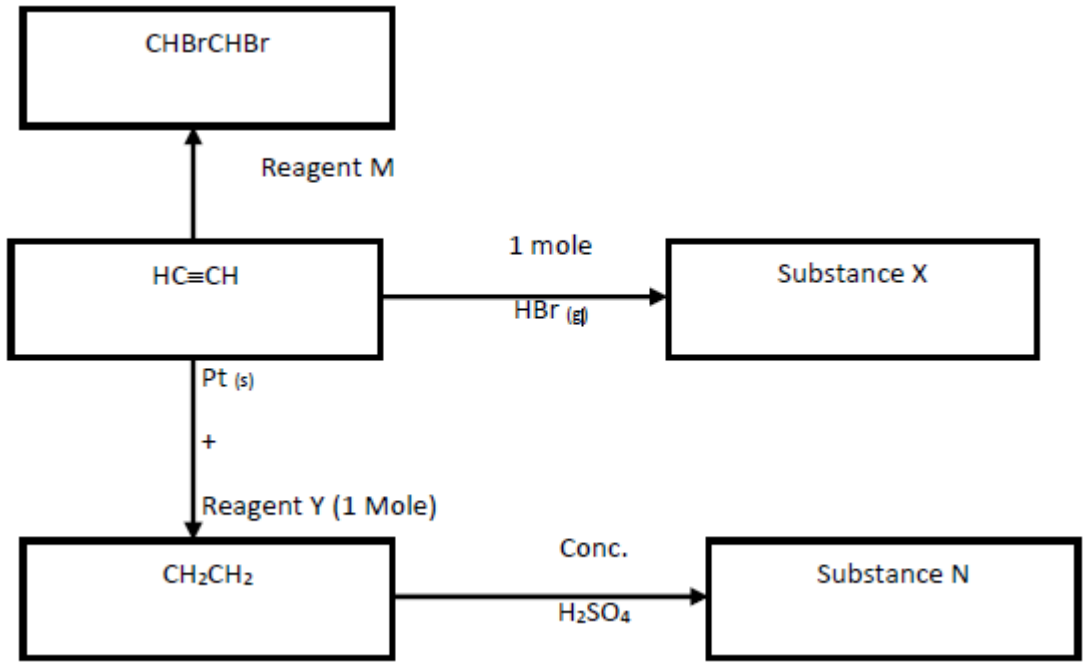
……

c) State one environmental hazard of the nitrogen compounds. (1mk)

……

……

20. The scheme below shows some reactions starting with ethyne. Study it and answer the questions that follow.



n and name the

……

b. Name: (1mk)

……

……

21. Study the following equilibrium equation.

$2X_2(g) + Y_{2(g)} \rightleftharpoons 2X_2Y_{(g)} \quad \Delta H = -197Kj/mol$

Give and explain two ways of increasing the yield of X_2Y. (3mks)

……

……

……

……

22. Given the following reagents: Solid sodium Carbonate, water, solid Lead (II) nitrate. Describe how a sample of Lead (II) Carbonate can be prepared in the laboratory. (3mks)

……

……

……

……

.

23. Study the information in the table and answer the questions below.

Substance	Solubility g/100g water
V	126
W	2

Describe how a solid sample of substance **V** could be obtained from a solid mixture of **V** and **W**. (3mks)

……..
……..
……..
……..

24. The pH of a soil sample was found to be 5.7. An agricultural officer recommended addition of lime.

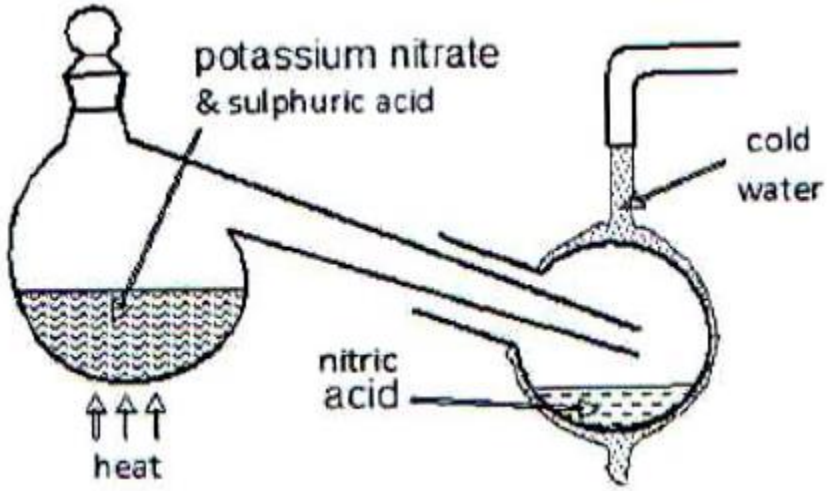
a. State two functions of the lime. (2mks)

……
……

b. Give the name of the process applied in (a) above. (1mk)

……
……

25. The diagram below shows the set-up that was used to prepare and collect a sample of nitric (V) acid.



a) Give a reason why it is possible to separate nitric (V) acid from sulphuric (VI) acid in the set-up. (1mk)

……..
……..

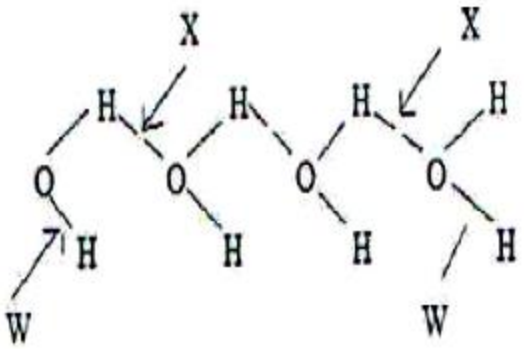
b) Name another substance that can be used instead of potassium nitrate. (1mk)

……..
……..

c) Give one use of nitric (V) acid. (1mk)

……..
……..

26. The structure of water molecules can be represented as shown below.



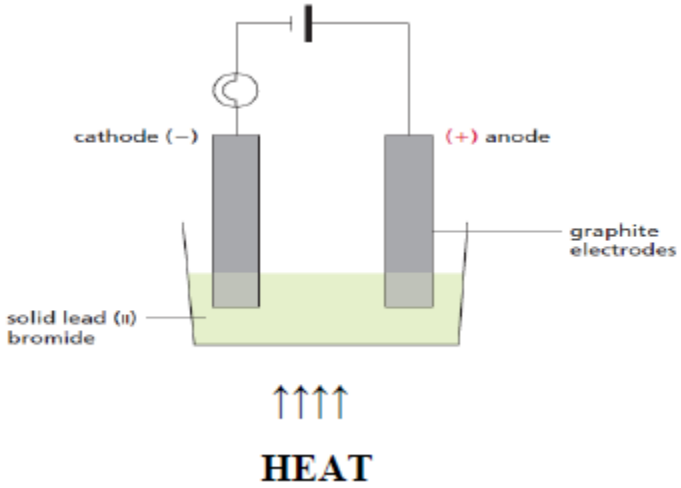
i. Name the bond type represented by letter **X** and **W**. (1mk)

……..
……..

ii. Relative molecular mass of methane and water are almost similar; however, the boiling of water is 100^0C while that of methane is -161^0C. Explain. (2mks)

……..
……..
……..

27. The set-up was used to electrolyse Lead (II) bromide. Study it and answer the questions that follow;



a) Write an ionic equation for the reaction that occurred at the cathode. (1mk)

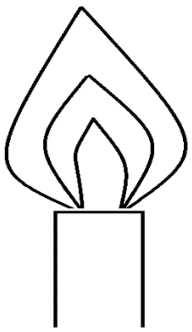
……
……

b) State and explain what happened at the anode (2mks)

……..
……..
……..

SERIES 12

1. Below is a Bunsen burner flame. Study it and answer the questions that follow.



a) How is this type of flame is produced? (1 mark)

……

……

b) Label on the diagram the least hot part of the flame. (1 mark)

c) Name the gas produced by a burning candle that is a non-pollutant. (1 mark)

……

2. a) A hydrocarbon consists of 92.3% carbon. Its molecular mass is 26. Calculate its molecular formula. (2 marks)

……

……

b) Draw the structure of the hydrocarbon. (1 mark)

……

……

……

3. Hydrogen sulphide gas is slightly soluble in water. The reaction is given by equation below.

$$H_2S_{(aq)} \rightleftharpoons H^+_{(aq)} + HS^-_{(aq)}$$

State and explain the effect of addition of Potassium hydroxide pellets on the concentration of hydrogen sulphide. (3 marks)

……

……

……

……

4. In the presence of U.V light, ethane gas undergoes substitution reaction with chlorine.

a) What is meant by the term Substitution reaction? (1 mark)

……

……

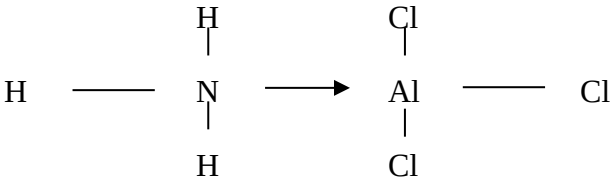
b) Give the structural formula and the name of the organic product formed when equal volumes of ethane and chlorine react together. (2 marks)

……

……

……

5. The diagram below shows the bonding between aluminium chloride and ammonia.



a) Name the types of bonds that exist in the molecule (1 mark)

……

……

b) How many electrons are used for bonding in the molecule? (1mark)

……

c) State one commercial use of dry ice (1 mark)

……

6. a) Give one advantage of universal indicator over other indicators. (1 mark)

……

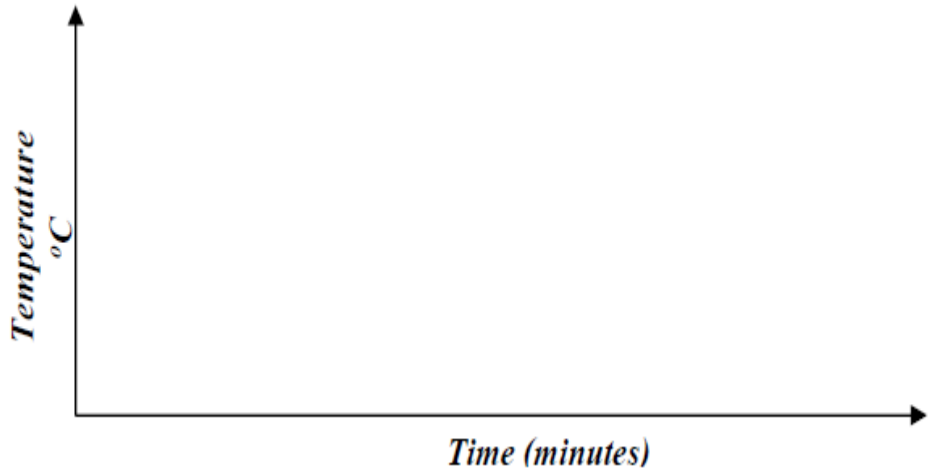
……

b) Describe how a mixture of barium sulphate and lead (II) chloride be separated in to pure solids. (2

……

7. Substance Q has a melting point of 15^{o}C and boiling point of 70^{o}C.

a) On the same axes, draw the heating curve for Q if temperature started rising from 0^{o}C. (2 marks)

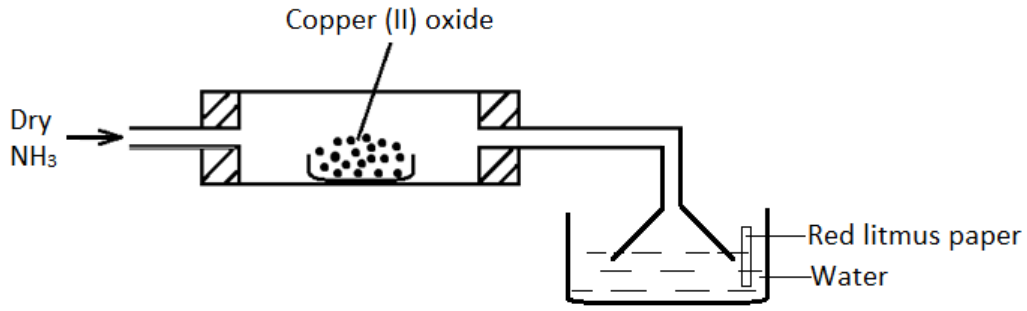


b) State the physical state of substance **Q** at room temperature (room temperature =25^{o}C)

(1 mark)

……

8. The set-up below is used to investigate the properties of ammonia.



i) On the diagram, indicate what should be done for the reaction at the combustion tube to occur.
(½ mark)

ii) Name another gas that can be used instead of ammonia gas. (½ mark)

……

iii) State and explain what happens to the red litmus paper. (1 mark)

……

iv) Explain the observation made in the combustion tube. (1 mark)

……

9. a) What is a binary electrolyte? (½ mark)

……

……

b) In an experiment, the quantity of electricity passed to deposit 1.2g of metal Q from its salt, was 3860 coulombs. (RAM of Q=120, 1 faraday = 96500 coulombs)

i) How many faradays of electricity are required to deposit 1mole of Q? (2 marks)

……

……

……

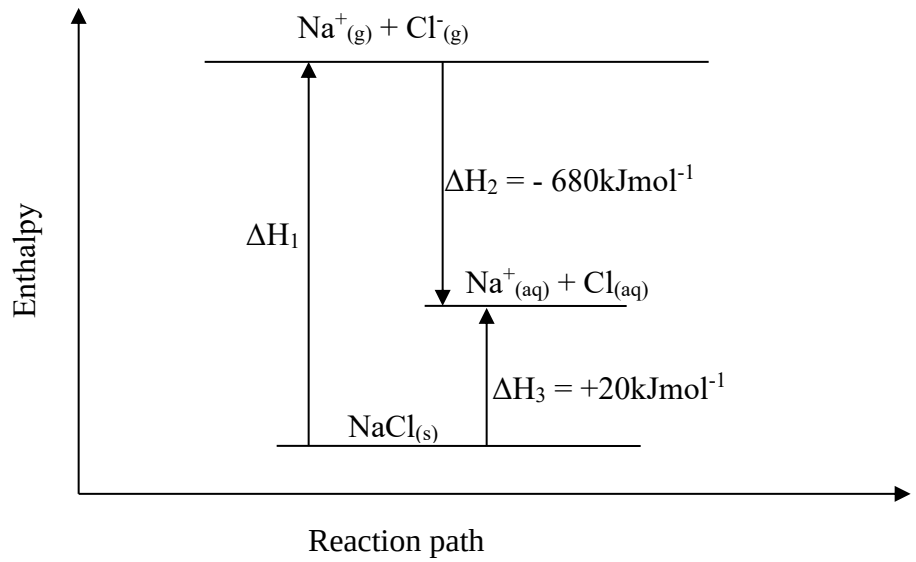
……

ii) One of the ions present in the solutions of the salt of Q has the formula Q^{y+}. What is the numerical value of y? (½ marks)

……

……

10. Study the diagram below which shows an energy level diagram.



i) Name enthalpy (1½ mark)

ΔH_1 ……

ΔH_2 ……

ΔH_3 ……

ii) Calculate the ΔH_1 from the energy level diagram (1½ mark)

……

……

11. Below is a table of 1st ionization energies for elements A, B, C, and D which are metals.

Elements	A	B	C	D
Ionization energies $kJmol^{-1}$	494	418	519	376

a) What is meant by 1st ionization energy? (1 mark)

……

……

b) With an explanation, arrange the elements in order of increasing reactivities. (2 marks)

……

……

12. In the manufacture of Sulphuric (VI) acid by contact process Sulphur (IV) oxide is made to react with air to form Sulphur (VI) oxide as shown: -

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)\ \Delta H = -196KkJ$

(i) Name the catalyst in this reaction (1 mark)

……

(ii) State effect of the following changes on the yield of Sulphur (VI) oxide

I. Increasing the pressure (½ mark)

……

II. Using a catalyst (½ mark)

……

(iii) Explain why Sulphur (VI) oxide gas is absorbed in concentrated Sulphur (VI) acid before dilution (1 mark)

……

……

13. a) What are isotopes? (1 mark)

……

……

b) Determine the number of neutrons in $^{18}_{8}O$ (1 mark)

……

……

c) An isotope of element E has 34 neutrons and its mass number is 64. E forms a cation with 28 electrons. Write the formula of the cation formed by the element E. (1 mark)

……

……

14. The standard electrode potentials of four half-reactions are: -

I.	$Sn^{2+}_{(aq)} + 2e^-$	→	$Sn_{(s)}$	$E^\theta = -0.14V$
II.	$Fe^{3+}_{(aq)} + e^-$	→	$Fe^{2+}_{(aq)}$	$E^\theta = +0.77V$
III.	$V^{2+}_{(aq)} + 2e^-$	→	$V_{(s)}$	$E^\theta = -1.20V$
IV.	$Br_{2(aq)} + 2e^-$	→	$2Br^-_{(aq)}$	$E^\theta = +1.07V$

i) Identify the strongest oxidizing agent. (1 mark)

……

ii) Calculate the electrode potential for the electrochemical cell constructed from half-cell III and IV (1 mark)

……

……

iii) State two applications of electrolysis (1 mark)

……

……

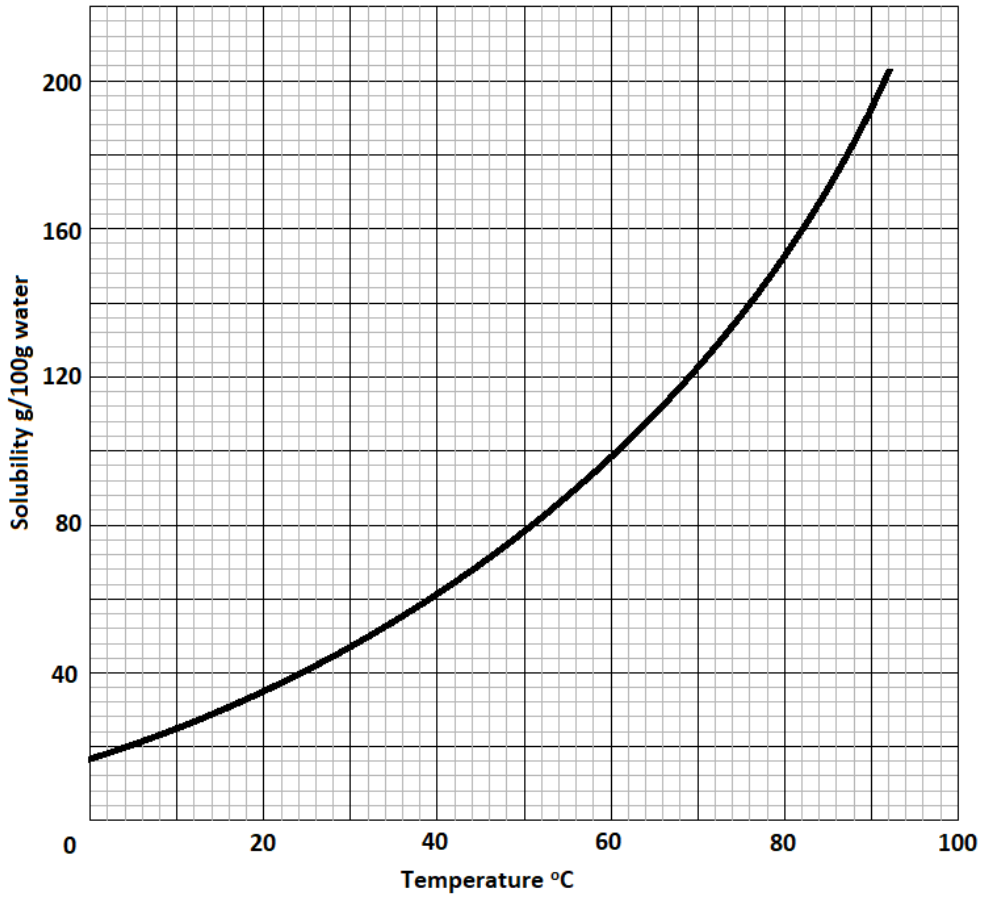
15. A sample of river water is suspected to contain magnesium salt. Describe how the presence of Mg^{2+} ions can be established. (3 marks)

……

……

……

16. The solubility curve of potassium nitrate is shown below.



(a) Determine the solubility of potassium nitrate at 80°C. (1 mark)

……

(b) Determine the molar concentration of saturated potassium nitrate at 50°C. (K = 39.0, O = 16.0, N = 14.0 and density of water = 1 g/cm^3). (2 marks)

……

……

……

……

17. Galvanization is an example of the efficient methods used in preventing rusting.

a) What is meant by galvanisation? (1 mark)

……

……

b) Other than galvanisation, name 2 methods of preventing rusting. (1 mark)

……

……

c) State the use of the mixture of hydrazine with oxygen. (1 mark)

……

18. a) Name 2 gases that are collected during fractional distillation when the temperature of liquefied air is raised from -200℃ to -185℃of the distillation chamber. (1 mark)

……

……

b) Name 2 gases that are removed at the temperature between 25℃ and -25℃ (1 mark)

……

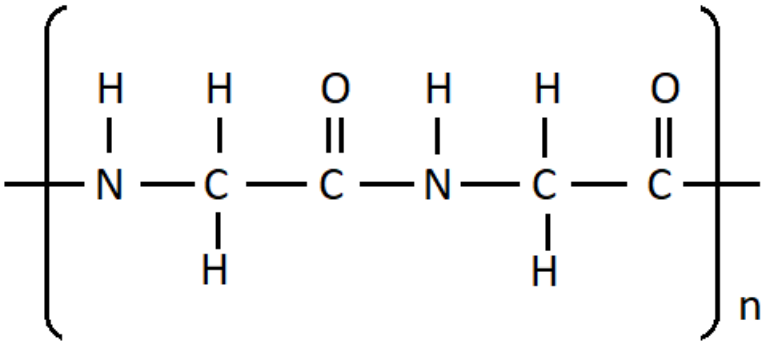
……

c) Why is it necessary to remove the gases named in (b) above before the cooling dust free air to -200℃? (1 mark)

……

……

19. The structure of protein is shown below. Study it and answer the questions that follow.



a) Draw the structure of the monomer that undergoes polymerization to form protein. (1 mark)

……

……

……

b) Which type of polymerization is the formation of protein? Explain. (2 marks)

……

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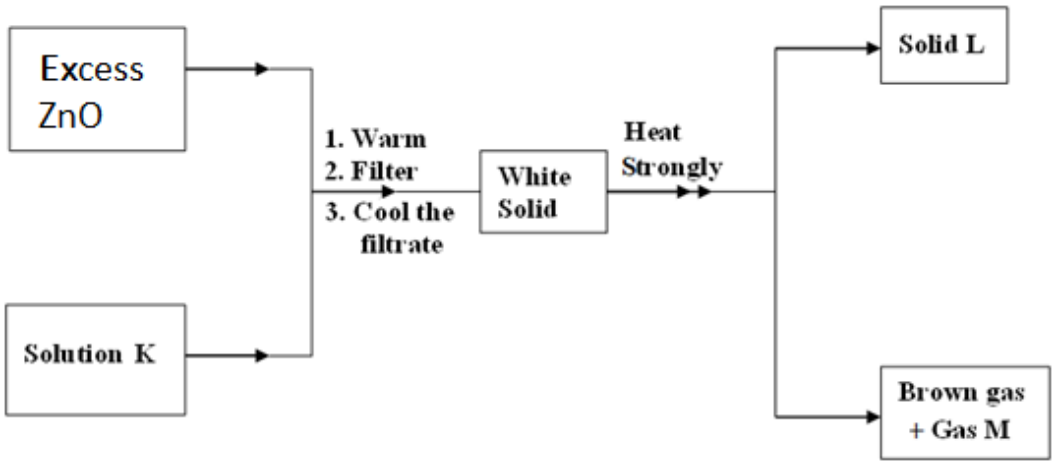
……

20. Study the flow chart below and answer the question that follows.



Identify: (3 marks)

a) Solution K

……

b) Solid L

……

c) Gas M

……

21. $50cm^3$ of oxygen gas diffused through a porous plug in 80 seconds. How long will it take $100cm^3$ of Sulphur (IV) oxide to diffuse through the same plug? (S = 32, O = 16). (3 Marks)

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22. $15.0cm^3$ of ethanoic acid (CH_3COOH) was dissolved in water to make $500cm^3$ of solution. Calculate the concentration of the solution in moles per litre. (C=12.0; H=1.0; O=16.0; density of ethanoic acid is 1.05 g/cm^3) (3 marks)

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23. When excess chloride gas is bubbled through dilute sodium hydroxide solution the resulting solution acts as a bleaching agent.

a) Write an equation for the reaction between chlorine gas and sodium hydroxide solution. (1 mark)

……

……

……

b) Explain how the resulting solution acts as a bleaching agent. (2 marks)

……

……

……

24. Calcium oxide can be used to dry ammonia gas.

a) Explain why calcium oxide is not used to dry hydrogen chloride gas. (2 marks)

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……

……

b) Name one drying agent for hydrogen chloride gas. (1 mark)

……

25. a) Explain why it is not advisable to prepare a sample of carbon(IV)oxide using barium carbonate and dilute Sulphuric(VI) acid. (2 marks)

……

……

……

b) State a method that can be used to collect dry carbon(IV)oxide gas. Give a reason. (1 mark)

……

……

26. Study the information in Table 3 and use it to answer the questions that follow.

Elements	**Na**	**Mg**	**Al**	**Si**	**P**	**S**	**Cl**
Atomic Numbers	11	12	13	14	15	16	17

Atomic radii(nm)	0.157	0.136	0.125	0.117	0.110	0.104	0.099

(a) Explain the trend in atomic radii from sodium to chlorine. (1 mark)

…….....

…….....

(b) Explain how the chloride of aluminium differs from those of other metals in the period. (2 marks)

…….....…….....

.....

27. When solid magnesium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no apparent reaction. On addition of water to the resulting mixture, there was vigorous effervescence. Explain these observations (2 marks)

…….....

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The Last Printed Page

SERIES 13

1. Gases obey laws that can be used to determine the volume of a fixed mass of a gas.
   (a) State Graham's law of diffusion. (1 mark)

……
……
……

   (b) One litre of hydrogen gas at s.t.p has a mass of 0.09g. Calculate the mass of 2.56 litres of hydrogen gas at 25^{o}C and 736mmHg. (H = 1) (3 marks)

……
……
……

2. Draw a well-labelled diagram to show how a dry sample of sulphur (IV) oxide can be prepared in the laboratory. (3 mark)

3. Radioisotopes have a wide range of applications.
   (a) Give two uses of radioisotopes in medicine. (2 marks)

……
……
……

   (b) Uranium has three radioisotopes.

Isotope	U-234	U-235	U-238
% Abundance	0.01	0.72	99.27

   Which of these isotopes has the longest half-life? (1 mark)

……
……

4. The following table shows the number of spots different solvents formed when chromatography was carried out with denim dye used to make blue jeans.

Solvent	**Number of spots**
A	2
B	5
C	1
D	0

   (a) Which is the most appropriate solvent to use for chromatography of denim dye? Give a reason. (2 marks)

……
……
……

   (b) What conclusion can be drawn about solvent D from the table? (1 mark)

……
……

5. Magnesium hydrogen carbonate causes temporary water hardness.
   (a) Describe how temporary water hardness is formed. (2 marks)

……

   (b) Write an equation for softening hard water by addition of ammonia solution. (1 mark)

……

6. Reaction rate can be determined by measuring how fast reactants are consumed or how fast products are formed.
   (a) State how a decrease in temperature affects the rate of reaction. (1 mark)

……

   (b) Sketch two curves on the same axis to show the volume of oxygen produced by the decomposition of hydrogen peroxide, one with a catalyst and the other without a catalyst.
   (2 marks)

7. Using a diagram, illustrate the setup for an experiment to demonstrate Charles's Law.
   (3 marks)

8. Describe an experiment to prepare a sample of sodium chloride from sodium hydroxide and hydrochloric acid. (3 marks)

……
……
……

9. **(a)** Define latent heat of vaporization. (1 mark)

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……
……

(b) Explain why the temperature remains constant when ice is melting. (2 marks)

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……
……

10. Classify the following substances as elements, compounds, or mixtures: (3 marks)
    (i) Water…….
    (ii) Iron……...
    (iii) Air……...
11. (a) Explain the term 'hydrated salt'. (1 mark)

……
……
……

(b) Describe the procedure for testing the presence of chloride ions in a solution.
(2 marks)

……
……

12. (a) Define isomerism. (1 mark)

……
……
……

(b) Draw and name all the positional isomers of butanol. (2 marks)

13. Given the reaction:
$Mg(s)+CuSO_4(aq)\rightarrow MgSO_4(aq)+Cu(s)$
(a) Identify the reducing agent. (1 mark)

……
……

(b) Explain the change in oxidation states for magnesium and copper. (2 marks)

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……
……

14. (a) Describe how you would test for the presence of hydrogen gas. (2 marks)

……
……
……

(b) State one use of hydrogen in the field of metallurgy. (1 mark)

……

15. (a) Give the difference between the bleaching action of chloride and that of sulphur (IV) oxide gas.
(2 marks)

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……
……

(b) Give the advantage of the bleaching action of chlorine over that of sulphur (IV) oxide gas.
(1 mark)

……
……

16. (a) Explain why elements in the same group have similar chemical properties. (2 marks)

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……
……

(b) Explain why noble gases are chemically inert. (1 mark)

……
……

17. (a) Define the term molar mass. (1 mark)

……
……
……

(b) 7.467g of a gas Q has a volume of 5.6dm^3 at r.t.p. Calculate its molar mass. (Molar gas volume at r.t.p = 24,000 cm^3) (2 marks)

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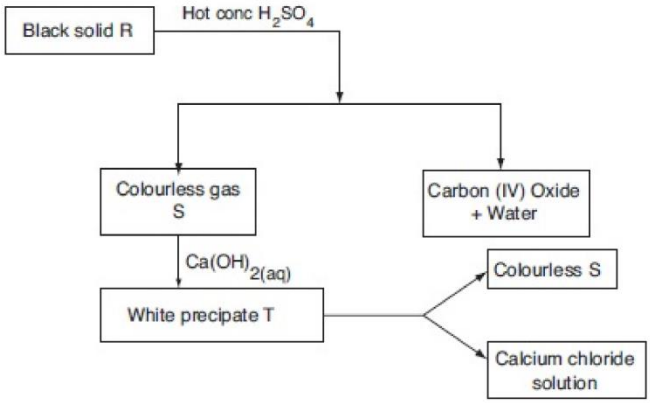
……

18. Study the flow chart below and answer the following questions.



(a) Name: (1 mark)
(i) R……
(ii) S……

(b) Write the equation for the formation of calcium chloride solution. (1 mark)

……
……

(c) Write the equation for the formation of white precipitate T. (1 mark)

……
……

19. (a) What is a fuel? (1 mark)

……
……
……

(c) State two environmental effects of fuels and suggest two alternative energy sources. (2 marks)

Effects

……
……

Alternative energy sources

……
……

20. Describe an experiment to show that air is necessary for combustion. (3 marks)

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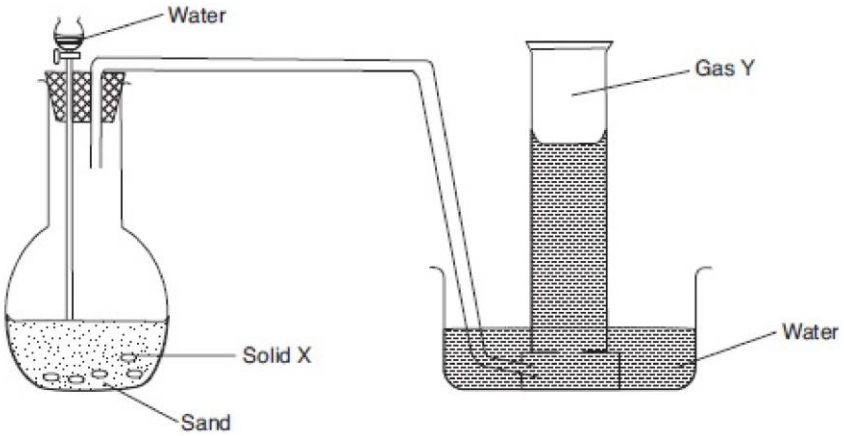
……

21. The set up below was used to prepare a hydrocarbon, Study it and answer the following questions.



(a) Name: (1 mark)
(i) Solid X……
(ii) Gas Y……

(b) What is the function of the sand in the set-up? (1 mark)

……
……

(c) Write an equation for the formation of gas Y. (1 mark)

……
……

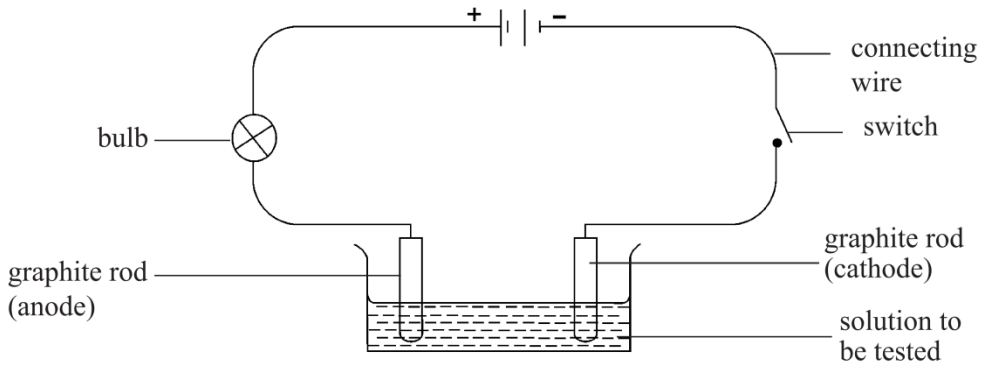
22. (a) Explain why water is considered a universal solvent. (2 marks)

……
……

(b) State whether the following substances and soluble or insoluble in water. (1 mark)

(i) Silver bromide……
(ii) Cobalt (II) chloride……

23. Study the diagram below and answer the following questions.



(a) What does the set-up illustrate? (1 mark)

……

(b) Explain the observation on the bulb when the switch is closed if the solution to be tested is urea solution. (1 mark)

……

(c) Give the meaning of the term cathode. (1 mark)

……
……

24. The table below shows some ions of elements J, K, L and M. (Letters are not actual symbols of the elements.

Ion	**Atomic number**
J^{2+}	12
K^{3-}	13
L^{+}	3
M^{2-}	17

(a) Select two stable ions. (1 mark)

……..

(b) Which of the ions has the largest radius? (1 mark)

……..

(c) Compare the atomic radius of element K to that of its ion K^{3-}. (1 mark)

……..

25. (a) Sodium reacts with water vigorously while magnesium reacts with water very slowly. Explain. (2 marks)

……
……

(b) Hydrogen is a reducing agent. Write an equation for the reaction that takes place when dry hydrogen is passed over heated copper (II) oxide in a combustion tube in the laboratory.
(1 mark)

……
……

26. Esters can be made by the reaction of many different types of alkanols (alcohols) and alkanoic (carboxylic) acids.
Draw the structural formula of the esters formed from: (2 marks)
(i) Methanol and ethanoic acid.

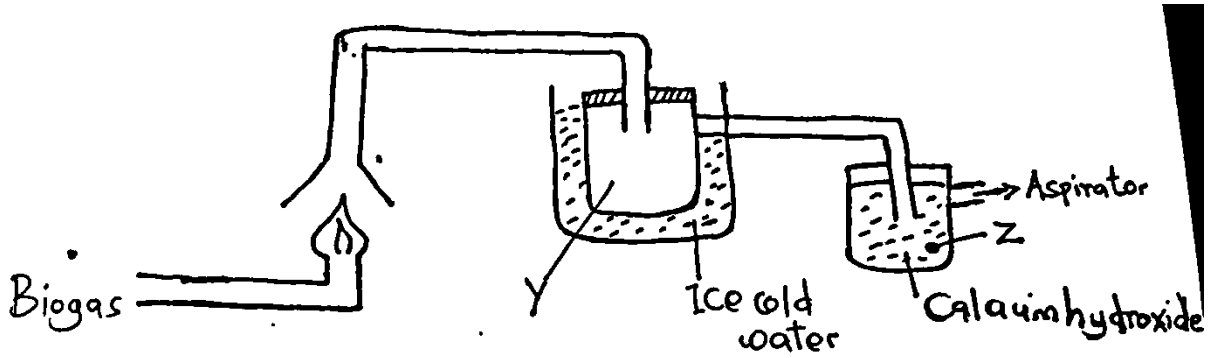
(ii) Ethanol and butanoic acid.

27. Give three differences between a permanent chemical change and a temporary physical change.
(3 marks)

……
……

SERIES 14

1. Describe an experimental procedure that can be used to extract oil from nut seeds. (2mks)
   ……
   ……
   ……
   ……
2. A luminous flame produces more light than a non-luminous flame. Explain. (1mk)
   ……
   ……
3. Ethanol and dimethyl ether have both molecular formulae C_2H_6O. Explain why ethanol boils at 78.2°C and dimethyl ethen has a boiling point of -24°C. (2mks)
   ……
   ……
   ……
4. In an experiment, ammonium chloride was heated in a boiling tube with a moist red and blue litmus paper at the mouth of tube. State and explain the observation made. (3mks)
   ……
   ……
   ……
   ……
   ……
   ……
5. The set up below was used to investigate the products of burning biogas (methane). Study it and answer the questions that follow:



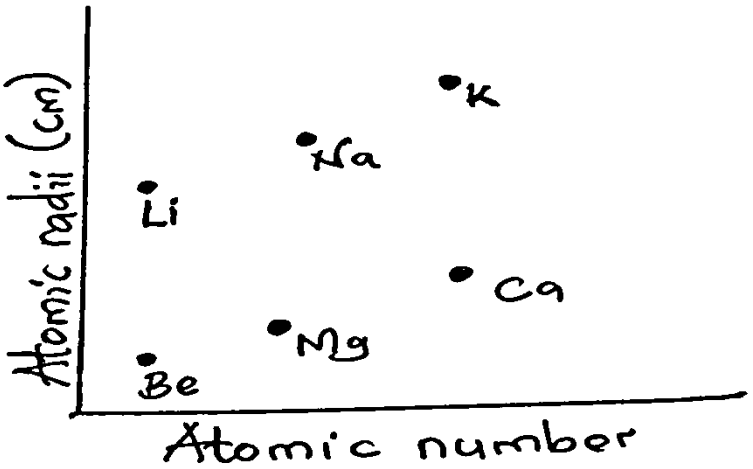
a) State one chemical test for the product formed in tube Y. (1mk)

……

b) State and explain the observation which would be made in Z. (2mks)

……
……

6. The plots below were obtained when the atomic radii of some elements in group I and II were plotted against atomic number.



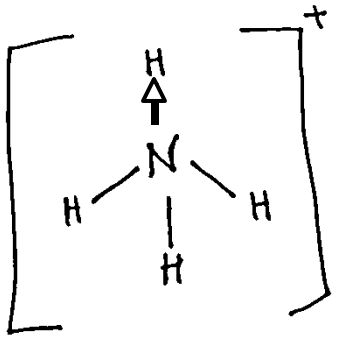
a) Explain the trends shown by Li, Na and K. (1mk)

……
……

b) Explain why the atomic radius of elements Be, Mg and Ca are lower than those of Li, Na and K.(2mks)

……
……
……....

7. (a) Ammonium ion has the following structure



Label on the structure:

(i) Covalent bond (1mk)

……...

(ii) Dative bond (1mk)

……...

(b) Why does an ammonia molecule form an ammonium ion with a proton? (1mk)

……
……

8. Hydrogen sulphide is highly toxic and flammable gas and is usually prepared in the flame chamber.

(a) Name any two reagents that can be used to prepare the gas in the laboratory. (1mk)

……
……....

(b) Other than vulcanization of rubber. Identify any other use of sulphur. (1mk)

……

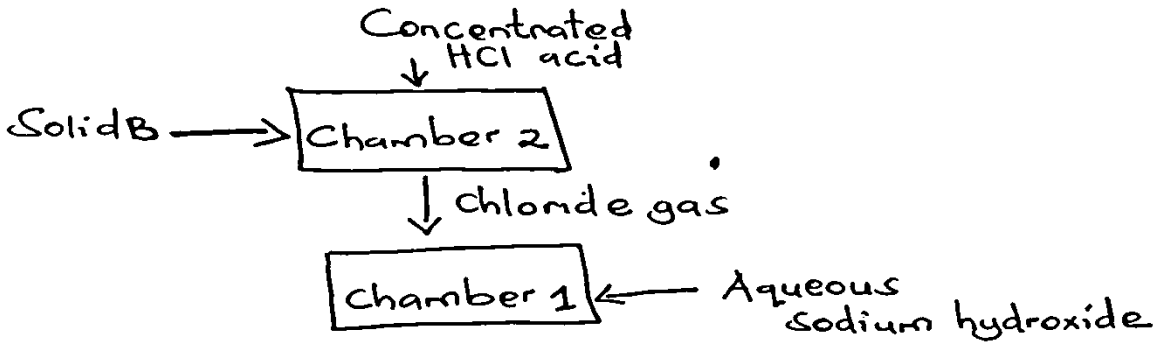
9. Describe two chemical tests that can be used to distinguish ethanol from ethanoic acid. (3mks)

……
……
……
……

10. (a) The electronic arrangement of the ion of element Q is 2,8,8. If the formula of the ion is Q^{3-}. State the group and period to which Q belongs.
Group …… (1mk)
Period …… (1mk)

11. Draw and name three isomers of pentene. (3mks)

12. Study the flow chat below and answer the questions that follow.



(a) Identify solid B. (1mk)

……

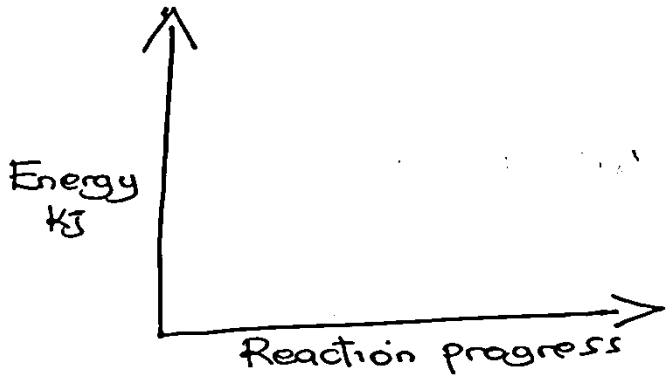
(b) Name the type of reaction that takes place in chamber 2. (1mk)

……

(c) Write an equation for the reaction that takes place in chamber 1. (1mk)

……
……

13. The molar enthalpy of solution for potassium hydroxide is – 42kJ/mole.
a) On the axes provided, draw a labelled energy level diagram for the dissolution process of potassium hydroxide. (2mks)



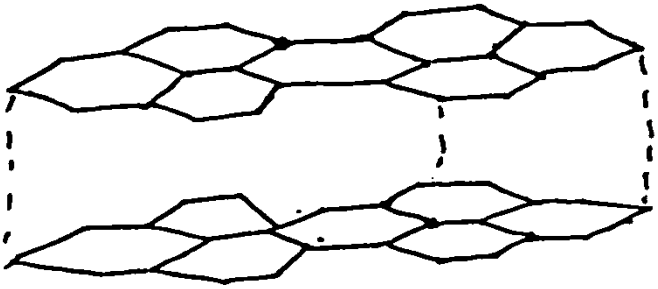
b) Calculate the enthalpy change when 5.6g of potassium hydroxide is completely dissolved in water (K=39, O=16, H=1) (2mks)

14. a) What is meant by allotropy. (1mk)

……

……

b) The diagram below shows the structure of one of the allotropes of carbon.



(i) Identify the allotrope. (1mk)

……

(ii) State two properties of the above allotrope and explain how it is related to its structure.(2mks)

……

……

15. Why is dilute nitric acid not used to prepare hydrogen gas. (1mk)

……

……

16. Starting with copper (II) oxide, describe how you can prepare copper (II) sulphate crystals.(3mks)

……

……

……

……

……

17. (a) State Boyles' Law. (1mk)

……

……..

(b) A fixed mass of a gas occupies 200cm^3 at temperature of 23°C and pressure 740mmHg. Calculate the volume of the gas at -25°C and 780mmHg pressure. (2mks)

……
……
……
……
……
……
……
……

18. When a hydrated sample of calcium sulphate $CaSO_4$. nH_2O was heated until all the water was lost, the following data was recorded.

Mass of crucible = 30.296g
Mass of crucible + hydrated salt = 33.111g
Mass of crucible + unhydrous salt = 32.781g

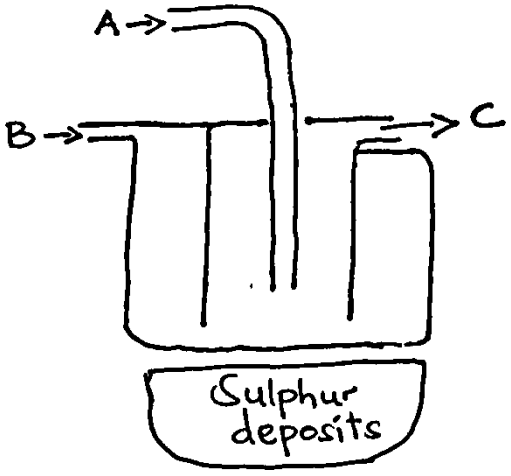
Determine the empirical formula of the hydrate salt (Relative formula mass of $CaSO_4$ =136, H_2O=18) (3mks)

……
……
……

19. When excess lead (II) nitrate solution was added to a solution of sodium chloride, the precipitate was found to weigh 5.56g, determine the amount of sodium chloride in the solution. (3mks) (Na=23, Pb=207, Cl=35.5, N=14, O=16)

……
……
……
……..

20. The diagram below shows how sulphur is extracted from sulphur deposits.



(a) Name the process represented above. (1mk)

…….

(b) Identify A. (1mk)

……..

(c) State one physical property of sulphur that makes it possible to be extracted by this method. (1mk)

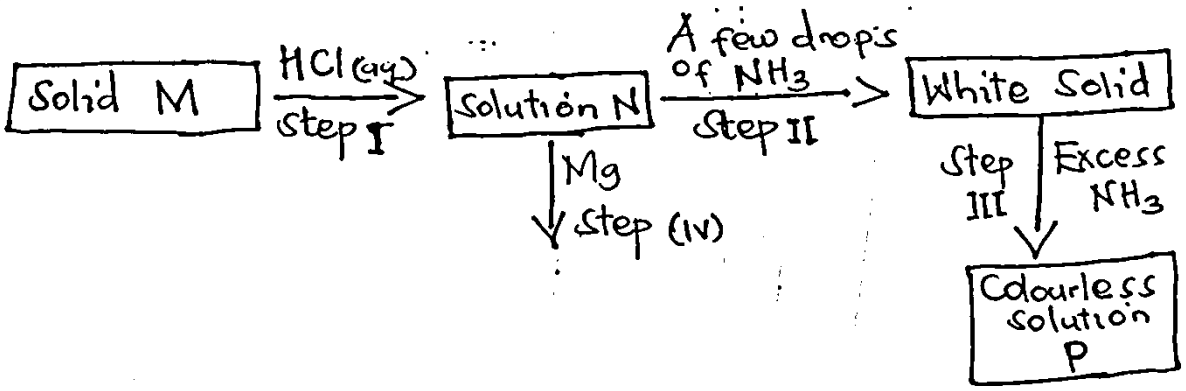
……
……

(d) State one physical property of sulphur that makes it possible to be extracted by this method. (1mk)

……

……

21. The scheme below shows some reaction sequence starting with solid M. Study it and answer the questions.



(a) Write the formula of the complex ion in solution P. (1mk)

……

……

(b) Write an equation for the reaction in step IV. (1mk)

……

……

(c) Write an equation for the reaction in step I. (1mk)

……

……

22. Draw a well labelled diagram used to prepare dry samples of hydrogen gas in the laboratory. (3mks)

23. (a) What are Isotopes. (1mk)

……

……

(b) Element Q (not the actual symbol of the element) has two isotopes with mass numbers 8 and 9. If the relative atomic mass of Q is 8.94, determine the percentage abundance of each isotopes. (3mks)

……

……

24. Aluminium is extracted from aluminium oxide by electrolysis.

(a) Other than the cost of electricity, give another reason why this method is expensive. (1mk)

……

……

(b) Calculate the mass of aluminium obtained when a current of 20A is used for 5 hours (1 farudary=96500C, Al=27) (3mks)

……

……

……

……

……

25. (a) Name two ores of iron. (2mk)

……

……

(b) Give the name of the suitable method used in extracting iron from the ore. (1mk)

……

(c) Name one impurity present in pig iron and state one effect of the impurity in the physical property of iron. (2mks)

……

……

26. The consentration of a solution of aluminium sulphate is 0.02M. How many sulphate ions are contained in $150cm^3$ of the solution. (3mks)
(Avogadros constant 6.0×10^{23})

……

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……

…

27. At room temperature, nitrogen (iv) oxide exists as an equilibrium mixture with dinitrogen tetra oxide.

$NO_{2(g)}$ ⇌ $N_2O_{4(g)}$ $\triangle$ H is –ve
(Brown) (Yellow)

State the observation made when the mixture is heated. Give a reason. (2mks)

……..

……..

28. Define solubility. (1mk)

……

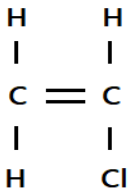
……

SERIES 15

1. An atom of element A has mass number 23 and 12 neutrons.
   (a) Write the electron arrangement of the atom (1 mark)
   ……
   (b) State the period and group to which element A belongs
   Group …….. (½ mark)
   Period …….. (½ mark)
   (c) State whether the element is a metal or a non-metal. (1 mark)
   ……
2. (a) What is an indicator? (1 mark)
   ……
   ……
   (b) Name the indicator which can be used to determine the pH value of lemon juice. Give a reason for your answer. (2 marks)
   ……
   ……
3. At $20^{O}C$, NO_2 and N_2O_4 gases exist in equilibrium as shown in the equation below:

   $$\underset{\text{Brown}}{2NO_{2(g)}} \rightleftharpoons \underset{\text{pale yellow}}{N_2O_{4(g)}};\ \triangle H = -ve$$

   State and explain the observation that would be made when;
   (a) A syringe containing the mixture at $20\ ^{O}C$ is immersed in ice-cold water. (1 ½ marks)
   ……
   ……
   ……
   (b) The volume of the gaseous mixture in a syringe is reduced. (1 ½ marks)
   ……
   ……
   ……
4. A monomer has the following structure

   (a) Draw the structure of its polymer that contains two monomers. (1 mark)
   ……
   ……
   (b) A sample of the polymer formed from the monomer has a molecular mass of 4500. Determine the number of monomers that formed the polymer (C= 12; H= 1; Cl=35.5). (2 marks)
   ……
   ……
   ……
5. (a) Name the gaseous pollutant produced during Contact Process (1 mark)
   ……
   (b) Describe how scrubbing of the gas named in **(a)** above is done to reduce pollution. (1 mark)
   ……
6. Use the table below to answer the questions that follow. (The letters are not the actual symbols of the elements)

Element	Atomic number	Boiling point (°C)
A	19	774
B	11	890
C	17	-35
D	13	2470
E	14	2360

(a) Identify an element that exists as a gas at room temperature. Explain. (2 marks)

……

(b) Using dots (●) and crosses(**x**) draw the bonding formed when element **A** and **C** react to form a compound. (1 mark)

……

7. Lead (II) chloride can be prepared from lead (II) carbonate using the following procedure:

Step 1: Add excess lead (II)carbonate to dilute nitric (v) acid.

Step 2: Filter to obtain lead (II)nitrate solution as filtrate.

Step 3: Add sodium chloride solution to the filtrate.

Step 4: Filter off to obtain lead (II)chloride as residue.

Step 5: Wash the lead (II)chloride residue with distilled water dry between filter papers.

Why are the following steps necessary?

(a) Using **excess** lead (II)carbonate used in step 1 (1 mark)

……

(b) Using dilute nitric(V) acid instead of sulphuric (VI) or hydrochloric acid in step 1 (1 mark)

……

……

(c) Washing the lead (II)chloride residue with distilled water in step 5 (1 mark)

……

8. Phosphorus is in group (V) of the periodic table. Explain the following observations.

(a) Phosphorus exhibits two melting points. (1 mark)

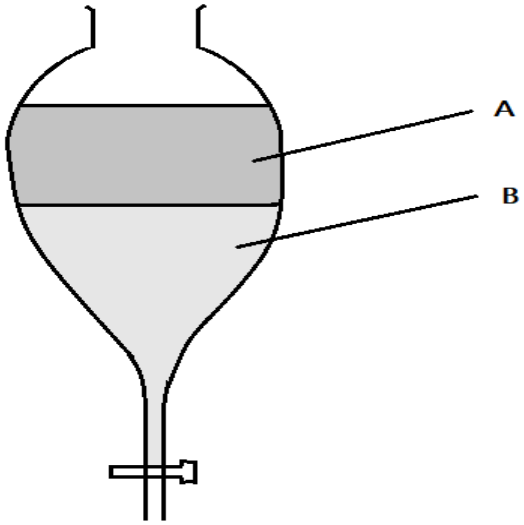
……..

(b) The chloride of phosphorus forms musty fumes in damp air. (2 marks)

……

……

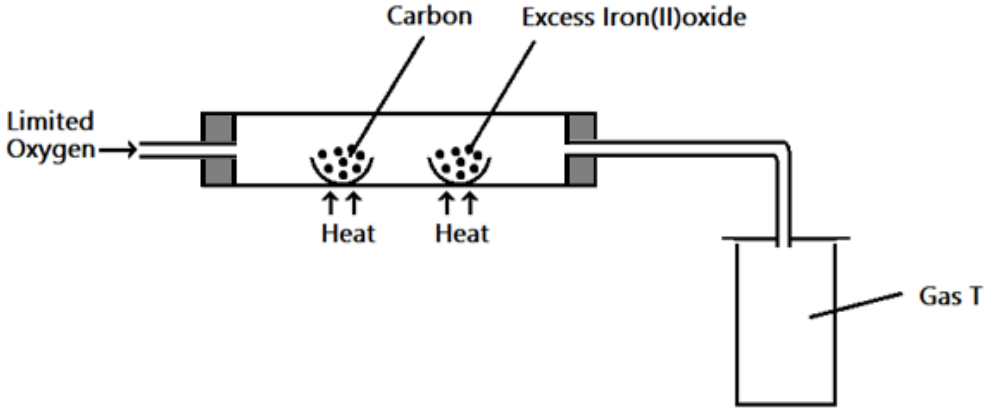
9. The apparatus below was used to separate a mixture of **water** and **kerosene**.



(a) State **two** properties of the liquids that make it possible to separate them using such apparatus. (1 mark)

……
……
(b) Name the liquids **A** and **B.** (1 mark)
……
……
(c) Give the name of the above method of separation. (1 mark)
……

10. The set up below was used to obtain a sample of iron.



(a) Write **two** equations for the reactions which occur in the combustion tube. (2 marks)
……
(b) Identify Gas **T** (1 mark)
……

11. Chlorine gas was bubbled through potassium iodide solution.
(a) State the observation that would be made. (1 mark)
……
(b) Write the ionic equation for the reaction that took place in (a) above. (1 mark)
……
(c) Identify the oxidizing agent in the ionic equation (b) above. (1 mark)
……

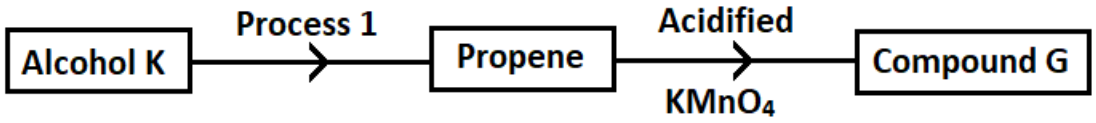
12. Consider the reaction chain below.

$$^{214}_{83}Bi \xrightarrow{I} {}^{210}_{81}Ti \xrightarrow{II} {}^{210}_{82}Pb \xrightarrow{III} {}^{210}_{83}Bi \xrightarrow{IV} {}^{210}_{84}Po \xrightarrow{V} {}^{206}_{82}Pb$$

(a) Identify the particles emitted in
(i) I (½ mark)
……
(ii) II (½ mark)
……
(b) Write the nuclear equation for the reaction that takes place in V. (1 mark)
……
(c) State one environmental effect of radioisotopes. (1 mark)
……

13. $25cm^3$ of 0.1M sulphuric (VI) acid required $20cm^3$ of sodium carbonate solution for complete neutralization. Calculate the concentration of sodium carbonate in moles per litre. (3 marks)
……

14. Study the flow chart **below**.



(a) Write the molecular formula of alcohol **K**. (1 mark)

……

(b) Name

(i) Compound **G** …… (1 mark)

(ii) Process **I** ……..…… (1 mark)

15. (a) Define the term oxidation state. (1 mark)

……

(b) Calculate the oxidation states of chromium and manganese in the following ions.

(i) Chromium in $Cr_2O_7^{2-}$ (1 mark)

……

(ii) Manganese in MnO_4^- (1 mark)

……

16. (a) What is a flame? (1 mark)

……

(b) Which type of flame is produced when the air hole of a Bunsen burner is closed? (1 mark)

……

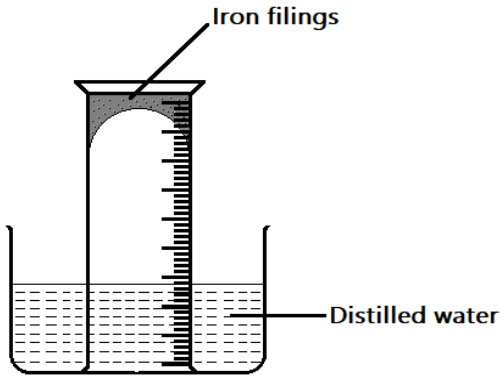
(c)State one observable differences between a luminous and a non-luminous flame. (1 mark)

……

17. In an experiment to electroplate a copper spoon with silver, a current of 0.5A was passed for 18 minutes. Calculate the amount of silver deposited on the spoon (1 Faraday = 96500 coulombs, Ag =108) (3 marks)

……

18. A measuring cylinder containing moist iron filings was inverted in a trough of distilled water as shown in the diagram below.



(a) State and explain the observations made on the:

(i) Moist iron filings after four days; (1 mark)

……

(ii) Water level in the measuring cylinder after four days. (1 mark)

……

(b) What would be the effect of using iron filings moistened with tap water? (1 mark)

……

19. Below are properties of some elements in period 3 of the periodic table

Element	Na	Mg	Al
Atomic radius (nm)	0.152	0.136	0.125
Melting points (^{O}C)	97.8	650	660

(a) Explain the trend in the melting points (2 marks)

……

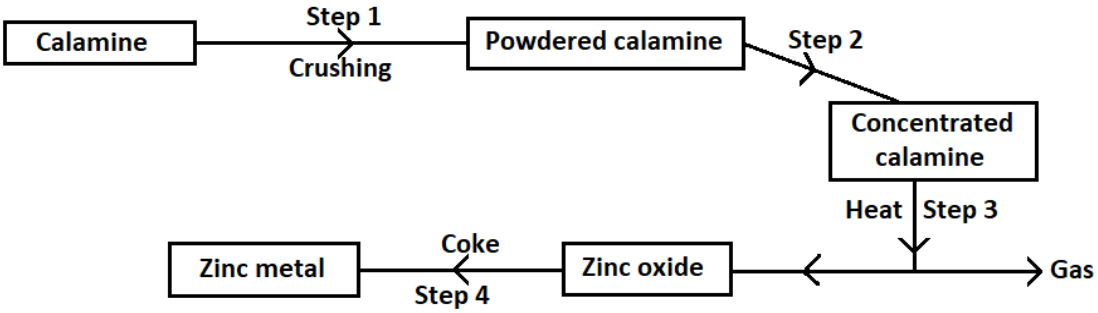
……

(b) Why is there a decrease in size of the atoms from Na to Al? (1 mark)

……

……

20. The flow chart below shows steps used in the extraction of zinc from one of its ores.



(a) Name the process that is used in **step 2** to concentrate the ore. (1 mark)

……

(b) Write an equation for the reaction which takes place in **step 3**. (1 mark)

……

(c) State one use of zinc other than galvanizing. (1 mark)

……

21. (a) What is the type of the heat change that occurs when one mole of a substance burns completely in oxygen? (1 mark)

……

(b) Methane reacts with oxygen according to the equation given below.

$CH_4\ (g) + 2O_2(g) \rightarrow CO_2\ (g) + 2H_2O\ (l)$ $\Delta H = 890\ kJ\ mol^{-1}$

Calculate the volume of methane which would produce 111.25 kJ when completely burnt. (Molar volume of a gas = 24 litres.) (2 marks)

……

……

……

……

22. (a) State the Graham's law diffusion. (1 mark)

……

(b) The molar masses of gases W and X are 16.0 and 44.0 respectively. If the rate of diffusion of W through a porous material is $12cm^3s^{-1}$ calculate the rate of diffusion of X through the same material. (2 marks)

……

……

……

……

23. Coal, oil and natural gas are major sources of energy. They are known as fossil. Hydrogen is also a source of energy.

(a) State two reasons why hydrogen is a very attractive fuel compared to fossil fuels (2 marks)

……
……
……

(b) State one disadvantage of using hydrogen fuel instead of fossil fuels. (1 mark)

……
……

24. (a) Other than salt, identify two substances that are formed when an acid reacts with a carbonate. (1 mark)

……
……

(b) When hydrogen chloride gas is dissolved in water, the solution formed turns blue litmus paper red but there is no effect on blue litmus paper, when the gas is dissolved in methylbenzene. (2 marks)

……
……
……

25. When burning magnesium ribbon is introduced into a gas jar full of nitrogen, it continues to burn producing a greenish yellow powder.

(a) Write an equation for the reaction between nitrogen and magnesium. (1 mark)

……

(b) Explain why magnesium continues to bum in nitrogen but sulphur does not. (2 marks)

……
……
……

(c) State one use of nitrogen. (1 mark)

……

26. Describe how the presence of calcium ions in a water sample can be tested in the laboratory. (3 marks)

……
……
……
……

27. (a) Name the particles that are responsible for electrical conductivity in:

(i) Solids (½ mark)

……

(ii) Both melts and aqueous solution (½ mark)

……

(b) Give two properties of graphite that make it suitable for use as an electrode. (2 marks)

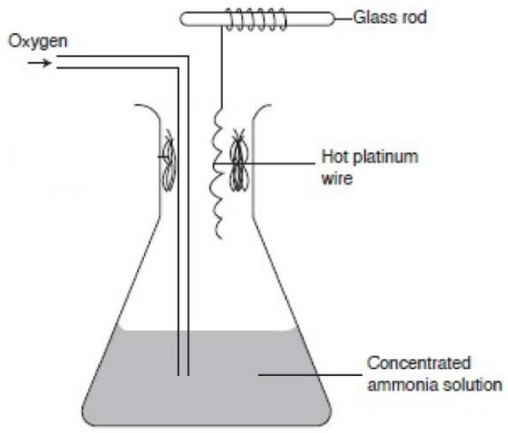
……
……

(c) State one precaution that is necessary when carrying out electrolysis of molten lead (II) bromide (1 mark)

……

SERIES 16

1. The set-up below shows the catalytic oxidation of ammonia in the laboratory.



(a) State and explain the observation made. (**2marks)**

……
……
……
……

(b) Write a chemical equation for the first reaction taking place in the conical flask. **(1 mark)**

……
……

2. When sulphur is heated in a boiling tube in the absence of air, the yellow crystals melts into a golden yellow mobile liquid at 113°C. The liquid changes at 180°C into a dark brown liquid that is very viscous. Heating at 400°C produces a brown less viscous liquid.)

   (a) Draw the molecular structure of sulphur in the yellow liquid. **(1 mark)**

(b) Name two allotropes of sulphur. **(2 marks)**

……

……

3. Iron (III) oxide was found to be contaminated with copper (II) sulphate. Describe how a pure sample of iron (III) oxide can be obtained. **(3 marks)**

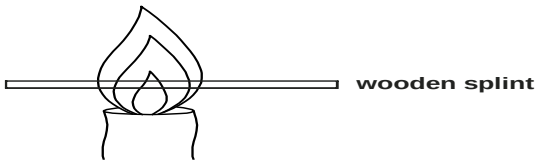
……

……

……

……

4. Study the diagram below then use it to answer the questions that follow.



a) Draw the wooden splint at the end of the experiment. If it was slipped, then removed quickly.

(1 mark)

b) Explain the appearance of the wooden splint in (a) above. **(2 marks)**

……

……

……

5. Identify the acid in the following reaction. Give a reason. **(2 marks)**

$NH_4^+ (aq) + OH^- (aq) \rightarrow NH_3 (aq) + H_2O (l)$

……

6. State **two** methods that can be used to remove water hardness. **(1 mark)**

……
……

7. (a) Define the term solubility. **(1 mark)**

……
……

(b) In an experiment to determine the solubility of solid Q in water at 50^{o}C, the following data was obtained.

Mass of empty evaporating dish = 46.5 g

Mass of evaporating dish + saturated solution = 62.5 g

Mass of evaporating dish + dry solid Q = 50.4 g

Use the data to calculate the solubility of solid Q. **(2 marks)**

……
……
……
……

8. What is meant by lattice energy? **(1 mark)**

……
……

(b) Use the information below to calculate the heat of solution of calcium chloride.

(2 marks)

Lattice energy of $CaCl_2$	-2195 kJ/mol
Hydration energy of Ca^{2+} (g)	-189 kJ/mol
Hydration energy of Cl^- (g)	-384 kJ/mol

……
……

……
……

9. (a) State Boyle's law. **(1 mark)**

……
……

(b) A gas occupies 500 cm^3 at 37^oC and 100,000 Pa. What will be its volume at 10^oC and 101,325Pa? **(2 marks)**

……
……
……
……

10. Describe how a solid sample of copper (II) carbonate can be prepared starting with copper metal. **(3 marks)**

……
……
……
……
……
……

11. (a) Give the name of the 3rd member of the alkene homologous series. **(1 mark)**

……
……

(b) Draw and name all isomers of butane. **(2 marks)**

12. Draw a diagram to illustrate the electrolysis of molten aluminium oxide. **(3 marks)**

13. (a) A molecule of a compound has a mass of 7.34×10^{-23} g. Calculate its RMM.
L = 6.023×10^{23} **(2 marks).**

……
……
……
……

(b) State Avogadro's law. **(1 mark)**

……
……

14. The diagram below represents a set of apparatus used to study the properties of chlorine water.

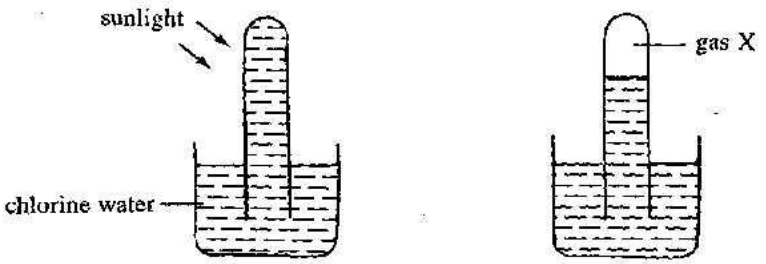


Diagram A Diagram B

(a) Name gas X. **(1 mark)**

……..

(b) Write an equation for the reaction that produces gas X. **(1 mark)**

……

……

(c) Give **one** use of chlorine. **(1 mark)**

……

……

15. (a) What is the meaning of polymerization? **(1 mark)**

……

……

(b) **Draw** and **name** the structure of polymer formed from propene. **(2 marks)**

16. A sample of 0.63g of lead powder were dissolved in excess nitric (V) acid to form lead (II) nitrate solution. All the lead (II) nitrate was then reacted with sodium sulphate solution.

(a) Write an ionic equation for the reaction between sodium sulphate solution and lead (II) nitrate solution**.** **(1 mark)**

(b) Determine the mass of the lead salt formed in the reaction in (a) above. **(2 marks)**

(Pb = 207, S = 32, O = 16)

17. For each of the following experiments, give the observations and the type of change that occurs (*temporary physical or temporary chemical*) **(3 marks)**

Experiment	Observation	Type of change
A few drops of water are added to small amount of anhydrous copper (ii) sulphate		
A few crystals of iodine are heated gently in a test tube		

18. What is the role of the following parts during the fractional distillation of a mixture of water and ethanol?

(i) Fractionating column **(1 mark)**

……

……

(ii) Glass beads in the fractionating column **(1 mark)**

……

……

(iii) State any one application of fractional distillation process. **(1 mark)**

……

19. (a) Carbon (IV) oxide does not support combustion but burning magnesium continues to burn in carbon (IV) oxide. Explain. **(2 marks)**

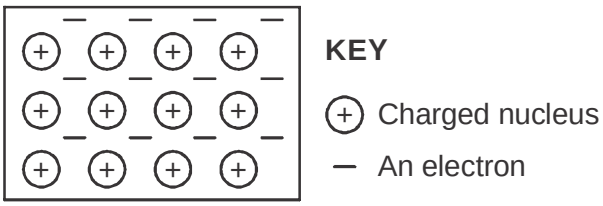
……

……

(b) Write an equation for the reaction in (a) above. **(1 mark)**

……

20. The diagram below is a section of a model of the structure of element T.



a) State the type of bonding that exists in T. **(1 mark)**

……

b) In which group of the periodic table does element T belong? Give a reason. **(2 marks)**

……

……

21. Below are pH values of some solutions.

Solution	Z	Y	X	W
pH	6.5	13.5	2.2	7.2

i) Which solution is likely to be

I. acidic rain……...... **(1 mark)**

II. Potassium hydroxide …… (**1 mark)**

ii) Substance V reacted with both solutions Y and X. What is the nature of V. (**1 mark)**

……

22. Draw a set up that can be used to prepare dry hydrogen gas in the laboratory. **(3 marks)**

23. The grid below represents a part of the periodic table. Study it and answer the questions that follow. Letters are not actual symbols of elements.

F	I				M		O	
G	J		K	L		N	P	
H								Q

(a) How does the atomic radius of K compare to that of L? Explain. **(2 marks)**

……

……

……

……

(b) Element R forms an oxide of the formula RO_2 and belongs to period 2. Indicate in the grid the position of R. **(1 mark)**

(c) Write down the formula of the compound formed between K and P. **(1 mark)**

……

24. When $Na_2CO_3.\mathbf{X}H_2O$ is heated strongly it loses 63.20% of its mass. Calculate the value of **X**. (Na=23.0, C=12.0,O=16.0,H=1.0) **(3marks)**

25. (a) Give the meaning of the term prescription. **(1 mark)**

……

……

(b) A patient was given tablets with prescription 2 x 3 on the envelope. Clearly outline how the patient should take the tablets.

(1 mark)

……

……

(c) State two long-term effects of drug abuse. **(1 mark)**

……

……

26. Describe a chemical test that can be used to distinguish between aqueous solutions of sodium carbonate and sodium hydrogen carbonate. **(3 marks)**

……

……

……

……

……

……

27. To which homologous series do the following general formulae conform to? **(3marks)**

C_nH_{2n}…… .

C_nH2_{n-2}……

C_nH_{2n+2} ……

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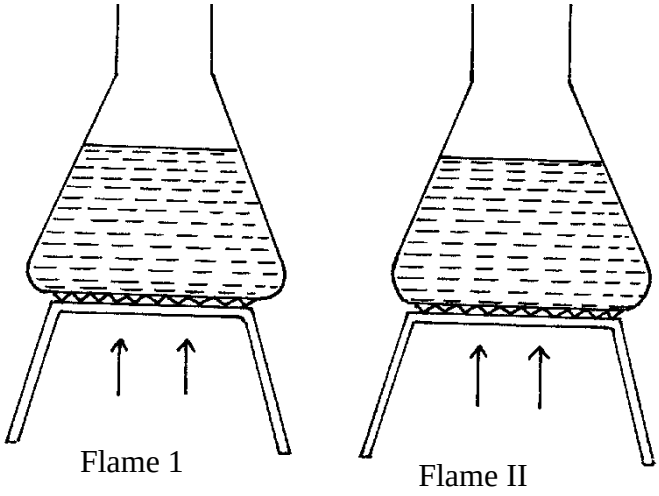
SERIES 17

1. The samples of equal volumes of water were put in 100cm^3 conical flasks and heated for 5 minutes on a Bunsen flame. It was observed that sample 1 registered a low temperature than sample II



(a) Name flame I (1mk)

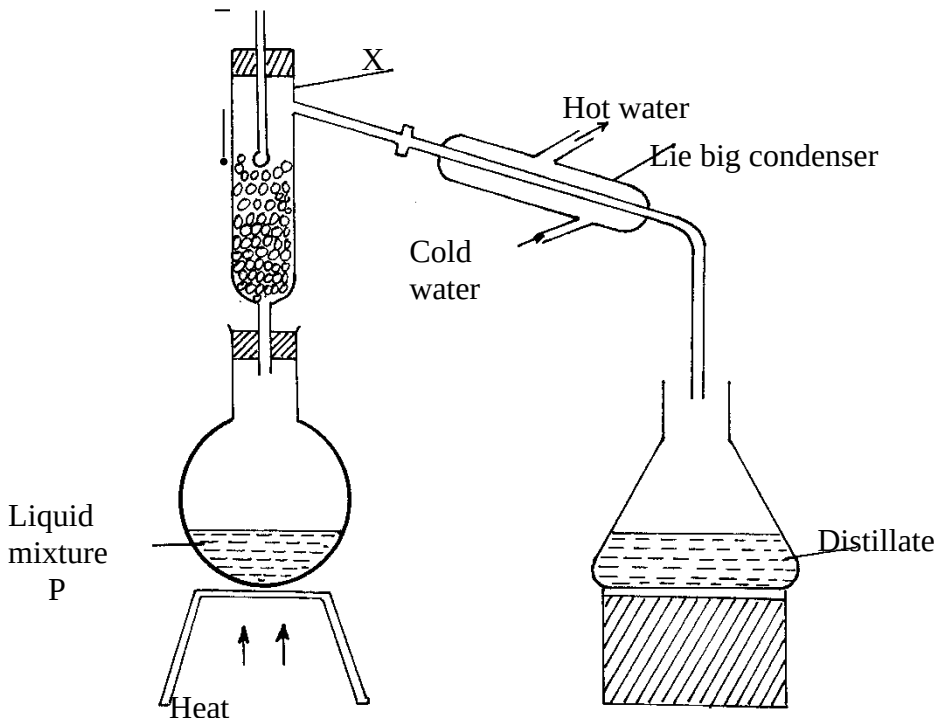
……..

(b) State one disadvantage of using flame I for heating (1mk)

……..

2. Study the diagram below and answer the questions that follow.

The diagram shows the method used to separate component of mixture P



(a) Name X . (½mk)

……

(b) What is the name given to the method used in separation of mixture P (½mk)

……

(c) What would happen if the inlet and outlet of water were interchanged (1mk)

……

……

(d) Which physical property is used to separate mixture P (1mk)

……..

3. The table below shows the solubility of three solids P, Q, and R.

SOLID	COLD WATER	HOT WATER
P	Soluble	soluble
Q	insoluble	insoluble
R	insoluble	soluble

How would you obtain pure samples of R,P and Q (2mks)

……

……

……

……

……

4. State one physical property that would suggest the presence of each of the following gases from a leaking gas cylinder:

a) H_2S (1mk)

……

b) N_2O (1mk)

……

c) Cl_2 (1mk)

……

5. The P^{H} values of some solutions are given below

P^{H}	14.0	1.0	8.0	6.5	7.0
Solution	M	L	N	P	Z

(a) Identify the solution with the lowest concentration of hydrogen ion. Give reason for your answer (1mk)

……

……

(b) Which solution would be used as an anti-acid for treating stomach upset. Give reason for your answer (1mk)

……

……

6. The data below gives the electronic configuration of some selected atoms and ions

Atom/ion	A^{2+}	B	C^{2-}	D^{2+}	E	F^{-}	G^{+}	H
Electronic configuration	2	2.4	2.8	2.8.8	2.8	2.8.8	0	2.8.2

(a) Select an atom that is a noble gas (1mk)

……..

(b) What is the atomic number of C and A (1mk)

……

……

(c) Select an element that belong to group 2 and period four (1mk)

…….

……..

7. Helium is used instead of hydrogen in balloons for metrological research. Explain (1mk)

……

……

8. Zinc metal and hydrochloric acid reacts according to the following equation

$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2\,(aq)} + H_{2\,(g)}$

1.96g of Zinc metal were reacted with 100cm^3 of 0.2M hydrochloric acid

a) Determine the reagent that was in excess (2mks)

Zn=65.2; Molar gas volume at s.t.p 22.4 liters

……

……

……

……

(b) Calculate the total volume of hydrogen gas that was liberated at s.t.p (1mk)

……

……

……

9. Give the IUPAC names of the following compounds (1mk)

(i) .$CH_3CH_2CH_2CH\ CH_3$

CH_3 ……

(ii) $CH_3CH{=}CHCl$ …… (1mk)

10. 0.9g of potassium chloride and potassium carbonate mixture completely reacted with 25cm^3 of 0.2M hydrochloric acid

(i) Write an equation of the reaction which takes place (1mk)

……

(ii) Determine the number of moles of the acid used (1mk)

……

……

(iii) Calculate the mass of potassium chloride in the mixture (K=39.0; C=12.0; O=16.0) (1mk)

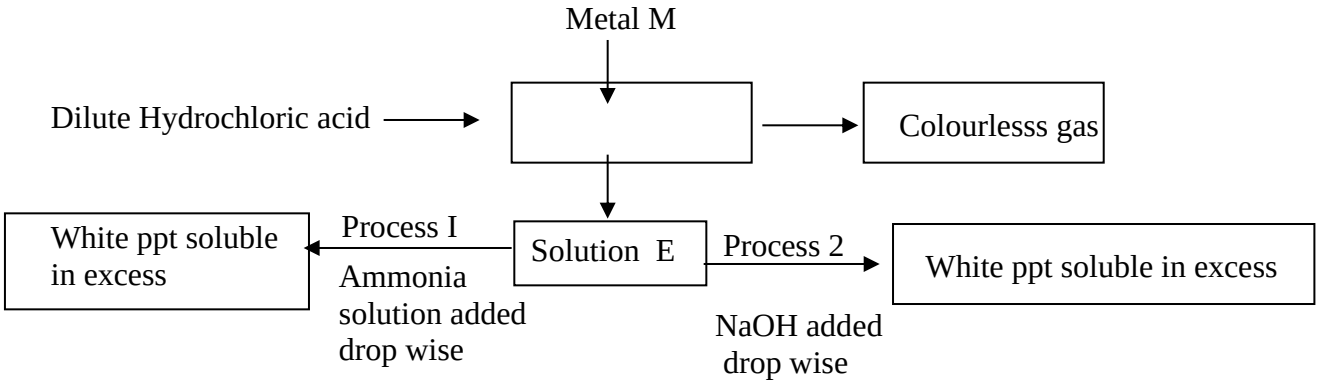
……

……

……

……

11. Study the flow chart below and answer the questions that follow



(i) Identify metal M: ……. (1mk)

(ii) Colourless gas: ……. (1mk)

(iii) Write an equation that leads to the formation of white precipitate in process (1mk)

……

……..

12. a) Define the term dynamic equilibrium (1mk)

……

……

……..

b) A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2-}_{[aq]} + H_2O_{\{l\}}$

Yellow orange

State and explain the observation made when NaOH is added to the equilibrium mixture (2mks)

……

……

……

……

13. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

a) State one observation made (1mk)

……

b) Write an ionic equation of the reaction that occurred in the test tube (1mk)

……

14. A compound of carbon, hydrogen and oxygen contains 57.15% carbon, 4.76% hydrogen and the rest oxygen. If its relative molecular mass is 126, find its molecular formula. (C = 12, H = 1, O = 16) (3mks)

……

……

……

……

a) State Grahams law of diffusion. (1mark)

……

……

……

b) The rate of diffusion of sulphur(IV)oxide gas through a porous material is 40cm3s $^{-1}$. Calculate the rate of diffusion of carbon(IV)oxide gas through the same porous material *(S=32,O=16,C=12)* (2 marks)

……

……

……

……

……

15. a) Distinguish between strong and concentrated acid (1mk)

……

……

……

……

b). A solution of ammonia in methylbenzene has no effects on red litmus paper while a solution of ammonia in water turns red litmus paper blue. Explain (2mks)

……

……

……

……

16. Name the process which takes place when

i. Iodine changes directly from solid to gas (1mk)

……..

ii. $Fe^{2+}_{(aq)}$ changes to $Fe^{3+}_{(aq)}$ (1mk)

……

iii. White sugar changes to black when mixed with concentrated sulphuric (VI) acid (1mk)

……

17. In the last stage of the solvay process, a mixture of sodium hydrogen carbonate and ammonium chloride is formed

a) State the method of separation used (1mk)

……..

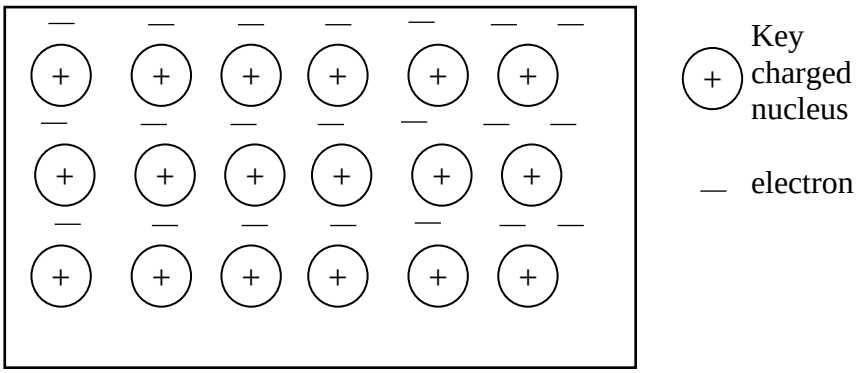
b) Write an equation showing how lime is slaked (1mk)

……..

c) Name the product recycled in the above process (1mk)

……..

18. The diagram below is a section of a model of the structure of element K



a) State the type of bonding that exist in K (1mk)

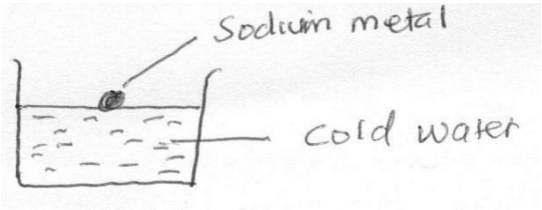
……

b) In which group of the periodic table does element K belong. Give a reason (2mks)

……

……

19. Study the diagram below and answer the questions that follow



a) State two observations made in the above experiment when sodium react with water (2 mks)

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

……

……

20. (a) Explain why permanent hardness in water cannot be removed by boiling (2mks)

……

……

……

(b) Name two methods that can be used to remove permanent hardness from water (1mk)

……

……

22. Write an equation to show the effect of heat on the nitrate of: - (2mks)

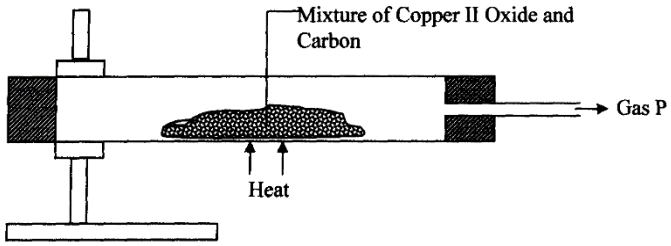
i) Potassium

……..

(ii) Silver

……

23. Study the diagram below and use it to answer the questions that follow.



(a) State the observation made in the combustion tube. (1mk)

……

……

(b) Write an equation for the reaction that took place in the combustion tube. (1mk)

……

(c) Name gas **P** (1mk)

……

24. Sulphur exists in two crystalline forms.

a) Name **one** crystalline form of Sulphur. (1mk)

……..……

b) State **two** uses of Sulphur. (2mks)

……..…

……..……

25. Bond energies for some bonds are tabulated below: -

BOND	**BOND ENERGY KJ/mol**
H – H	436
C = C	610
C- H	410
C – C	345

Use the bond energies to estimate the enthalpy for the reaction. (3mks)

$$C_2H_{4(g)} + H_{2(g)} \longrightarrow C_2H_{6(g)}$$

……

……

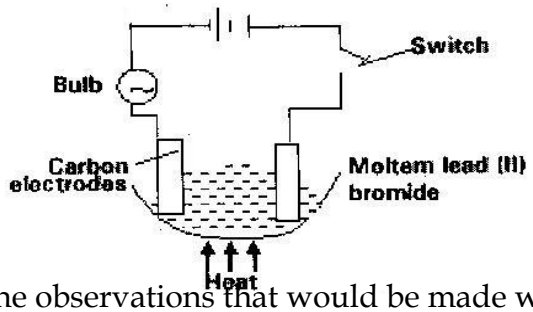
……

……

……

……

26. Study the set up below and answer the questions that flows



State all the observations that would be made when the circuit is completed (3mks)

……..……..……..……..

……

……

……..

27. Describe how solid samples of salts can be obtained from a mixture of lead (II) chloride, sodium chloride and ammonium chloride. (3mks)

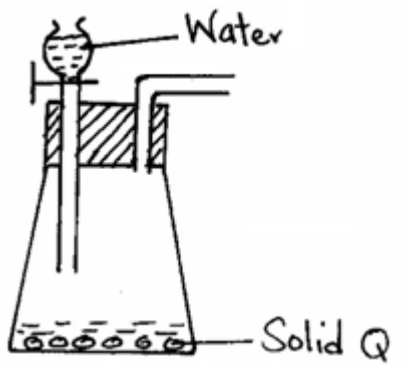
……

……

……

……

28. The diagram below represents a set-up used to prepare oxygen gas.



(a) Name substance Q. (1mk)

…….

(b) Complete the set-up to show how oxygen gas is collected. (1mk

(c) Write the equation for the reaction that occur. (1mk)

……

29. Two reagents that can be used to prepare chlorine gas are potassium manganate (VII) and hydrochloric acid.

(a) Write an equation for the reaction. (1mk)

……..

c) Give the formula of another reagent that can be used instead of potassium manganate (VII). (1mk)

……..

(c) Using an equation illustrate how chlorine bleach coloured substances. (2mks)

……

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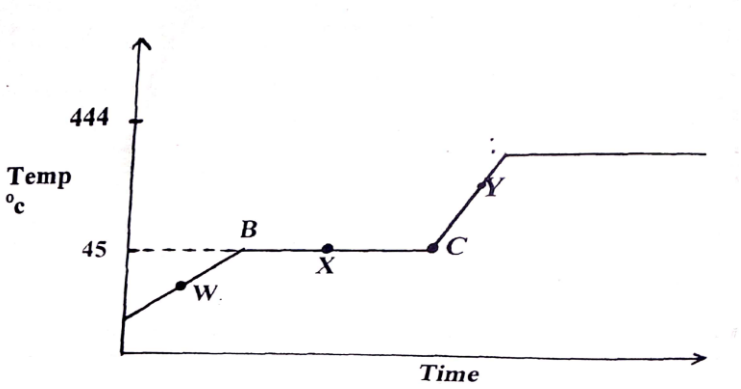
SERIES 18

1. The diagram below shows the heating curve of a pure substance. Study it and answer the questions that follow.



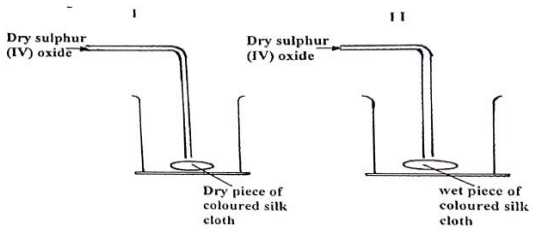
a) What are the physical states of the substances at point W and Y. (2mks)

b) Explain why the temperature remains constant between point B and C. (2mks)

2. Consider the reaction below.
$Cr_2O_7(aq) \rightleftharpoons CrO^{2-}_4(aq) + 2H^+(aq)$

Using oxidation numbers explain whether the above reaction is a redox reaction or not.
(3mks)

3. Dry sulphur (IV) oxide was passed through two pieces of coloured silk both in a gas jar as shown in the diagram.



a) State the observation in the gas jars. (2mks)

b) Write equations to explain your observations in flask II. (2mks)

4. The equations show some reactions. Use the equations to answer the following questions.

$CH_3CH_2OH \xrightarrow{\text{Step I}} CH_2=CH_2 \xrightarrow{\text{Step II}} CH_3CH_3$

a) Name the type of reaction in step I and II. (2mks)

b) Explain why ethane burns with a more smoky flame than ethane. (2mks)

5. The third number of the alkenes is converted to its corresponding saturated hydrocarbon by hydrogenation. Using the bond energy values given below, answer the questions that follow.

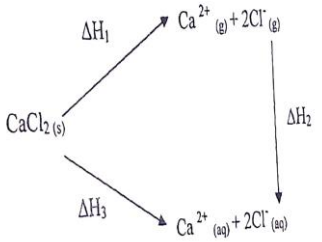
Bond	**Bond energy kJ/mol**
H-H	432
C=C	610
C-C	346
C-H	413

Determine the enthalphy change for the conversion of the third member of the alkenes to its corresponding saturated hydrocarbon by hydrogenation. (3mks)

6. a) Graphite is a non metal most commonly used as an electrode. State two properties that make it suitable for use as an electrode. (2mks)

b) Graphite is an allotrope of carbon. Distinguish between allotropes and isotopes. (2mks)

7. Use the information in the energy cycle below to answer the questions that follow.



i. What is the name given to the energy changes? (3mks)

ΔH_{1}-

ΔH_{2}-

ΔH_{3}-

ii. Given H_1= 2237KJ/Mol and ΔH_2= -2378KJ/Mol, calculate the value of ΔH_3. (1mk)

8. The 1st 2nd and 3rd ionization energies in KJ/Mol of element G and R are given below.

Element	**1st I.E**	**2nd I.E**	**3rd I.E**
G	520	7,300	9,500
R	420	3,100	4,800

i. Define the term 1st ionization energy. (1mk)

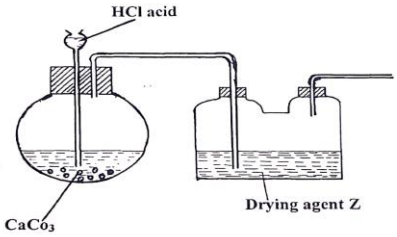
ii. Apart from the decrease in energy levels, explain the big difference between the 1st and 2nd ionization energies. (1mk)

iii. Calculate the amount of energy for the process. (1mk)

$R(g) \longrightarrow R(g) + 3e$

9. When solid Zinc carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no observable change. On addition of some water to the mixture to the mixture there was effervescence. Explain theses observation. (2mks)

10. a) The diagram below represents an incomplete set-up of apparatus that can be used to prepare dry carbon (iv) oxide gas. Complete the diagram and answer the questions that follow.

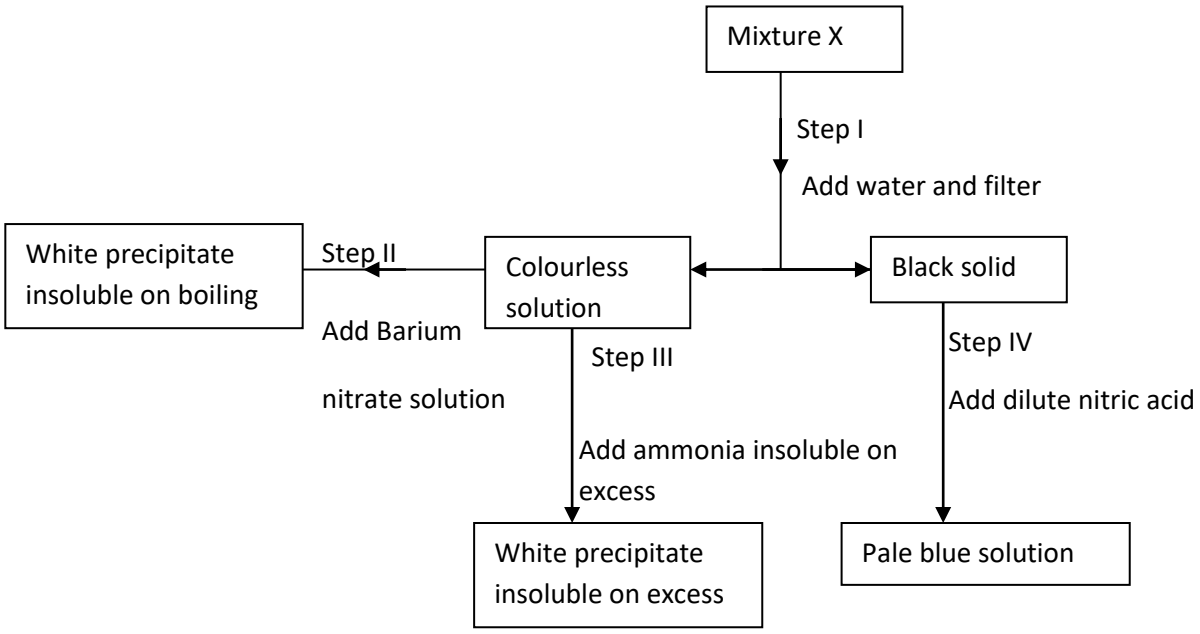


i. Write an equation for the reaction that takes place. (1mk)

ii. Name liquid Z. (1mk)

iii. State two advantages of using 'dry ice' over ordinary ice as a refrigerant. (2mks)

11. Study the chart below and answer the questions that follow.



a) Name:

i. Cations present in mixture X. (1mk)

ii. Anions present in the solution. (1mk)

b) Write an equation to show how the white precipitate in step III dissolves. (1mk)

c) Name the process outlined in step IV above. (1mk)

12. i) A student intending to prepare lead (II) sulphate reacted lead metal with dilute sulphuric acid. However, he was not successful. Explain why he was not successful.
(1mk)

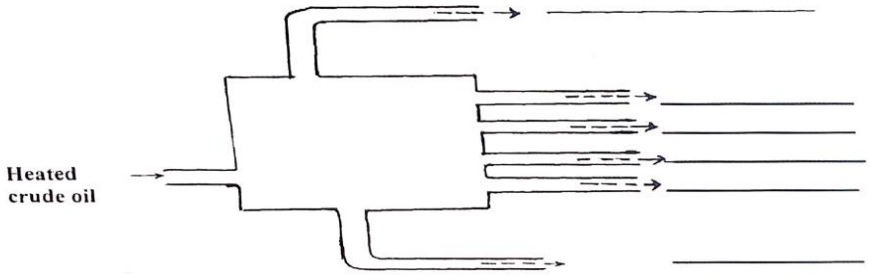
ii) Suggest a method the student could have used to prepare lead (II) sulphate. (2mks)

iii) Write an ionic equation that would take place in (ii) above. (1mk)

13. In an experiment, ammonium chloride was heated in a test-tube. A moist red litmus paper placed at the mouth of the test-tube first changed blue then red. Explain these observations.
(2mks)

14. An element X has two naturally occurring isotopes X-22 and X-20. If its relative atomic mass is 21.8, calculate the percentage abundance of the more stable isotope. (2mks)

15. Fractional distillation of crude oil used to produce the following fractions; petrol, diesel, petroleum gases, kerosene, naphtha and bitumen. Below is a simplified diagram of a fractionating column used during the refining of crude oil.
i. On the diagram, write the names of theses fractions in their correct positions.
(3mks)



ii. Which fraction is used as a jet fuel? (1mk)

iii. What process is used to convert higher fractions to lower fractions? (1mk)

16. Carbon (iv) oxide and silicon (iv) oxide are both covalent oxides but carbon is a gas whereas silicon (iv) oxide is a solid with high melting point. Explain. (2mks)

17. The ability of hard water to conduct electricity falls when water is boiled but is not much affected when the water hardness is removed by addition of washing soda (sodium carbonate). Explain. (2mks)

18. When sulphur is heated in a boiling tube in absence of air, the yellow crystals melts into golden yellow mobile liquid at 113^{o}C. The liquid changes at 180^{o}C into a dark brown very viscous liquid. More heating to about 400^{o}C, produces a brown less viscous liquid.

a) Draw the molecular structure of sulphur in the yellow crystals. (1mk)

b) Explain why the molten liquid becomes viscous. (1mk)

c) If the brown liquid at 400^{o}C is cooled rapidly by pouring it into cold water, which form of sulphur is produced? (1mk)

d) State the observation made when sulphur is heated in a deflagrating spoon. (1mk)

19. The table below gives some information about certain chemical substances. The letters used are not the actual chemical symbols or formulae.

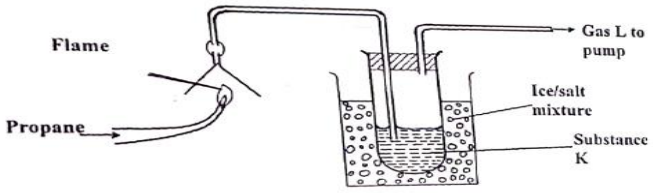
Substance	**Melting point (^{o}C)**	**Boiling point (^{o}C)**	**Electrical conductivity**		
			Of solid	**Of liquid**	**In water**
A	1540	3000	Good	good	Insoluble

B	-114	-85	Poor	poor	good
C	712	1418	Poor	good	good
D	-39	357	Good	good	insoluble
E	2045	3000	Poor	good	insoluble
f	1700	2776	Poor	good	insoluble

a) From the table, select;
   i. Two substances that cannot be elements. (1mk)
   ii. A substance that is likely to have giant atomic structure. (1mk)

   iii. A substance that is likely to consist of molecules and which produce ions when added to water. (1mk)

20. Study the diagram below and answer the questions that follow.



i. Write the equation for the combustion of propane. (1mk)

ii. The pH of substance K was found to be less than 7. Explain this observation. (1mk)

21. Explain how you would separate a mixture of nitrogen and oxygen gases given that their boiling points are -196^{o}C and -183^{o}C respectively. (2mks)

22. Dry carbon (iv) oxide gas reacts with heated lead (ii) oxide as shown in the equation below.

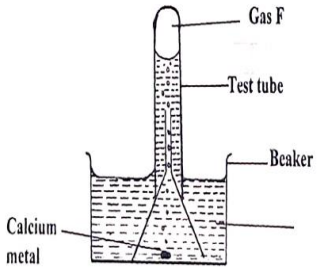
$PbO(s) + CO(g) \longrightarrow Pb(s) + CO_2(g)$

a) Name the process undergone by the lead (ii) oxide. (1mk)

b) Give a reason for your answer in (a) above. (1mk)

c) Name another gas that can be used to perform the same function as carbon(IV) oxide gas in the above reaction. (1mk)

23. The set-up below was used to collect gas F, provided by the reaction between water and calcium metal.



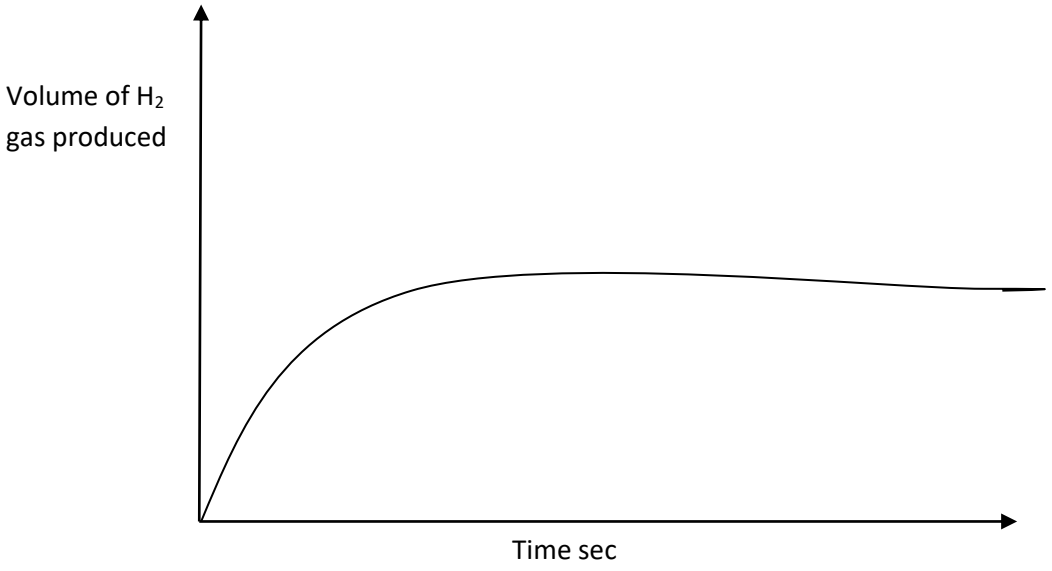
a) Name gas F. (1mk)

b) At the end of the experiment the solution was found to be a weak base. Explain why the solution is a weak base. (2mks)

c) Give one laboratory use of the solution formed in the beaker. (1mk)

24. In terms of structure and bonding, explain why graphite is used as a lubricant. (2mks)

25. The reaction between a piece of magnesium ribbon with excess 2M hydrochloric acid was investigated at 25^{o}C by measuring the volume of hydrogen gas produced as the reaction progressed. The sketch below represents the graph that was obtained.



a) Name one piece of apparatus that may be used to measure the volume of hydrogen gas produced. (1mk)

b) On the same diagram the curve that would be obtained if the experiment was repeated at 35^{o}C. (1mk)

26. Methane reacts with oxygen according to the equation given below;
$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g)\ 2H_2O(g)\ \ \triangle H = -890KJMol^{-1}$
Calculate the volume of methane whoch would produce 11.25KJ when completely burnt at r.t.p (molar volume of a gas at r.t.p = 24litre) (2mks)

SERIES 19

1. The table below gives some properties of gases M and N

GASES	Density	Effect of $HCl_{(aq)}$	Effect of $KOH_{(aq)}$
M	Lighter than air	Reacts to form a salt	dissolves without reacting
N	Heavier than air	Not affected	Not affected

(a) Describe how one would obtain a sample of gas N from a mixture of gases **M** and **N** (2mks)

……

……

……

……

(b) Name two neutral oxides (1mk)

……

2. Iron roofing sheets are coated with zinc as sacrificial metal;

(i) What is meant by the term 'sacrificial'? (1mk)

……

……

(ii) Give the name given to the process by which iron sheets are coated with zinc. (1mk)

……

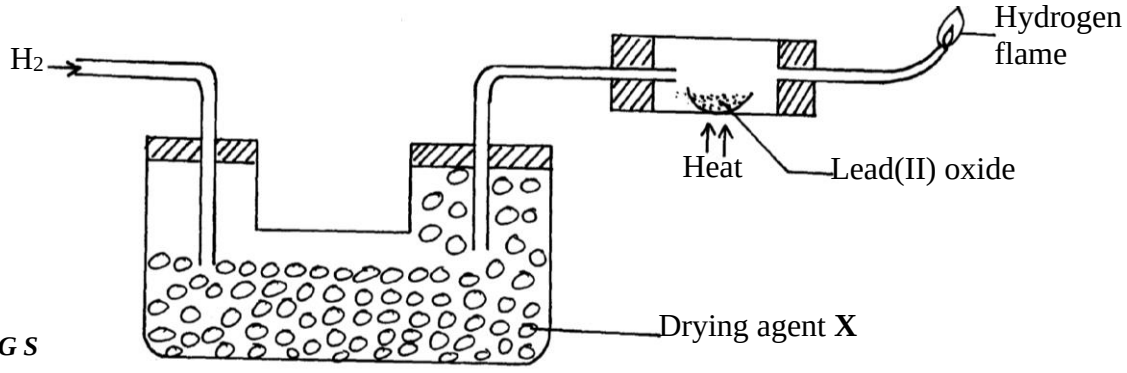
(iii) Zinc is higher than iron in reactivity series yet it does not corrode as fast as iron.

Explain (1mk)

……

……

3. The set-up below was used to investigate the properties of hydrogen gas.



(i) Write an equation for the reaction that takes place in the combustion tube. (1mk)

……

……

(ii) Suggest a possible drying agent **X**. (1 mk)

……

……

(iii) Which property of Hydrogen is under investigation in the set up above? (1mk)

……

……

4. The table below shows pH values of solutions A to E

Solution	E	B	D	A	C
pH	3	14	7	6	9

Which solution;

(a) Contains the largest concentration of hydroxyl ions? (1mk)

……

……

(b) Contains the largest concentration of hydrogen ions (1mk)

……

……

(c) Is likely not to react with solution **A**? (1mk)

……

……

5. Potassium is isotopic and has a relative atomic mass (R.A.M) of 39.5, work out the percentage abundance of each isotope. The three isotopes are, ^{39}K, ^{40}K and ^{38}K (0.01%) (3mks)

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6. An ion of element Q can be represented as $^{32}_{16}Q^{2-}$

(a) Draw the structure of the ion (2mks)

(b) How does the ionic radius of Q compare with its atomic radius? Explain. (1mk)

……

……

7. The electronic configuration for elements represented by letters A, B, C and D are

A 2.8.6

B 2.8.2

C 2.8.1

D 2.8.8

(a) Select the element which forms;

(i) A double charged cation (1mk)

……

(ii) A soluble carbonate (1mk)

……

(b) Which element has the shortest atomic radius (1mk)

……

8. When concentrated sodium chloride was electrolysed for a long time. Two gases were Obtained at the anode;

(i) Name the **two** gases (1mk)

……

……

(ii) Explain why the gases were obtained. (2mks)

……

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……

……

9. Using dots (•) and crosses (X) to represent electrons, draw diagrams to show bonding in;

(a) C_2H_4 (C=12 H=1) (1mk)

(b) Hydroxonium ion H_3O^+ (H=1 O=8) (1 mk)

10. A student reacted Silver Nitrate and Barium Chloride solutions to prepare two salts.

(i) Write an ionic equation for the reaction that took place. (1mk)

……

……

(ii) Describe how a sample of Lead (II) Chloride and Silver Chloride can be differentiated in the laboratory (2 mks)

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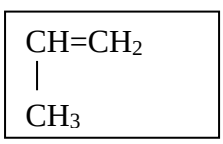
11. A monomer has the following structure. (1mk)



a) Draw the structure of its polymer that contains four monomers. (1 mk)

(b) A sample of the polymer formed from the monomer has a molecular mass of 4116. Determine the number of monomers that formed the polymer (C = 12, H = 1) (2mks)

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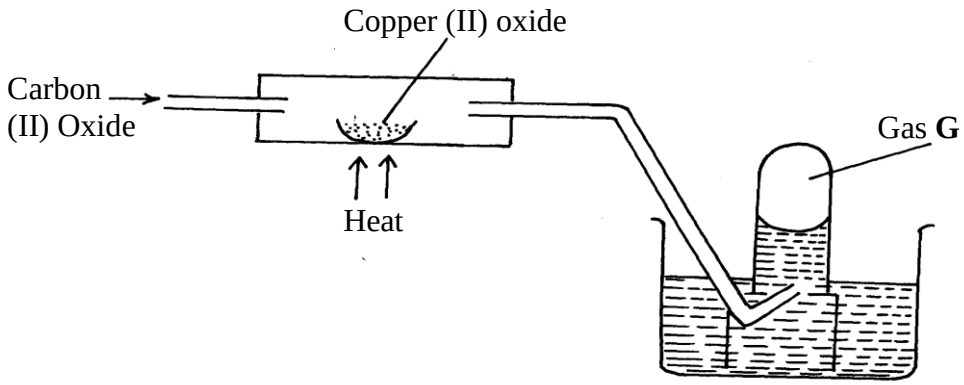
12. Use the diagram below to answer the questions below:



(i) Identify gas **G** (1mk)

……

(ii) Write an equation for the reaction taking place in the combustion tube. (1mk)

……

……

(iii) Carbon (IV) oxide is said to be a "silent killer". Explain why? (1mk)

……

……

13. $400cm^3$ of Nitrogen gas diffuses through a porous plug in 70seconds. How long would it $200cm^3$ of Carbon (IV) oxide to diffuse through the same porous pot? (C=12, O=16, N=14) (3mks)

……

……

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……

……

14. $20.0cm^3$ of NaOH solution containing $8.0gdm^{-3}$ were required for complete neutralization of 0.118g of a dibasic acid. Calculate the Relative Molecular Mass (R.M.M) of the acid.
(Na=23, O=16, H=1) (3mks)

……

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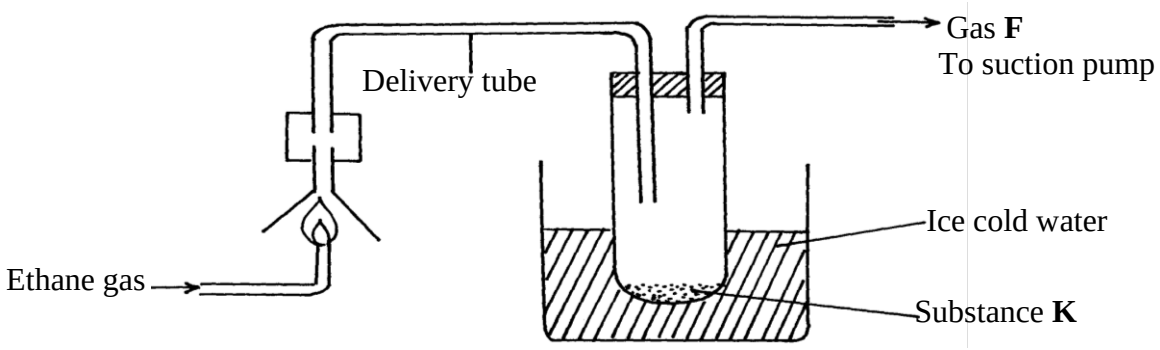
15. The diagram below shows the combustion of ethane gas. Study it and answer the questions that follow:



(a) Identify substance **K** (1mk)

……

(b) Write an equation for the complete combustion of ethane gas. (1mk)

……

(c) The pH of substance **K** is found to be less than 7. Explain this observation (1mk)

……

……

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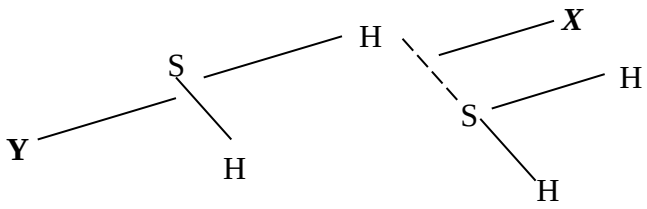
16. The structure of hydrogen sulphide can be represented as shown below:



(a) Name the bond type represented by letters **X** and **Y** (2mks)

X…….

Y…….

(b) Give a chemical test for hydrogen sulphide gas (1mk)

……

……

17. In the Haber process, the industrial manufacture of ammonia is given by the following equation;

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \Delta H = -97KJmol^{-1}$$

(i) What is source of the Hydrogen that is used in the process (1 mk)

……

(ii) Name the catalyst used in the above reaction (1mk)

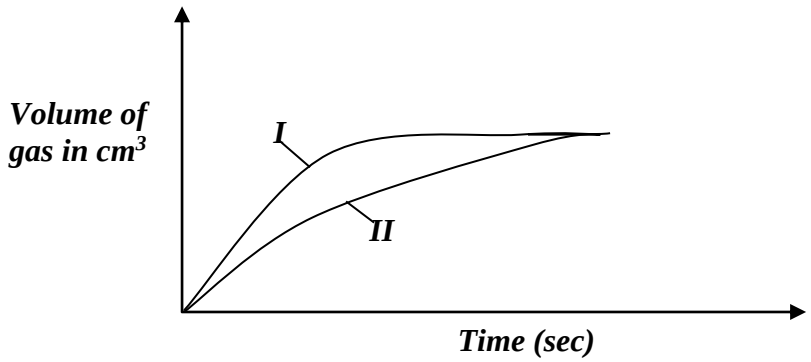
……

(iii) What is the effect of increasing temperature on yield of ammonia? Explain (1mk)

……

……

18. The curves below were obtained when equal volumes of 1.5M HCl were reacted with 2.0g of marble chips ($CaCO_3$). In one of the reactions, the acid was warmed before adding the marble chips.



(a) Write the equation for the reaction (1mk)

……

……

(b) Identify the curve representing the reaction where the acid was warmed. (1mk)

……

(c) The volume of the gas produced in the two experiments is the same. Explain. (1mk)

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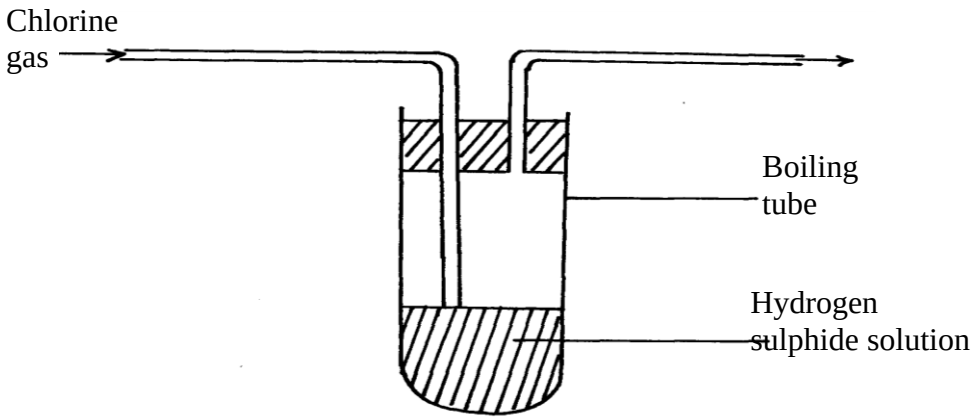
19. Chlorine gas was bubbled into a solution of hydrogen sulphide as shown below:



(i) Explain the observation made in boiling tube. (2mks)

……

……

……

……

(ii) What precautions should be taken in the experiment (1mk)

……

……

20. Given the bond energies:

H-Cl	431kJ/mol
H-H	435kJ/mol
Cl-Cl	243kJ/mol

Calculate the molar enthalpy change for the formation of hydrogen chloride as per the equation below

$H_{2\,(g)} + Cl_{2\,(g)} \longrightarrow 2HCl_{\,(g)}$ (3 mks)

……

……

……

……

21. Study the physical properties of Magnesium and Beryllium. Use it to answer the questions that follow:

Element	**Be**	**Mg**
Mp ^{o}C	1280	650
Bp ^{o}C	2450	1110
Atomic number	4	12
Atomic radius (nm)	0.086	0136

(a) Explain why Beryllium has a higher m.p than Magnesium (2mks)

……

……

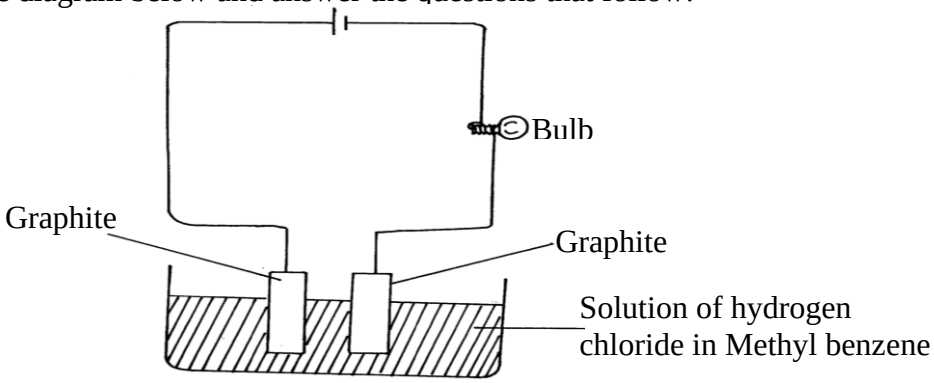
……

(b) Write the electron arrangement of Magnesium in the following compound; $Mg_3(PO_4)_2$ (1mk)

……

……

22. Study the diagram below and answer the questions that follow:



(i)What observation was made during the experiment? Explain? (1½mks)

……

……

……

(ii) What observation would be made if the solution of hydrogen in methylbenzene was replaced with solution of hydrogen chloride in water? Explain (1½mks)

……

……

……

23. Describe how you would prepare Copper (II) Chloride, staring with copper metal. (3mks)

……

……

……

……

……

……

……

24. 0.28g of iron burns in air to form Iron (II) oxide. Calculate the mass of Iron (II) oxide formed (O=16, Fe=56) (2mks)

……

……

……

……

……

……

……

……

25. a) Define the term solubility (1 mk)

……

……

……

b) The following were the results obtained in an experiment to determine the solubility of potassium nitrate at room temperature.

Mass of evaporating dish = 20.66 g

Mass of evaporating dish+ saturated solution = 44.16 g

Mass of residue on the evaporating dish = 6.1 g

Calculate the solubility of potassium nitrate from the above result. (2 mks)

……

……

……

……

……

……

26. Given that the E^{θ} of Cu(s) /Cu^{2+}(aq) is +0.34V and that of Zn(s)/ Zn^{2+} (aq) is -0.76 V, draw a labeled diagram of zinc and copper electrochemical cell. (3 mks)

27. Aluminium is obtained from its ore, with formula $Al_2O_3.2H_2O$. The ore is first heated and refined to obtain pure aluminium oxide (Al_2O_3). The oxide is then electrolysed to get Aluminium and Oxygen gas using carbon electrodes

a) Write the equation that takes place at the anode (1mk)

……

……

b) What would be the importance of heating the ore before electrolysed (1 mk)

……

……

c) Explain why Aluminium is used for making cooking pans yet it is a reactive metal (1 mk)

……

……

……

28. State two advantages of hard water (1 mk)

……

……

……

……

SERIES 20

1. The electronic configurations for elements represented by letters **A**, **B**, **C** and **D** are

A 2.8.6 **B**. 2.8.2. **C**.2.8.1. **D**.2.8.8

(a) Select the element which forms:
i) A double charged cation (1 mark)

……

ii) A soluble carbonate (1 mark)

……

(b) Which element has the largest atomic radius (1 mark)

……

2. An element **R** has atomic number 3, relative atomic mass 6.94 and consist of two isotopes of mass numbers 6 and 7.

(i) What is the mass number of the more abundant isotope of **R**? Give a reason for your answer. (2 marks)

……

(ii) Complete the following table. (1 mark)

Element	**Number of neutrons**	**Number of electrons**
R		

3. $R\,COO^{-}\,Na^{+}$ and $RC_6H_5\,OSO_3^{-}Na^{+}$ represent two cleaning agents where R is a long hydrocarbon chain.

(a) Which of the cleansing agents is suitable for use with hard water? (1 mark)

……

……

(b) Write the formula of an ion than causes:

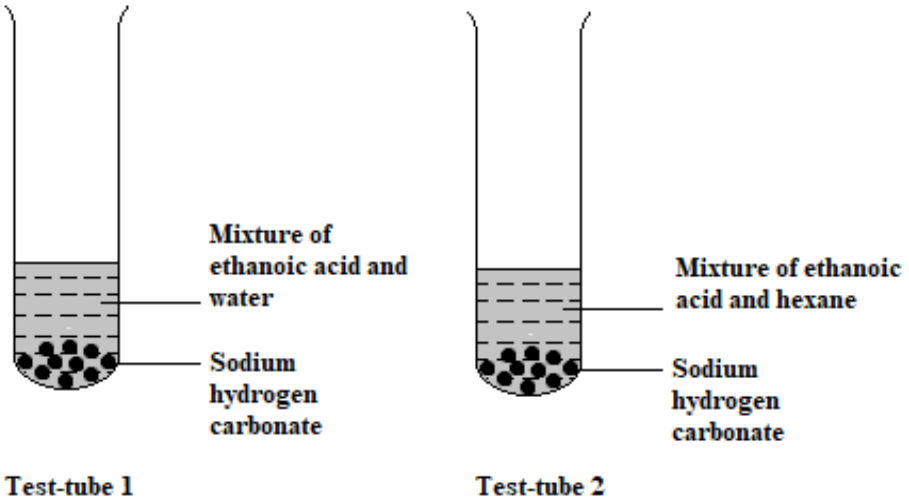
(i) Water hardness (1 mark)

……

(ii) Permanent water hardness (1 mark)

……

4. In an experiment, a student put equal volumes of mixtures of ethanoic acid in water and ethanoic acid in hexane in two test-tubes as shown below. In each test tube, equal amounts of solid sodium hydrogen carbonate were added.



a) State the observation which was made in each test-tube (1 mark)

Test tube 1

……

Test tube 2

……

b) Explain the observations in (a) above (2 marks)

……

……

……

5. Bromine reacts with ethane as shown below

$C_2H_6 + Br_2 \longrightarrow C_2H_5Br + HBr.$

(a) What condition is necessary for this reaction to occur? (1 mark)

……

(b) Identify the bonds which are broken and those that are formed. (2 marks)

……

……

……

6. Draw a well labelled diagram of the non-luminous flame (3 marks)

7. In an experiment $20cm^3$ of 0.1 M sulphuric (VI) acid were reacted with $20cm^3$ of 0.1 M sodium hydroxide.

(a) Write in equation of the reaction that took place. (1 mark)

……

(b) State the observations that were made when both red and blue litmus papers were dropped into the mixture. (1 mark)

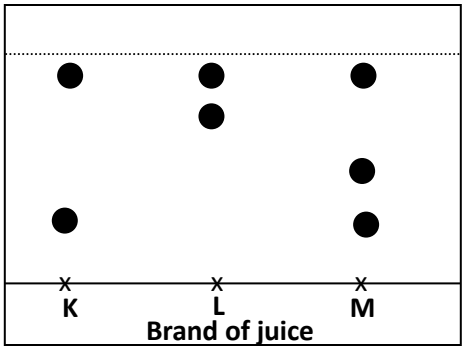
……

……

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

……

8. The diagram below represents a paper chromatogram for three brands of juices suspected to contain banned food colourings.



The results showed the presence of banned food colourings in **L** and **M** only. On the same diagram:

a) Circle the spots which show the banned food colourings (2 marks)

b) Show solvent front. (1 mark)

9. A Compound whose general formula is $M(OH)_3$ reacts as shown by the equation.

$$M(OH)_{3\,(q)} + OH^-_{(aq)} \longrightarrow M(OH)^-_{4(aq)}$$

$$M(OH)_{3(q)} + 3H^+_{(aq)} \longrightarrow M^{3+}_{(aq)} + 3H_2O_{(l)}$$

(a) What name is given to compounds which behave like $M(OH)_3$ in the two reactions. (1 mark)

……

(b) Name **two** elements whose hydroxides behave like that of M. (2 marks)

……

……

10. A compound contains 82.75% carbon and the rest is Hydrogen. (C=12, H=1)

(a) **Determine** its empirical formula. (2 marks)

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(b) **Determine** the molecular formula if its molecular mass is 58. (1 mark)

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11. A form four student wanted to determine the solubility of potassium nitrate. He obtained the following results.

Mass of evaporating dish	**= 15.13g**
Mass of evaporating dish and solution	**= 36.51g**
Mass of evaporating dish and salt	**= 19.41g**

Use the information above to calculate the solubility of potassium nitrate. (3 marks)

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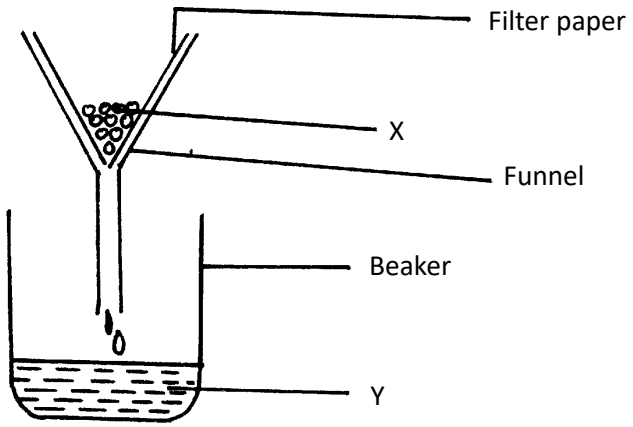
12. Filtration is carried out in the apparatus shown below.



a) Name X and Y (2 marks)

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……..……

b) State one application of filtration (1 mark)

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13. a) State Boyle's law (1 mark)

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……..……

b) A gas occupies a volume of 80dm^3 at s.t.p. At what pressure will its volume be doubled if the temperature rises by 105℃? (At s.t.p temperature = 0℃, pressure = 760mmHg) (2 marks)

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14. Consider the reaction below.

Alkanol + Alkanoic acid $\rightleftharpoons$ **Ester + water**

a) Give the name of the process represented by the above reaction. (1 mark)

……

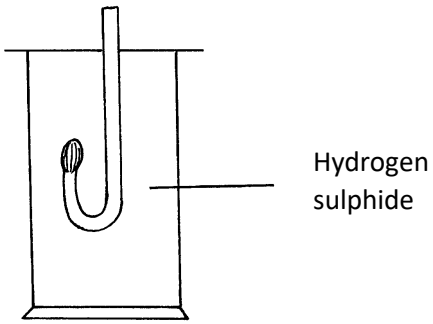
b) Name the catalyst which is usually used in the above reaction. (1 mark)

……

c) State the observation made during the reaction of alkanols and alkanoic acids. (1 mk)

……

15. Hydrogen sulphide gas was lighted in a gas jar of air using the arrangement below.



a) Write an equation for combustion of hydrogen sulphide gas. (1 mark)

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b) State what is observed if the product is passed through acidified potassium dichromate (VI) solution. (1 mark)

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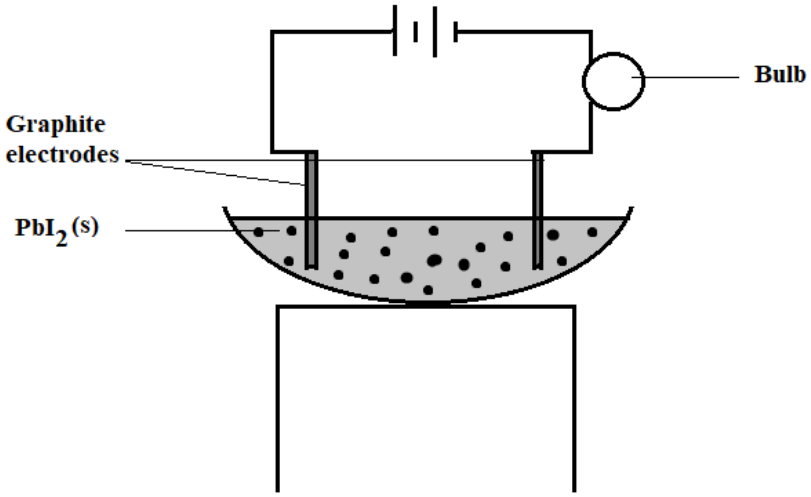
16. A set-up to investigate electrical conductivity of substances was assembled as shown below.



The bulb did not light.

(a) What was missing in the set-up? (1 mark)

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(b) The bulb lit when the omission was corrected. Explain. (1 mark)

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(c) State one application of electrolysis. (1 mark)

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17. Steam is passed over heated iron filings in a combustion tube.

(a) Name the two products of this reaction. (2 mark)

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(b) Why is it not advisable to react sodium metal with steam? (1 mark)

……

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18. Diamond and graphite are allotropes of carbon.

(a) What are allotropes? (1 mark)

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(b) In terms of structure and bonding explain why diamond is used in drilling through hard rocks while graphite is a lubricant (2 marks)

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19. Give the systematic name of each of the compounds represented by the formulae below. (3 marks)

(a) $CH_3C{\equiv}CCH_3$

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(b) $CH_3CH{=}CHCH_2CH_3$

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(c) CH_3CH_2COONa

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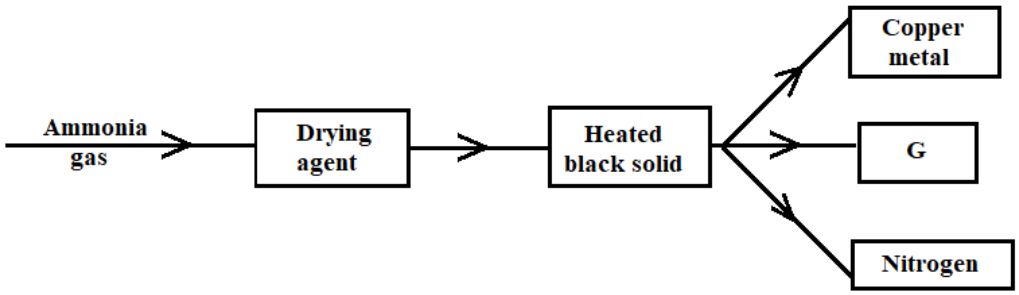
20. Study the flow chart below and answer the questions that follow.



(a) Name a suitable drying agent for ammonia. (1 mark)

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(b) Describe one chemical test for ammonia. (1 mark)

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(c) Name G. (1 mark)

……

21. Describe how dry chlorine and hydrogen chloride gases in gas jars can be distinguished using dry blue litmus papers, distilled water and a fume chamber. (3 marks)

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22. (a) State two factors that accelerate rusting. (2 marks)

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(b) Iron sheets are dipped in molten zinc to prevent rusting. Name this process. (1 mark)

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23. Given the following substances: wood ash, lemon juice and sodium chloride.

(a) Name one commercial indicator that can be used to show whether rain water wood ash, lemon juice and sodium chloride are acidic, basic or neutral. (1 mark)

……

(b) Classify the substances in 15(a) above as acids, bases or neutral. (2 marks)

Acidic	Basic	Neutral

24. Emission of carbon (IV) oxide into the atmosphere has become one of the world's major concerns.

(a) State one disadvantage of releasing carbon (IV) oxide into the atmosphere. (1 mark)

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(b) What causes the level of carbon (IV) oxide in the atmosphere to increase? (1 mark)

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(c) How can the amount of carbon (IV) oxide in the atmosphere be reduced other than avoiding the causes in (b) above? (1 mark)?

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25. When Xcm^3 of 0.5M zinc nitrate solution were reacted with excess ammonium carbonate solution, the mass of zinc carbonate formed was 12.5g.

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

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(b) Calculate the value of X. (C = 12.0, Zn = 65.0, O = 16.0) (2 marks)

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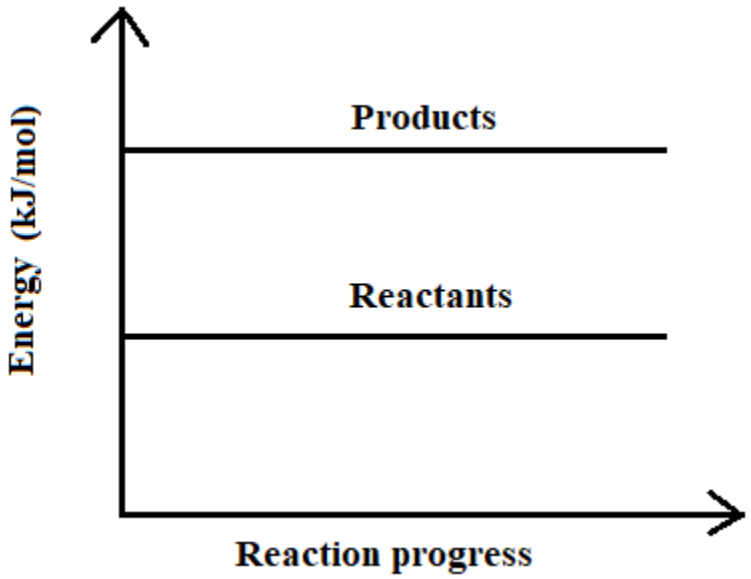
26. Below is a sketch of an energy level diagram.



a) On the diagram show the heat of reaction Δ**H.** (1 mark)

b) State and explain the type of reaction represented by the above energy level diagram. (2marks)

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27. Starting with copper metal describe how a sample of crystals of copper (II) chloride may be prepared in the laboratory (3 marks)

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