Name _____Index No. _____

Candidate's signature _____

Date _____

233/1
CHEMISTRY
PAPER 1
JULY 2011
2 HOURS

MAKUENI / KATHONZWENI JOINT EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 1
2 HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name and index number in the spaces provided.

(b) Sign and write the date of examination in the spaces provided above.

(c) Answer all questions in the spaces provided.

(d) Mathematical tables and silent electronic calculators may be used.

(e) All working MUST be clearly shown where necessary

FOR EXAMINER'S USE ONLY

QUESTION 1- 30	80
CANDIDATE'S SCORE	

This paper consists of 13 printed pages

Turn Over

1. (i) State the observations made when iodine is heated in a boiling tube. (1 mark)

(ii) Name the type of change and the name of the process that occurs in 1(i) above. (2 marks)

2. (a) An element X forms an oxide of formulae X_2O_5. In which group of the periodic table is X likely to be found. Give a reason. (1 mark)

(b) What is the nature of the oxide X_2O_5. (1 mark)

3. (a) State and explain what is observed when chlorine gas is bubbled through a solution of potassium bromide solution. (2 marks)

(b) Write an ionic equation for the above reaction. (1 mark)

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

Substance	Boiling point	Melting point	Solubility in water	Electrical conductivity	
				Solid	Molten
A	10	-39	Insoluble	Poor	Poor
B	2660	1610	Insoluble	Good	Good
C	1420	801	Soluble	Poor	Good

With reasons, select a substance

(a) With an electrovalent bond. (1 ½ marks)

_____

_____

_____

_____

(b) Likely to be a metal. (1 ½ marks)

_____

_____

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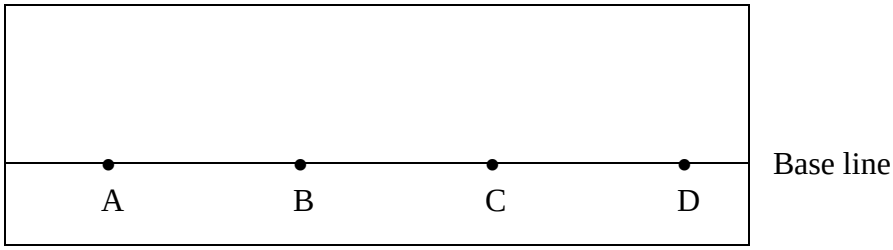
_____

5. The diagram below shows spots of pure substances A, B and C on a chromatography paper. Spot D is that of a mixture



After development A, B and C were found to have moved 4cm, 1.5cm and 3cm respectively. D had separated into two spots which had moved 3cm and 4cm.

(i) On the diagram show the positions of all the spot after development. (3 marks)

(ii) Identify the substances present in the mixture D. (1 mark)

_____

_____

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_____

6. Solutions of lead (II) nitrate and silver nitrate were electrolysed by passing identical currents for the same length of time. It was found that 0.108g of silver ions was deposited at the cathode. Calculate the mass of lead deposited (Ag = 108, Pb = 208 IF = 96500) (3 marks)

7. Chlorine is used to prepare Vinyl chloride (chloro ethane) $CH_2 = CHCl$.

(i) State why vinyl chloride $CH_2 = CHCl$, undergoes addition polymerization. (1 mark)

_____

_____

_____

_____

(ii) Name the polymer formed. (1 mark)

_____

_____

_____

(iii) Complete the following equation to show how the two monomers combine during the polymerization. (1 mark)

$CH_2 = CHCl + CH_2 = CHCl \longrightarrow$

8. Describe how a solid sample of lead (II) nitrate can be prepared. (3 marks)

_____

_____

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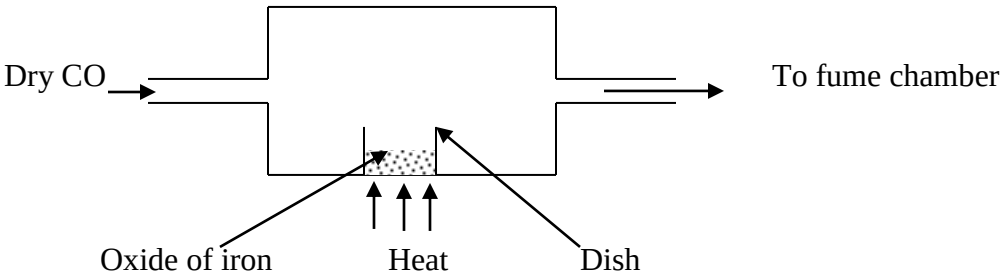
9. Excess carbon (II) oxide gas was passed over a heated sample of an oxide of iron. Study the diagram and data below it and answer the questions that follow.



Mass of empty dish = 10.98g
Mass of empty dish + oxide of iron = 13.14g
Mass of empty dish + residue = 12.66g

(i) Determine the formular of the oxide of iron
(Fe = 56.0, O = 16.0) (3 marks)

10. Describe a chemical test you would use to distinguish between nitrogen (I) oxide and nitrogen (II) oxide. (3 marks)

11. The use of materials of lead in roofing and in water pipes is being discouraged
State
(i) Two reasons why these materials have been used in the past. (2 marks)

_____

_____

_____

_____

(ii) One reason why their use is being discouraged. (1 mark)

_____

_____

_____

_____

12. The table below shows some properties of gases

Gas	Solubility in water	Density compared with air	Reaction with conc. H_2SO_4
A	Insoluble	Less dense	No reaction
B	Slightly	More dense	No reaction
C	Very soluble	Less dense	Forms salt
D	Insoluble	Little more	No reaction

Select a gas (es) which would be collected
(a) (i) Over water (1 mark)

_____

_____

_____

(ii) By upward delivery. (1 mark)

_____

_____

_____

(b) Which of the gases would you not dry by passing through concentrated sulphuric acid. (1 mark)

_____

_____

_____

13. A form 1 student was supplied with a colourless liquid suspected to be water.
(i) Describe one chemical test that could be carried out to show that the liquid was water. (1 mark)

_____

_____

_____

_____

(ii) How could it have been shown that the liquid was pure water? (1 mark)

_____

_____

_____

_____

14. (a) The ions of W^{3+} and V^{2-} have identical electron arrangement of 2.8. Write down the electron arrangement of W and V.

W _____

V _____ (1 mark)

(b) Give the formula of the compound formed between W and V. (1 mark)

_____

_____

_____

_____

(c) Use crosses (x) and dots (.) to show how W and V form their ions. (2 marks)

15. Hydrogen sulphide gas was passed into a solution of hydrogen peroxide as shown in the diagram below.

(a) Explain what would be observed in the boiling tube. (2 marks)

_____

_____

_____

_____

(b) What observations would be made if the hydrogen peroxide was replaced with a solution of iron (III) chloride. Explain. (2 marks)

_____

_____

_____

_____

_____

16. Study the table below showing tests carried out on a sample of water and results obtained then answer the questions that follow.

	Tests	Results
(i)	Addition of sodium hydroxide solution drop wise until in excess	- White precipitate formed which dissolves in excess.
(ii)	Addition of aqueous $NH_{3(aq)}$ drop wise until in excess	- Colourless solution obtained.
(iii)	Addition of dilute hydrochloric acid followed by barium chloride solution	- White precipitate is formed.

(a) Identify the anion present in the water. (1 mark)

_____

_____

_____

(b) Write an ionic equation for the reaction in (iii) above. (1 mark)

_____

_____

_____

_____

(c) Write the formula of the complex ion formed in (II) above. (1 mark)

17. The table below gives the rate of decay for a sample of radioactive element R. Study it and answer the questions that follow.

Mass of $R_{(g)}$	Number of days
72	0
36	50
9	120

(a) Define the term '<u>half life'</u> as used in radioactivity. (1 mark)

(b) Determine the half-life of element R. (2 marks)

18. During the extraction of copper, the ore is first concentrated and roasted to produce copper (I) sulphide.

(a) Name the ore from which copper is commonly extracted. (1 mark)

(b) Write an equation for the reaction in which copper (I) sulphide is produced by roasting the ore in air. (1 mark)

(c) Give one effect that the process in (b) above could have on the environment. (1 mark)

(d) Give one use of copper metal. (1 mark)

19. Use the following information to determine the enthalpy change of formation of calcium hydroxide. ($Ca(OH)_{2(s)}$)

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(g)}$ $\Delta H = -286.86J$

$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(s)}$ $\Delta H = -64.26J$

$Ca_{(s)} + \frac{1}{2} O_{2(g)} \longrightarrow CaO_{(s)}$ $\Delta H = -637.56J$

(i) Write the equation for the formation of calcium hydroxide from its constituent elements.

_____

_____

_____

_____

(ii) Draw an energy cycle diagram for all the reactions above. (2 marks)

20. A gas occupies a volume of $4dm^3$ at a pressure of 760mmHg. Calculate the gas pressure if the volume of the gas is reduced to $2dm^3$ at constant temperature. (2 marks)

21. An element Q reacts with dilute acids but not with cold water. Element R does not react with dilute acids. Elements S displaces element P from its oxides. P reacts with cold water. Arrange the four metals in order of their reactivity starting with the most reactive. (1 mark)

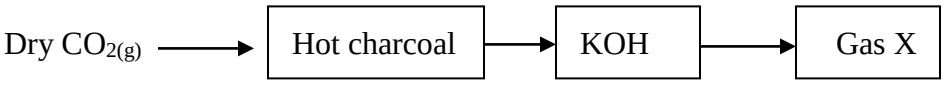
_____

_____

_____

_____

22. Study the reaction scheme below and answer the questions that follow.



(i) Write an equation involving hot charcoal and dry carbon (IV) oxide gas. (1 mark)

(ii) Name gas X and state one chemical property of the gas. (1 mark)

23. When chlorine gas is mixed with excess Ammonia gas, white fumes and a spark of light are observed. Using equations where necessary, explain the above observations. (2 marks)

24. Explain the following :

(i) Nitric acid is stored in dark brown bottles. (½ mark)

(ii) Alkalis are not stored in Aluminium containers or bottles. (½ mark)

25. How does the use of manganese (IV) oxide in the laboratory preparation of chlorine gas differ from its use in the laboratory preparation of hydrogen gas ? (1 mark)

26. Briefly explain the following observations.

(i) Alkaline earth metals are generally less reactive than the alkali metals. (1 mark)

_____

_____

_____

_____

(ii) The order of reactivity increases down group I elements but decreases down group (VII) elements. (2 marks)

_____

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27. 0.35g of impure zinc dust contaminated with zinc oxide was added to an excess iron (III) solution. The iron (II) solution produced after the reaction required $100cm^3$ of 0.02M potassium manganate (VII) solution for titration. Calculate the percentage purity of zinc given the equations below.

$Zn_{(s)} + 2Fe^{3+}{}_{(aq)} \longrightarrow Zn^{2+}{}_{(aq)} + 2Fe^{2+}{}_{(aq)}$

$MnO_4{}^{-}{}_{(aq)} + 5Fe^{2+}{}_{(aq)} + 8H^{+}{}_{(aq)} \longrightarrow Mn^{2+}{}_{(aq)} + 4H_2O_{(l)} + 5Fe^{3+}{}_{(aq)}$

(Zn = 65.4) (3 marks)

28. Consider the following reaction at equilibrium.

$PCl_{5\,(g)} \rightleftharpoons PCl_{3\,(g)} + Cl_{2\,(g)}$

Explain what will be the effect on the position of equilibrium

(i) By increasing pressure. (1 mark)

_____

_____

_____

_____

(ii) By removing chlorine gas. (1 mark)

_____

_____

_____

(iii) By adding Helium gas to the mixture. (1 mark)

_____

_____

_____

29. Study the reduction potentials for the half cells below and answer the questions that follow. (The letters do not represent the actual symbols of the elements)

Half reaction	E^{θ} (Volts)
$F_{2\,(aq)} + 2e^{-} \longrightarrow 2F^{-}_{(aq)}$	+ 0.54
$G^{2+}_{(aq)} + 2e^{-} \longrightarrow G_{(s)}$	- 0.44
$H^{2+}_{(aq)} + 2e^{-} \longrightarrow H_{(s)}$	+ 0.34
$2J^{+}_{(aq)} + 2e^{-} \longrightarrow J_{2\,(g)}$	0.00

(a) Identify the strongest reducing agent. Explain. (1 mark)

_____

_____

_____

(b) (i) Write the equation for the reaction that takes place when solid G is added to a solution containing $H^{2+}_{(aq)}$ ions. (1 mark)

_____

_____

_____

_____

(ii) Calculate the E^{θ} value for the reaction in (ii) above. (1 mark)

30. State one cause of temporary hardness in water. (1 mark)

_____

_____

_____

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PAPER 1

MARKING SCHEME

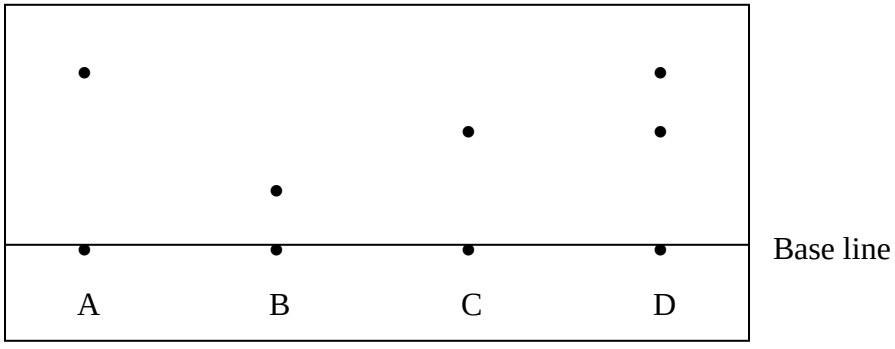
1. (i) Dark crystals turn into purple vapour √1.
   (ii) Temporary /physical change √1
   Sublimation√1

2. (a) Group (V) . Has a valency of 5 / 5 electrons in the outermost energy level

3. (a) Colourless solution √1 turns orange √1
   (b) $Cl_{2\,(g)} + 2Br^-_{(aq)} \longrightarrow 2Cl^-_{(aq)} + Br_{2\,(s)}$ √1
   eq. Must be balanced
   Balanced without states √ ½

4. (a) C √ ½ - Has high B.P and M.P
   - Does not conduct in solid state but conducts when molten.
   - Soluble in water
   ½ for any two

   (b) - Has high B.P and M.P
   - Is insoluble in water
   - Conducts in both solid and molten states
   ½ for any two

5. 

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6. 1 mol of Ag^+ ⟶ 96500C

$\frac{0.108g}{108}$ x 96500 = 96.5C √1

1 mole of Pb^{2+} (208g) ⟶ 2 x 96500C

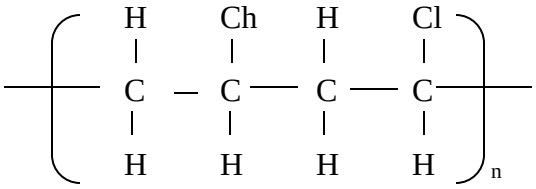
? ⟶ 96.5C

$\frac{96.5}{2 \times 96500}$ x 208 √1 = 0.104g

7. (i) Is unsaturated √1

(ii) Polyvinyl chloride √1

(iii)



8 . - Pour some dilute HNO_3 in a glass beaker and warm it.
- Add excess PbO to the acid √ ½
- Filter √ ½ and collect filtrate
- Evaporate / heat √ ½ solution to saturation √ ½
- Cool solution √ ½ to form crystals
- Dry crystals √ ½ between filter paper

9. Mass of iron oxide = 13.14g – 10.98 = 2.16g √ ½
Mass of iron = 12.66 – 10.98 = 1.68g √ ½
Mass of oxygen = 2.16 – 1.68 = 0.48g √ ½

Moles	Fe	O
	$\frac{1.68}{56}$	$\frac{0.48}{16}$ √ ½
	$\frac{0.03}{0.03}$	$\frac{0.03}{0.03}$
	1	1 √ ½

Formular FeO √ ½

10. - Bubble each gas in Fe(II) $SO_{4\,(aq)}$ √1
- Nitrogen (I) oxide turns the pale green √ ½ $FeSO_4$ to dark brown √ ½
- N_2O, the colour of Fe(II) $SO_{4\,(aq)}$ remains unchanged √1

Alternatively
- Expose both to air
- $NO_{(g)}$ forms brown fumes
- N_2O – no observable change

11. (I) Lead does not react with water √1 and air √1
(II) Lead id an heavy metal which has adverse effects on the environment √1

12. (a) (i) A √ ½ and B √ ½
(ii) A √ ½ and C √ ½
(iii) C √1

13. (a) Add the colourless liquid to :-
- Anhydrous copper (II) sulphate which turns colour from white to blue. √1
- Anydrous cobalt (II) chloride which turns colour from blue to pink

(Any one)

(b) - Determine its boiling point which is 100^0C or freezing point (which is 0^0C) √1
- Or determine its refractive index

(Any one correct @ 1)

14. (a) W – 2.8.3 √ ½
V – 2.6 √ ½

(b) $W^{3+}V^{2-}$ W_2V_3 √1

(c) 3+ 139 14n W^{3+} V^{2-} 2- √1 √1 √1 √1 8p 8n

15. (a) - Yellow deposits are formed √1
- Hydrogen sulphide gas is oxidized by the hydrogen peroxide to yellow deposits of sulphur √1

(b) - The brown colour of iron (III) chloride changes to green colour of iron (II) chloride solution √1
- This is because Fe^{3+} ions are reduced to $Fe^{2+}{}_{(aq)}$ ions. √1

16. (a) $SO_4^{2-}{}_{(aq)}$ √1

(b) $Ba^{2+}{}_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow BaSO_{4\,(s)}$ √1

(c) $[\,Zn\,(NH_3)_4\,]^{2+}{}_{(aq)}$ √1

17. (a) Half-life is the time taken for a given number of nuclides to decay to half its original number √1
(Mark any other relevant definition)

(b) $72 \xrightarrow{t_{1/2}} 36 \xrightarrow{t_{1/2}} 18 \xrightarrow{t_{1/2}} 9$ √ ½

No of half-lives = $3t_{1/2}$
If $3t_{1/2}$ = 120 days √ ½
$1\ t_{1/2}$ = ?
$^1/_3$ x 120 = 40 days

Thus $t_{1/2}$ = 40 days √1

18. (a) Copper pyrites √1

(b) $CuFeS_{2(s)} + 4O_{2(g)} \longrightarrow 3SO_{2(g)} + 2FeO_{(s)} + Cu_2S_{(s)}$ √1

(c) There is release of sulphur (IV) oxide that escapes into atmosphere and combines with rainwater to form '<u>acid rain</u>' hence environmental pollution. √ 1

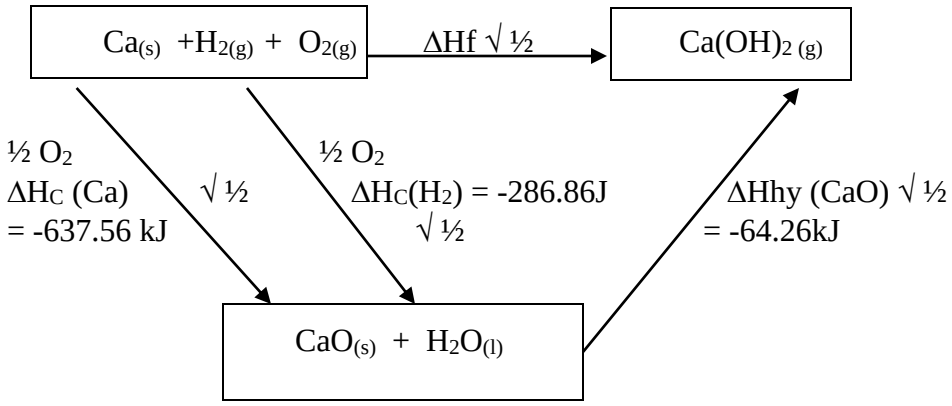
(d) <u>Uses of Cu</u>

- Making electrical wires and contact √1 in switches, plugs and sockets.
- Making soldering instruments due to its high thermal conductivity.
- Making alloys e.g brass (Cu and Zn), bronze (Cu and Sn).
- Making coins and ornaments.
- Making cooking utensils.
- Making roofing sheets for large buildings due to its resistant corrosion.

(Any 1 @ 1 mark)

19. (i) $Ca_{(s)}\ H_{2(g)} + O_{2(g)} \longrightarrow Ca(OH)_{2(s)}$ √1 (1 mark)

(ii)



(2 marks)

20. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{760 \times V_1}{T_1} = \frac{P_2V_2}{T_2}$ √

$760 \times 4 = P_2 \times 2$

$P_2 = \frac{760 \times 4}{2}$ 2 √

= 1520mmHg √

21. $S > P > Q > R$ √1

22. (i) $CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$ √1
(ii) Carbon (II) oxide √ ½

One chemical property of gas X
- Reduces oxides of metals to their respective √ ½ metals and itself is oxidized to carbon (IV) oxide
- Burns in oxygen with a blue flame forming CO_2 which forms white precipitate with lime water.

One correct @ ½

23. - Chlorine gas is reduced by Ammonia gas to form hydrogen chloride gas. √
- The hydrogen chloride gas combines with excess ammonia to form white fumes √1 of Ammonium chloride.
- The spark of light is due to exothermic √1 nature of the reaction.

$4NH_{3(g)} + 3Cl_{2(g)} \longrightarrow 2NH_4Cl_{(g)} + N_{2(g)} + 4HCl_{(g)}$ √ ½

24. (i) Nitric acid undergoes slow decomposition when it is exposed to light. √ ½
(ii) Alkalis attack the thin aluminium oxide √ ½ coating on the aluminium making it to wear out because aluminium is amphoteric in nature.

25. - Used as an oxidizing agent √ ½ in the preparation of $Cl_{2(g)}$ while used as a catalyst √ ½ in the preparation of hydrogen.

26. (i) - Both GP I and GP II elements react by losing / donating electrons √ ½
- Alkaline earth metals have more protons hence attract their electrons more √ ½ than the alkali metals and therefore cannot donate them readily as in GPI elements

OR GP II elements have greater nuclear charge compared to GP I elements due to the more protons in GP II attracting the outer electrons more than GPI elements.

(ii) - GP I elements react by losing outermost electrons.
- As you go down GP I, the no. of energy levels increase making the electrons lost to be far away from the attraction of the nucleus hence can be donated easily. √ ½
- GP (VII) elements react by gaining electrons.
- As an electron is entering the outermost energy level, it is repelled √ ½ by the ones already there. As we go down the group, the energy levels increase.

So the incoming electron will be repelled and also the nuclear attraction becomes less √ ½ and this decreases reactivity of GP (VII) elements.

27. Moles of MnO_4^- = $\frac{100 \times 0.02}{1000}$

= 0.002 moles √ ½

No. of moles of Fe^{2+} from mole ratio $Fe^{2+} : MnO_4^-$

5 : 1

∴ 0.002 x 5

= 0.01 mole √ ½

No. of moles of Zn (from mole ratio)

Fe^{2+} : Zn

2 : 1

$0.01 : \frac{0.01}{2}$

Mass of Zn = 0.005 x 65.4

= 0.327g √ ½

%ge purity of Zn = $\frac{0.327}{0.35}$ x 100% √ ½

= 93.43% √1

28. (i) - Equilibrium will shift to the left √ ½ (i.e backward reaction favoured)
Reason : This is because it is the side √ ½ with less number of molecules / less volume.

(ii) - Equilibrium will shift to the right √ ½ (i.e forward reaction is favoured)
Reason : This is due to less concentration √ ½ of the $Cl_{2\,(g)}$ as they are revolved.

(iii) On addition of He to the mixture, no effect √ ½ on the position of the equilibrium.
Reason: Helium is inert √ ½ .

29. (a) G – Has the highest tendency to lose electrons √1
- Has the highest –ve value.

(b) (i) $G_{(s)} + H^{2+}_{(aq)} \longrightarrow H_{(s)} + G^{2+}_{(aq)}$ √1

(ii) $E_R - E_O$

= 0.34 – (-0.44)

= 0.34 + 0.44 √ ½

= + 0.78V √ ½

30. Presence of $Ca(HCO_3)_2$ and $Mg(HCO_3)_2$
Salts which are soluble √1

Name _____Index No. _____

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Date _____

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PAPER 2
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INSTRUCTIONS TO CANDIDATES

(a) Write your name and index number in the spaces provided above.

(b) Sign and write the date of examination in the spaces provided above.

(c) Answer all questions in the spaces provided.

(d) Mathematical tables and silent electronic calculators may be used.

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Question	Maximum Score	Candidate's Score
1	10	
2	14	
3	12	
4	11	
5	12	
6	11	
7	10	
Total Score	80	

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Turn Over

1. (a) The grid given below represents part of the periodic table. Study it and answer the questions that follow. (The letters do not represent the actual symbols of the elements)

								A
				B				
	C		D			E		
	F							

(i) What name is given to the group of elements to which C and F belong ? (½ mark)

_____

_____

_____

(ii) Which letter represents the element that is the least reactive? (½ mark)

_____

_____

_____

(iii) What type of bond is formed when B and E react? Explain. (2 marks)

_____

_____

_____

_____

_____

(iv) Write the formula of the compound formed when D and oxygen gas react. (1 mark)

_____

_____

_____

_____

(v) On the grid, indicate with a tick (√) the position of element G which is in the third period of the periodic table and forms G^{3-} ions. (1 mark)

(b) Study the information in the table below and answer the questions that follow.
(The letters do not represent the actual symbols of the substances)

Substance	Melting point (^{0}C)	Boiling point (^{0}C)	Solubility in water	Density at room temperature (g/cm^3)
H	-117	78.5	Very soluble	0.8
J	-78	-33	Very soluble	7.7×10^{-4}
K	-23	77	Insoluble	1.6
L	-219	-183	Slightly soluble	1.33×10^{-3}

(i) Which substance would dissolve in water and could be separated from the solution by fractional distillation ? Give a reason. (1 ½ marks)

_____

_____

_____

_____

(ii) Which substance is a liquid at room temperature and when mixed with water two layers would be formed? (1 mark)

_____

_____

_____

(iii) Which letter represents a substance that is a gas at room temperature and which can be collected.

I) Over water? Explain. (2 marks)

_____

_____

_____

_____

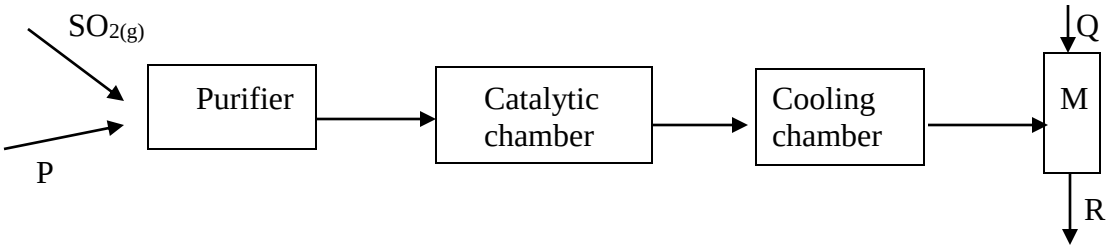
II) By downward displacement of air ? (Density of air = 1.29×10^{-3} g/cm^3 at room temperature). (½ mark)

_____

_____

_____

2. The flow chart below shows the manufacture of sulphuric (VI) acid by contact process.



(a) Identify substances P and R (1 mark)

P _____

R _____

(b) Explain why the mixture of sulphur (IV) oxide gas and P is passed through a purifier. (1 marks)

_____

_____

_____

_____

(c) Name the catalyst used for this process. (½ marks)

(d) Write an equation for the reaction which takes place in the catalytic chamber. (1 mark)

(e) Explain what will happen to the state of equilibrium in the reaction if:

(i) The temperature is lowered. (1 mark)

(ii) The pressure is lowered. (1 mark)

(f) Using equations, describe how sulphur (VI) oxide is converted into sulphuric (VI) acid. (2 marks)

(g) Give one harmful effect of sulphur (IV) oxide on the environment. (½ mark)

(h) Give one industrial use of sulphuric (VI) acid. (½ mark)

(i) The diagram shows the preparation and collection of sulphur (IV) oxide and collection of sulphur (IV) oxide.

S Solid T Liquid U Gas jar SO_2

(i) Name the substance represented by letters. 3 marks)

I) S _____

II) T _____

III) U _____

(ii) Write the equation of the reaction taking place between solid T and liquid S. (1 mark)

_____

_____

_____

_____

(j) (i) From the figure, what can be said about the density of sulphur (IV) oxide in relation to air ? (1 mark)

_____

_____

_____

_____

(ii) Name the method of collecting sulphur (IV) oxide. (½ mark)

_____

_____

_____

(k) State what would happen to

(i) Dry red and blue litmus papers placed in a gas jar of the collected sulphur (IV) oxide. (½ mark)

_____

_____

_____

_____

(ii) Wet red and blue litmus papers in a gas jar of SO_2. (½ mark)

_____

_____

_____

_____

3. (a) The diagram below represents the Halls cell used for the extraction of aluminium. Study it carefully and answer the questions that follow.

(i) Identify the following. (2 marks)

W _____

X _____

Y _____

Z _____

(ii) What is the role of sodium hydroxide in the extraction process ? (1 mark)

_____

_____

_____

(iii) Why is cryolite added into the above cell ? (1 mark)

(iv) Write the equations of the reactions occurring at the electrodes. (2 marks)

Cathode: (1 mark)

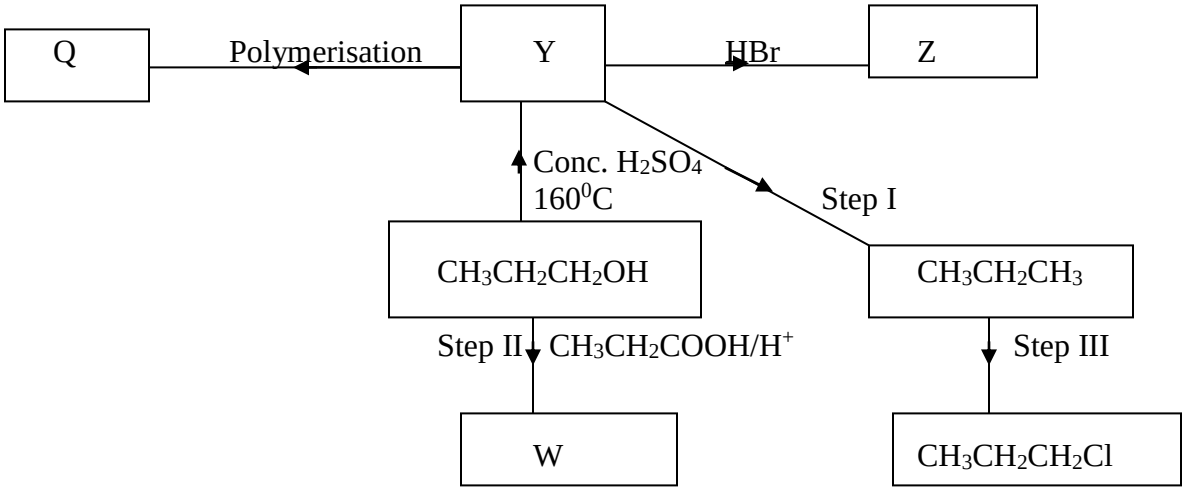
Anode : (1 mark)

(v) Why do the carbon anodes have to be replaced regularly? (1 mark)

(b) (i) A current of 250 amperes flows through the electrolyte of this cell for 8 hours. Calculate the mass of aluminium produced in kilograms. (IF = 96500C) (3 marks)

(ii) Using the same quantity of electricity in (b) (i) above, calculate the valume of oxygen evolved at room temperature and pressure. Molar gas volume = 24.0dm^3 at r.t.p) (2 marks)

4. Below is a scheme of some reactions of propanol. Study it and answer the questions that follow.



(i) State the reagents and conditions required to effect step I and step II. (2 marks)

Step I

Step II

(ii) Draw the structural formulae of the products Y and Z, (2 marks)

Y

Z

(iii) Name the products Q and W. (1 marks)

Q _____

W _____

(iv) State one use of polyvinyl chloride (PVC) (½ mark)

_____

_____

_____

(v) Explain how a sample of $CH_3CH_2CH_2OH$ could be distinguished from a sample of CH_3CH_2COOH by means of a chemical reaction. (2 marks)

_____

_____

_____

_____

(vi) Explain the observation that the boiling point of $CH_3CH_2CH_2OH$ is higher than that of $CH_3CH_2CH_3$. (1 mark)

_____

_____

_____

_____

(vii) What name is given to the process in step II ? (½ mark)

_____

_____

_____

(viii) Draw the structure of each of the following compounds .

(I) 1, 2-dibromopropane (1 mark)

(II) 2-methylbutan-1-ol (1 mark)

5. (a) The table below shows the solubility of ammonium nitrate in 100g of water at various temperatures.

Temperature ^0C	0	10	20	30	40	60	70	80	90	100
Solubility in g/100g of water	73	80	88	96	104	124	134	146	160	180

(i) Draw the solubility curve of ammonium nitrate. (3 marks)

(ii) From the graph obtain the temperature at which the solubility of ammonium nitrate is 150g per 100g of water. (½ mark)

(iii) A saturated solution initially at 95^0C is cooled to 45^0C.

I) At what temperature will crystals start forming ? (½ mark)

II) How much ammonium nitrate will crystallize out ? (1 mark)

(b) In an experiment to determine the solubility of sodium chloride, 5.0cm^3 of a saturated solution of sodium chloride weighing 5.35g were placed in a volumetric flask and diluted to a total volume of 250cm^3 25cm^3 of the dilute solution of sodium chloride completely reacted with 24.1cm^3 of 0.1M silver nitrate solution.

$$Ag\,NO_{3(aq)} + NaCl_{(aq)} \longrightarrow AgCl_{(s)} + NaNO_{3}{}^{(aq)}$$

Calculate:

(i) Moles of silver in 24.1cm^3 of solution. (1 mark)

(ii) Moles of sodium chloride in 25.0cm^3 of solution. (1 mark)

(iii) Moles of sodium chloride in 250cm^3 of solution. (1 mark)

(iv) Mass of sodium chloride in 5.0cm^3 of saturated sodium chloride solution.
(Na = 23.0, Cl = 35.5) (1 mark)

(v) Mass of water in 5.0cm^3 of saturated solution of sodium chloride. (1 mark)

(vi) The solubility of sodium chloride in g/100g of water. (2 marks)

6. The diagram below shows a set-up used to determine the standard electrode potential (E^{θ}) of zinc.

MH^{+} ions

(a) Name parts. (1 ½ marks)

A _____

B _____

C _____

(b) Write the equations of the reactions taking place in each of the electrodes. (1 mark)

(i) _____

_____

(ii) _____

_____

(c) Given below are standard electrode potentials. Study them and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Half cell equation			E^{θ} Volts
$P^{+}_{(aq)} + e^{-}$	⇌	$P_{(s)}$	- 2.92
$Q^{2+}_{(aq)} + 2e^{-}$	⇌	$Q_{(s)}$	- 1.55
$R^{3+}_{(aq)} + 3e^{-}$	⇌	$R_{(s)}$	- 1.35
$S^{2+}_{(aq)} + 2e^{-}$	⇌	$S_{(s)}$	- 0.76
$T^{2+}_{(aq)} + 2e^{-}$	⇌	$T_{(s)}$	+ 0.34
$U^{3+}_{(aq)} + 3e^{-}$	⇌	$U_{(s)}$	+ 0.46
$V^{+}_{(aq)} + e^{-}$	⇌	$V_{(s)}$	+ 0.80
$W_{2\,(g)} + 2e^{-}$	⇌	$2W^{-}_{(aq)}$	+ 1.36

From the above list

(i) Which is the most reactive metal. Give a reason. (½ mark)

_____

_____

_____

_____

(ii) Which is the most reactive non-metal. Give a reason. (1 mark)

_____

_____

_____

_____

(d) Draw the electrochemical cell made by half cells of metal S and V. (2 ½ marks)

(e) Calculate the e.m.f of the cell you have drawn in (d) above. (2 marks)

(f) Select two half cells which when combined give the highest cell potential from the above given electrode potentials. (1 mark)

_____

_____

_____

_____

(g) State two main functions of a salt bridge. (1 mark)

(i) _____

_____

(ii) _____

_____

7. A student from Kaasya secondary school wanted to determine the enthalpy change of combustion when a hydro carbon with the formula C_6H_{14} was burnt.
The following are the results of the experiment done.

Mass of water = 100g
Initial temperature = 18.0^0C
Final temperature = 58.0^0C

Mass of the hydrocarbon burned = 0.43g
Specific heat capacity = 4.2 $Jg^{-1}k^{-1}$

(a) (i) Name the hydrocarbon used. (½ mark)

_____

_____

_____

(ii) Write a balanced equation for combustion of the hydro carbon. (1 mark)

_____

_____

_____

_____

(b) (i) Calculate the amount of heat given out in kJ when 0.43g of the hydrocarbon burn in air. (2 marks)

(ii) Calculate the mass of 1 mole of the hydrocarbon. (1 mark)

(c) Calculate the number of moles of the hydrocarbon that were burnt. (1 mark)

(d) Calculate the molar enthalpy of combustion of the hydrocarbon. (1 ½ marks)

(e) The theoretical value of the heat released when one mole of the hydrocarbon is burnt is 4194.7 $kJmol^{-1}$. Give three reasons why the value obtained from this experiment is less than the theoretical value. (3 marks)

(i) _____

(ii) _____

(iii) _____

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PAPER 2
JULY 2011

MAKUENI / KATHONZWENI JOINT EXAMINATION
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CHEMISTRY
PAPER 2

MARKING SCHEME

1 (a) (i) Alkaline earth metals √ ½
(ii) A √ ½
(iii) Covalent √1
They form bonds by sharing electrons √1
(iv) D_2O_3 or Al_2O_3 √1
(v) On diagram, period 3 group V position √1

(b) (i) H √ ½
Their boiling points are quite close √1
(ii) K √1
(iii) I) L √1
Its boiling point is lower than room temperature and is slightly soluble in water √1
II) J √ ½

2. (a) P – Air (oxygen) √ ½
R – Concentrated sulphuric (VI) acid √ ½
(b) To remove impurities which would otherwise poison the catalyst √1
(c) Vanadium (V) oxide √ ½

(d) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ √1

(e) (i) Lowering temperature will shift the equilibrium to the right. More SO_3 will be formed. The forward reaction is exothermic and therefore it is favaoured by lower temperature. √1

(ii) Lowering pressure will shift the equilibrium to the left. This is because there are more volumes / molecules of the reactants the products. √1

(f) The sulphur (VI) oxide is first dissolved in concentrated sulphur (VI) acid to form oleum. √ ½
$H_2SO_{4\,(l)} + SO_{3\,(g)} \longrightarrow H_2S_2O_{7\,(l)}$ √ ½

Oleum is then reacted with just enough water to produce concentrated sulphuric (VI) acid. √ ½
$H_2S_2O_{7\,(l)} + H_2O_{(l)} \longrightarrow 2H_2SO_{4\,(l)}$ √ ½

(g) Forms acid rain which corrodes buildings / iron sheets and destroys plants √ ½

This paper consists of 8 printed pages

Turn Over

(h) - Manufacture of fertilizers
- In manufacture of drugs
- Processing of metal ores
- Manufacture of detergents
- Manufacture of plastics / dyes / paints
- In lead-acid accumulators

(One for √ ½ mark)

(i) (i) I) S : Dilute sulphuric (VI) acid. √ ½
II) T : Sodium sulphite / copper metal √ ½
III) U : Concentrated sulphuric (VI) acid. √ ½

(ii) Equation

$Na_2SO_{3\,(s)} + H_2SO_{4\,(aq)} \longrightarrow Na_2SO_{4\,(aq)} + H_2O_{\,(l)} + SO_{2\,(g)}$

Or $Cu_{\,(s)} + 2H_2SO_{4\,(l)} \longrightarrow CuSO_{4\,(aq)} + SO_{2\,(g)} + 2H_2O_{\,(l)}$

(j) (i) It is denser than air √1
(ii) Downward delivery / upward displacement of air

(k) (i) No observable change on both litmus papers √ ½
(ii) Blue turned red and no effect on the red litmus paper but after sometime both are bleached √ ½

3. (i) Identification
W – Carbon anodes √ ½
X – Cathode √ ½
Y – Molten aluminium √ ½
Z – Molten aluminium oxide dissolved in cryolite √ ½

(ii) It is a solvent for the ore and it's impurities. √1
(iii) To lower the melting point of aluminium oxide √1
(iv) Equations:
Cathode

$4\,Al^{3+}_{\,(l)} + 12e^- \longrightarrow 4\,Al_{\,(l)}$ √1

Anode

$6O^{2-}_{\,(l)} \longrightarrow 3O_{2\,(g)} + 12e^-$

(Penalise ½ mark for wrong state symbols)

(v) Reason for replacing the anodes regularly
The oxygen gas produced at high temperatures reacts with the carbon anode √ ½ to form carbon (IV) oxide eventually burning the √ ½ carbon away during the electrolysis.

(b) (i) Q – 1t
= 250 x 8 x 60 x 60
= 7200 000 C √ ½

Number of faradays (F) $= \frac{7,200000C}{96500}$ √ ½

= 74,6114F √ ½

$Al^{3+}_{(l)} + 3e^- \longrightarrow Al_{(l)}$ √ ½

From this equation

3F produce 0.027kg of Al

∴ 74611F would produce x kg

$x\ kg = \frac{74.6114 \times 0.027}{3}$ √ ½

= 0.6715kg √ ½

(ii) From the equation

$2O^{2-}_{(l)} \longrightarrow O_{2(g)} + 4e^-$ √ ½

4F produce one mole of oxygen

Therefore, 24.0dm^3 of $O_{2(g)}$ are released by 4F

∴ Xdm^3 are produced by 74.6114F

$\therefore X = \frac{24.0 \times 74.6114}{4}$ √1

= 447.668dm^3 of oxygen gas. √ ½

4. (i) Step I

Reagent – hydrogen √ ½

Conditions – Heat / Nickel catalyst √ ½

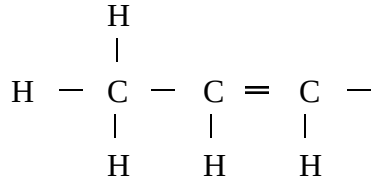
Step II

Reagent – Chlorine

Conditions – Sunlight / U.V light √ ½

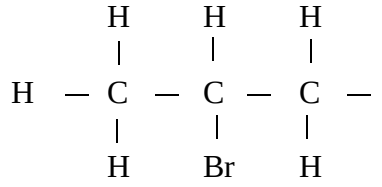
(ii)

Y:

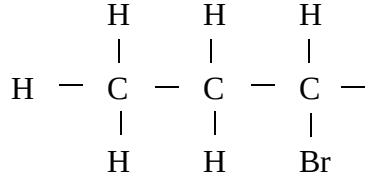


or $CH_3C(H)=CH_2$ √

Z:



or $CH_3CHBrCH_3$ √1



Accept

OR $CH_3CH_2CH_2Br$

(iii) Q – Polypropene √ ½

W – Propylpropanoate √ ½

(iv) Manufacture of pipes / paper bags / basins √ ½ (only one)

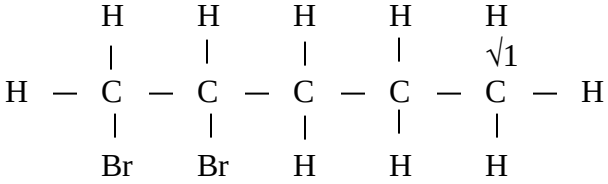
(v) Add a sample of each to sodium carbonate √ ½ in separate test tubes. There is effervescence √ ½ in one with CH_3CH_2COOH but no effervescence √ ½ in the one with $CH_3CH_2CH_2OH$ √ ½

(vi) $CH_3CH_2CH_2OH$ molecules are held by hydrogen bonds which are stronger than the van der waals forces which hold $CH_3CH_2CH_3$ molecules. √1

(vii) Esterification √ ½

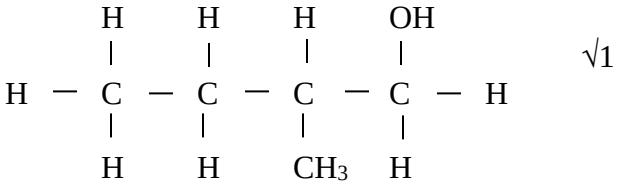
(viii) Structures

I) 1, 2 – dibromo propane



√1

II) 2-methyl butan-1-ol



√1

5. (a) 200 180 160 140 120 100 80 60 40 20 0 10 20 30 40 50 60 70 80 90 100
Temperature (^{0}C) Solubility (g/100g of water)

Marking Points

Scale 1 mark

Plotting 10 points 1 mark

8 points ½ mark

Smooth curve 1 mark

5. (a) (i) Graph

(ii) $82^0C \pm 0.5^0$ (Value read from graph) √ ½

(iii) $1.74^0C \pm 0.5^0$ √ ½

II) $95^0C \longrightarrow$ 166g dissolved √ ½

$45^0C \longrightarrow$ 108g dissolved

Mass that crystallizes = 166 – 108

= 58g √ ½

(b) (i) $\frac{24.1 \times 0.1}{1000}$ √ ½

= 0.00241 moles √ ½

(ii) Mole ratio $AgNO_3$: NaCl = 1 : 1

∴ moles of NaCl = 0.00241 moles √1

(iii) $25cm^3 \longrightarrow$ 0.00241 moles

$250cm^3 \longrightarrow$ x

$x = \frac{250 \times 0.00241}{25}$ √ ½

= 0.0241 moles

(iv) R.F.M of NaCl = 23 + 35.5

= 58.5 √ ½

Mass of NaCl = 0.0241 x 58.5

= 1.40985g √ ½

(v) Mass of water = 5.35 – 1.40985

= 3.94015g √1

(v) 1.40985g of NaCl ⟶ 3.94015g of water

x ⟶ 100g of water √ ½

Solubility = $\frac{1.40985 \times 100}{3.94015}$ √ ½ = 35.78g of water √1

6. (a) Parts

A – Plantinum electrode √ ½

B – Salt bridge √ ½

C – Hydrogen gas √ ½

(b) Equations :

(i) Plantinum electrode:

$2^{H+}{}_{(aq)} + 2e^- \longrightarrow H_{2\,(g)}$ √ ½

(ii) Zinc electrode:

$Zn_{(s)} \longrightarrow Zn^{2+}{}_{(aq)} + 2e^-$ √ ½

(c) (i) Most reactive metal is P √ ½

Reason : Has the most negative E^θ value meaning it donates electrons easily. √ ½

(ii) Most reactive non-metal is W √ ½

E^θ value hence gains electrons easily. √ ½

- Reason: Has the highest positive.

(d) Diagram

(If the half cells are interchanged penalize fully)

(e) E.M.F $_{cell}$ $= E^{\theta}{}_{RHS} - {}^{E\theta}{}_{LHS}$
$= 0.80 - (-07.6) \surd$
$= + 1.56V \surd 1$

(f) The two half cells;
W √ ½ and P half cells √ ½

(g) Functions of a salt bridge
(-) Helps in maintaining the electric charge balance of the two solutions. √ ½
(-) Helps in completing the electrical circuit of an electrochemical cell. √ ½

7. (a) (i) Hexane √ ½
(ii) $2C_6H_{14\,(l)} + 19O_{2\,(g)} \longrightarrow 12CO_{2\,(g)} + 14H_2O_{\,(g)}$ √1

(b) (i) Heat given out = $\frac{100 \times 40 \times 4.2}{1000}$ √1
= 16.8kJ √1

(ii) Mass of 1 mole of $C_6H_{4\,(s)}$
= (12 x 6) + (14 x 1)
= 86 √1

(c) No. of moles = $\frac{\text{mass}}{\text{Molar mass}}$
$= \frac{0.43}{86}$ √ ½
= 0.005 moles √ ½

(d) Molar enthalpy of combustion
0.005 moles produce 16.8kJ
1 mole produce x kJ

$$x = \frac{16.8}{0.005} \times 1 \quad \surd 1$$

$$= 3360 kJ\ mol^{-1}$$

(e) Three reasons :

(i) Not all heat is absorbed by 100g of water √1

(ii) Error in measuring temperatures √1

(iii) Error in measuring initial and final masses of the hydrocarbons and the lamp. √1

Name _____Index No. _____

Candidate's signature _____

Date _____

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CHEMISTRY
PAPER 3
PRACTICAL
JULY 2011
2 ¼ HOURS

MAKUENI / KATHONZWENI JOINT EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3
PRACTICAL
2 ¼ HOURS

INSTRUCTIONS TO CANDIDATES

- Answer all the questions in this paper in the spaces provided.
- You are not allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed time for the paper.
- Use the 15 minutes to read the question paper and note the chemicals you require.
- Mathematical tables and electronic calculators may be used.
- All working must be clearly shown where necessary.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1	19	
2	11	
3	10	
TOTAL		

This paper consists of 8 printed pages

Turn Over

1. You are provided with :

- 0.1M sodium hydroxide, solution B.
- Dilute hydrochloric acid solution A.
- 10g of a mixture of sodium hydrogen carbonate and sodium chloride per litre, solution C.

You are required to determine

(i) Molarity of solution A

(ii) Percentage purity by mass of sodium hydrogen carbonate.

Procedure I

Fill the burette with dilute hydrochloric acid, solution A.

Pipette 25.0cm^3 of 0.1M sodium hydroxide solution B into a clean conical flask. Titrate using 2 drops of methyl orange indicator until colour changes from yellow to permanent pink.

Fill in the table below. Repeat the titration two more times and complete the table below.

	1	2	3
Final burette reading			
Initial burette reading			
Volume solution A used			

(4 marks)

(a) Calculate average volume of the solution A used. (1 mark)

(b) Calculate the number of moles of hydrochloric acid that reacted with 25cm^3 of sodium hydroxide. (1 mark)

(c) Calculate the concentration of solution A in moles per litre. (2 marks)

Procedure II

Pipette 25.cm^3 of solution C into a conical flask. Titrate with solution A put in a burette using 2 drops of methyl orange indicator. Record your results in table II below.

Table 2

	1	2	3
Final burette reading			
Initial burette reading			
Volume solution A used			

(4 marks)

(i) Calculate the average volume of solution A used. (1 mark)

(ii) Write an equation for the reaction taking place between solution A and mixture C. (1 mark)

(iii) Calculate:

(a) Molarity of sodium hydrogen carbonate in moles per litre. (2 marks)

(b) Mass of sodium hydrogen carbonate in the mixture in grammes per litre. (1 mark)

(c) Mass of the sodium chloride in the mixture. (1 mark)

(d) The percentage purity of the sodium hydrogen carbonate. (1 mark)

2. You are provided with.
- 4 pieces of 1cm long magnesium ribbon.
- 2M hydrochloric acid. (D)
- Stop watch

You are required to determine the time taken for magnesium to disappear completely. Use the results to plot a graph of volume against time.

Procedure
- Measure 10cm^3 of 2M hydrochloric acid solution (D) using a measuring cylinder and place it in 100ml below.
- Put a piece of magnesium ribbon provided into the beaker and note the time taken for the magnesium to disappear completely. Repeat procedure 2, 3 and 4 as per the table below.
- Record your results in the table below.

(a)

Experiment	1	2	3	4
Volume of 2M HCl (D) in cm^3	10	8	6	4
Volume of distilled water cm^3	0	2	4	6
Time in seconds				

(3 marks)

(b) Plot a graph of volume in cm^3 of the acid D (x-axis) against time in seconds (y –axis) on the graph paper provided. (4 marks)

(c) From the graph find :

(i) Time taken for magnesium to disappear completely in $5cm^3$ of D. (1 mark)

(ii) Volume of the acid in which magnesium takes 100 seconds to disappear completely. (1 mark)

(d) The total volume of the solution remaining the same for all the experiment. Calculate the concentration of the acid in experiment 2 and 4. (2 marks)

3. You are provided with solid F and liquid K . Carry out the tests below. Write your observations and inferences in the spaces provided.

(a) Using a clean spatula heat the solid F in a Bunsen burner flame.

Observation	Inference
√ (½ mark)	√ (½ mark)

(b) Put the remaining portion of the solid F into a boiling tube and add $10cm^3$ of distilled water. Stir and filter. Keep the residue for further tests. Divide the filtrate into four portions.

(i) To the first portion, add sodium hydroxide solution till in excess.

Observation	Inference
√ (½ mark)	√ (½ mark)

(ii) To the second portion add ammonium hydroxide solution till excess.

Observation	Inference
√ (½ mark)	√ (½ mark)

(iii) To the third portion add lead (II) nitrate solution then warm.

Observation	Inference
√ (½ mark)	√ (½ mark)

(iv) To the fourth portion add barium chloride solution followed by hydrochloric acid.

Observation	Inference
√ (½ mark)	√ (½ mark)

(c) Dissolve the residue into about $5cm^3$ of 2M hydrochloric acid record your observations and make inferences.

Observation	Inference
√ (½ mark)	√ (½ mark)

(d) Carryout the following tests on liquid K.
Divide liquid K into two portions using a test-tube.

(i) Add 1-2 drops of acidified potassium manganate (VII) to the first portion.

Observation	Inference
√ (½ mark)	√ (½ mark)

(ii) To the second portion in a test-tube, add $4cm^3$ of ethanoic acid and 2 drops of concentrated sulphuric (VI) acid using a dropper.

Observation	Inference
√ (½ mark)	√ (½ mark)

(iii) Write the general reaction equation in (ii) above. (1 mark)

Observation	Inference
√ (½ mark)	√ (½ mark)

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MARKING SCHEME

TABLE I

Final reading	26.1	25.9	26.0
Initial burette reading	0.0	0.0	0.0
Vol. sol A used	26.1	25.9	26.0

Marking points

1. - Complete table 1 mark
   - Consistent use of decimal 1 mark
   - Penalise fully for mixed dec.
   - Accuracy 1 mark

   ± 0.1 1 mark

   ± 0.2 - ½ mark
   - Principles of averaging

   Values average ± 0.1 1 mark

   ± 0.2 ½

   Otherwise penalize fully

(a) Final answer – not rounded 1 mark
- rounded penalize ½
- Rounded to less than 2 d.p places unless it divides automatically – 0 mk

(b) No. of moles of NaOH in $25cm^3$

$$= \text{molarity} \times \frac{\text{vol}}{1000}$$

$$= 0.1 \times \frac{25}{1000} \quad \surd ½$$

(c) Conc. Of hydrochloric acid in moles per litre

$$= \frac{1000 \times \text{ans (b)}}{\text{Ans (a)}} \quad \surd ½$$

$$= \frac{1000 \times 0.0025}{26} \quad \surd ½ = 0.096153 \surd ½ \simeq 0.1 \text{ moles}$$

This paper consists of 3 printed pages

Turn Over

TABLE II
Marking as per table I

(i) Final answer (not rounded) √1
Equation
(ii) $HCl + NaHCO_3 \longrightarrow NaCl + CO_2 + H_2O$ √ ½ bal. chemical e.g
√ ½ states

(iii) (a) Molarity of $NaHCO_3$
Since mole ratio 1 : 1 √ ½
No. moles HCl = no. moles $NaHCO_3$ √ ½

$$0.09613 \times \frac{\text{vol (Av. Litre)}}{1000}$$ √ ½ = no. moles $NaHCO_3$ in $25cm^3$ of C

Moles $NaHCO_3$ in mol/dm^3 = ans. $\frac{\text{Above} \times 1000}{25}$ √ ½
= Ans √ ½

(b) Mass of sodium hydrogen carbonate
= ans. Above x R.M.M. $NaHCO_3$
= 0.1 x 84 √ ½
= 8.4g √ ½

(c) Mass of NaCl in the mixture = mass of mixture - $\frac{\text{answer above}}{\text{Mass mixture}}$

(d) % purity $NaHCO_3$ = $\frac{\text{answer above}}{\text{Mass mixture}} \times 100$
= $^{8.4}/_{10}$ x 100 √ ½ = 84% √ ½

2. (a) Time in seconds Expt. 1 – 30.0 sec
Expt. 2 – 88.0 sec
Expt. 3 – 111.0 sec
Expt. 4 – 149.0 sec
Accept 30.0, 50.0, 80.0, 160.0, respectively.

Marking
Complete table – 1 mark
Decimals used – 1 mark
Increasing trend – 1 mark

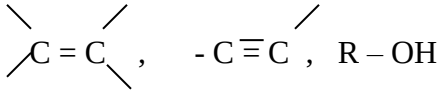
(b) Scale – 1 mark
Labelled axis – ½ x 2 = 1 mark
Curves and plotting – 2 marks

(c) (i) 105 sec (shown in graphs) penalize ½ mark for wrong units
(ii) 5.2 ± $1cm^3$ should be shown on graph
Penalise ½ for wrong units (1 mark)

(d) (i) $^{8}/_{10}$ x 2 = 1.6M Working ½ mark, answer ½ mark
Penalise ½ mark for wrong units (1 mark)

(ii) $^{4}/_{10}$ x 2 = 0.8M Working ½ mark, answer ½ mark
Penalise ½ mark for wrong units (1 mark

3.

	Observations	Inference
(a)	Blue green flame √ (½ mark)	Cu^{2+} present √ (½ mark)
b(i)	White precipitate formed √ (½ mark Soluble in excess √ (½ mark)	Al^{3+}, Pb^{2+}, Zn^{2+} (All three mentioned √ (½ mark)
(ii)	White precipitate formed √ (½ mark) Soluble in excess √ (½ mark)	Zn^{2+} present √ (½ mark)
(iii)	White precipitate formed √ ½ mark) Insoluble on warming	SO_4^{2-} present √ (½ mark)
(iv)	White precipitate formed Insoluble on adding HCl √ (½ mark)	SO_4^{2-} present √ (½ mark)
(c)	Effervescence / bubbles produced √ (½ mark)	CO_3^{2-}, HCO_3^{--} , SO_3^{2-} present (Any of them √ ½ mark)
(d) (i)	Decolourise acidified √ ½ H^+ /$KMnO_4$ from purple √ ½	Presence of  Named 3 – 1 mark Named 2 – ½ mark but no mark if R- OH
(ii)	Sweet fruity smell √ (½ mark)	R – OH confirmed √ (½ mark)

3. (d) (III) $R - OH + CH_3COOH \xrightarrow{H_2SO_4\ (l)} CH_3COOR + H_2O$ √ (1 mark)