Name _____ Index No. _____

Candidate's signature _____

Date _____

**233/1**
**CHEMISTRY**
**PAPER 1**
**THEORY**
**JULY 2011**
**2 HRS**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 1**
**THEORY**
**2 HRS**

**INSTRUCTION TO CANDIDATES**

- Write your name and index number in the spaces provided .
- Answer ALL the questions in the spaces provided.
- 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 – 29 | 80 | |

***This paper consists of 12 printed pages***

***Turn Over***

1. The electron arrangement of ions $M^{3+}$ and $N^{2-}$ are 2 : 8 and 2 : 8 : 8 respectively.

(a) Write the electron arrangement of the elements. ( 2 marks )

M : _____

N: _____

(b) Write the formula of the compound that would be formed between M and N. ( 1 mark )

2. (a) Complete the table below.

| Species | Number of neutrons | No. of electrons |
|---|---|---|
| $^{3}_{2}He^{2+}$ | | |

(b) An element K has atomic number 15. Given its two ions $K^{3-}$ and $K^{3+}$. Identify the stable ion. Explain. ( 2 marks )

_____

_____

_____

_____

3. A fixed mass of a gas occupies $100cm^3$ at $-15^0C$ and 650mmHg. At what temperature will it have a volume of $150cm^3$ if pressure is adjusted to 680mmHg. ( 3 marks )

4. Using dots (.) and crosses (x) to represent outermost electrons, draw diagrams to show bonding in $H_3O^+$ and CO
(Atomic numbers H = 1, C = 6, O = 8) ( 2 marks )

5. Element E has two isotopes. Two thirds of a sample of E consists of $^{33}E$ and one third is $^{x}E$. Find x if the relative atomic mass of E is 32. ( 3 marks )

6. Name the following compounds: ( 3 marks )

(a) $CH_3CH_2CH_2CH_3$ _____

(b) $CH_3CHBrCHBrCH_2CH_3$ _____

(c ) $CH_3CH_2CH_2CH_2CH_2OH$ _____

7. Sulphur burns in air to form sulphur (IV) oxide. A simple energy level diagram for the reaction is given below. Study the diagram and answer the questions that follow.

(a) What do the following represent . ( 2 marks )

(i) $\Delta H_1$ _____

(ii) $\Delta H_3$ _____

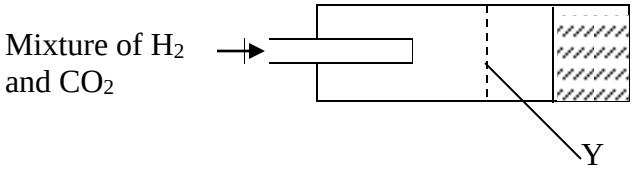
(b) Write an expression for $\Delta H_3$ in terms of $\Delta H_1$ and $\Delta H_2$.

_____

_____

_____

8. A mixture containing equal volumes of hydrogen and carbon (IV) oxide gases was introduced at one end of a tube as shown below.




Which gas would be detected at point Y first. Explain. ( 2 marks )

_____

_____

_____

_____

9. The catalytic oxidation of sulphur (IV) oxide is shown below.

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

Explain how pressure increase would affect the yield of $SO_{3(g)}$ ( 2 marks )

_____

_____

_____

_____

10. The curves shown below were obtained when two equal volumes of hydrogen peroxide of same concentration were allowed to decompose separately. In one case manganese (IV) oxide was added to the hydrogen peroxide.

Volume of gas I II Time

Which curve represents decomposition of hydrogen peroxide with manganese (IV) oxide? Explain. ( 2 marks )

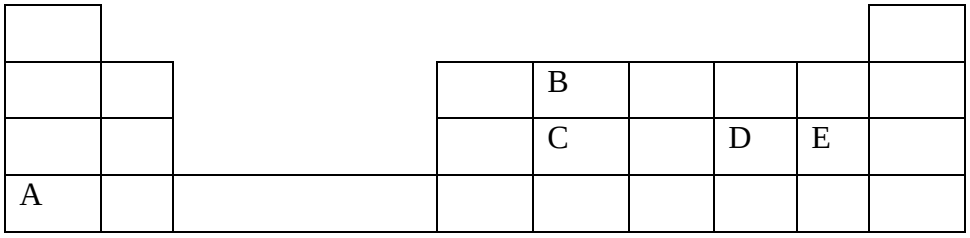
_____

_____

_____

_____

11. The grid below shows part of the periodic table. The letters do not represent the actual symbols of the elements.




(a) Select

(i) Two elements in the same group.

_____

_____

_____

(ii) Element with the largest atomic radius. _____

(iii) Most reactive non-metal _____ ( 3 marks )

(b) Show on the grid the position of element F which forms $F^{3-}$ ions with electronic configuration 2 : 8 : 8. ( 1 mark )

12. The table below shows the number of drops of soap solution needed to lather with $10cm^3$ of water.

| Sample | Cold water | Heated water |
|---|---|---|
| A | 5 | 5 |
| B | 6 | 2 |
| C | 2 | 2 |

(a) Identify the anions likely to be in:- ( 2 marks )

A _____

B _____

(b) State two methods used in removing temporary hardness of water. ( 1 mark )

_____

_____

_____

_____

13. A compound has an empirical formula $C_3H_6O$ and relative formula mass of 116.
(a ) Find its molecular formula.
(C = 12, O = 16, H = 1 ) ( 2 marks )

(b) Find the percentage composition of oxygen in the compound. ( 1 mark )

14. Study the flow diagram below for the preparation of copper carbonate and answer the questions below.

$CuO_{(s)} \xrightarrow[\text{Step I}]{X} Cu(NO_3)_{2(aq)} \xrightarrow[\text{Step II}]{L} CuCO_{3(s)}$

(a) Identify reagents ( 2 marks )
X _____

L _____

(b) Name the type of reaction exhibited in step I. ( 1 mark )
_____

(c ) Write an ionic equation for the reaction in step II. ( 1 mark )

15. The apparatus shown below is used in the chemistry laboratory.

(a) Name the apparatus _____ ( 1 mark )

(b) Explain how the shape of the apparatus is suitable for its function. ( 1 mark )

_____

_____

_____

16. The table below gives the rate of decay for a radioactive element (X)

| Number of days | Mass(g) |
|---|---|
| 0 | 384 |
| 270 | 48 |

Calculate the half-life of the radioactive element (X) (2 marks )

17. The general formula for homologous series of organic compound is $C_nH_{2n+1}OH$

(a) Give the name and structural formula of the fifth member of this series. ( 2 marks )

_____

_____

_____

(b) Write an equation for the complete combustion of the fifth member of the series. ( 1 mark )

_____

_____

_____

18. (a) Define molar enthalpy of solution. ( 1 mark )

_____

_____

_____

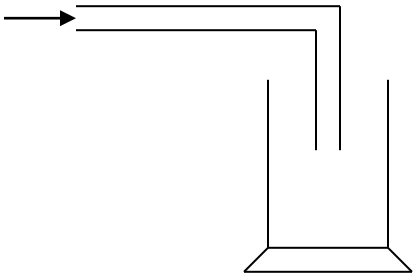
(b) Use the information provided below to calculate the molar enthalpy change of solution of an ionic solid NX:

$NX_{(aq)} \longrightarrow N^+_{(g)} + X^-_{(g)}$ : $\Delta H_1 = +766\ kJmol^{-1}$

$N^+_{(g)} \longrightarrow N^+_{(aq)}$ : $\Delta H_2 = -390\ kJmol^{-1}$

$X^-_{(g)} \longrightarrow X^-_{(aq)}$ : $\Delta H_3 = -381\ kJmol^{-1}$ ( 2 marks )

19. Study the set up shown below and answer the questions that follow.



(a) Name the method of gas collection shown above and state a gas collected by the above method. ( 2 marks )

Method of gas collection _____

Gas _____

(b) Which property of gas makes it possible to be collected by the method shown above. ( 1 mark )

_____

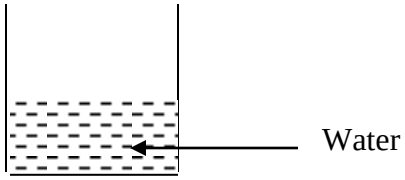
_____

_____

20. $20cm^3$ of a solution containing 4g per litre of sodium hydroxide was neutralized by $8cm^3$ of dilute sulphuric (VI) acid. Calculate the concentration of sulphuric (VI) acid in moles per litre ( Na = 23, O = 16 and H = 1 ) ( 3 marks )

21. (a) Complete the diagram below to show how a sample of aqueous solution of hydrogen chloride can be prepared in the laboratory . ( 1 mark )

HCl(g) ⟶ ═══════




(b) A few drops of lead (II) nitrate were added to the sample of the solution obtained above and the mixture warmed. State the observation made. ( 1 mark )

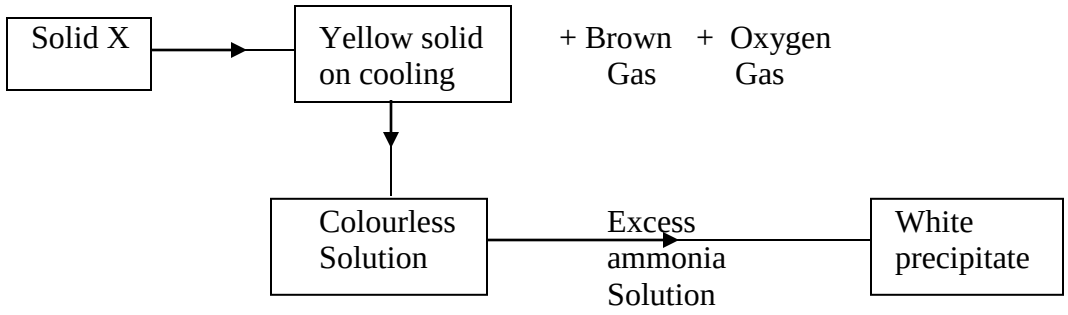
_____

_____

_____

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

(a)




Identify:

(i) Solid X _____

(ii) Yellow solid _____

(iii) White precipitate _____ ( 3 marks )

(b) What would have been observed if excess sodium hydroxide was added to the white precipitate. ( 1 mark)

_____

_____

_____

_____

23. Calculate the oxidation number of sulphur in $S_2O_3^{2-}$. ( 2 marks )

24. The table below shows the pH values of solution I, II, III and IV.

| Solution | I | II | III | IV |
|---|---|---|---|---|
| pH | 2 | 7 | 11 | 14 |

(a) Which solution is likely to be $Ca(OH)_{2(aq)}$ _____ ( 1 mark)

(b) Select two solutions in which a sample of $Al_2O_3$ is likely to dissolve. Give a reason for your answer. ( 2 marks )

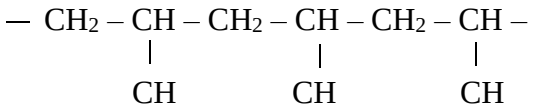
_____

_____

_____

_____

25. A polymer has the following structure



A sample of this polymer has a molecular mass of 5194. Determine the number of monomers in the polymer ( H = 1, C = 12, H = 14 ) ( 2 mark )

26. Give two properties of carbon (IV) oxide gas which makes it suitable for use in fire extinguishers. ( 2 marks )

_____

_____

_____

_____

27. Use the following half cell standard electrode potentials to answer the questions that follow.

| | $E^{\theta}$ |
|---|---|
| $J^{2+}_{(aq)} + 2e \longrightarrow J_{(s)}$ | -0.76v |
| $K^{2+}_{(aq)} + 2e \longrightarrow K_{(s)}$ | -0.13v |
| $L^{2+}_{(aq)} + 2e \longrightarrow L_{(s)}$ | +0.84v |
| $M^{2+}_{(g)} + 2e \longrightarrow M_{(s)}$ | +0.34v |

(a) Select the two half cells which when combined give the largest e.m.f. ( 1 mark )

_____

_____

_____

_____

(b) Calculate the e.m.f of the cell in (a) above. ( 1 mark )

(c ) Give the cell notation in (b) above. ( 1 mark )

_____

_____

_____

_____

28. The set up below was used to study some properties of air.

Moist iron wool Beaker Water Test tube

State and explain two observations that would be made at the end of one week. ( 2 marks )

_____

_____

_____

_____

29. The diagram below represents the set up that were used to study the effect of an electric current on pure water and copper (II) sulphate slution.
Platinum electrodes Pure water Copper (II) sulphate 1 2

State and explain the observations made when each experiment was started. ( 3 marks )

_____

_____

_____

_____

_____

_____

**233/1**
**CHEMISTRY**
**PAPER 1**
**THEORY**
**JULY 2011**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 1**

**MARKING SCHEME**

1. (a) M : 2 : 8 : 3 √1
N : 2 : 8 : 6 √1

(b) $M_2N_3$ √1 (3)

2. (a) Number of neutrons – 1 √ ½
Number of electrons – 0 √ ½

(b) $K^{3-}$ √1 : Has completely filled outer most energy level √1 ( 3 )

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

$T_2 = \frac{P_2V_2T_1}{P_1V_1}$ √1

$= \frac{680 \times 150 \times 258}{650 \times 100}$ √1

= 404.86K √1
Or = $131.86^0$C ( 3 )

4. (a) $H_3O^+$ O H H H √1

x– Oxygen electron
**.** – Hydrogen electron

***This paper consists of 5 printed pages***

***Turn Over***

(b) CO C O √1

x : Oxygen electrons
. : Carbon electron

5. $\frac{2}{3} \times \frac{11}{3} + {}^{1}/_{3}x = 32$ √1

$22 + {}^{1}/_{3}x = 32$

${}^{1}/_{3}x = 32 - 22$ √1

${}^{1}/_{3}x = 10$

$x = 30$ √1 (3)

6. (a) butane √1
(b) 2, 3- dibromopentane √1
(c ) Pentan-1-ol √1 (3)

7. (a) $\Delta H_1$ – Activation energy √1
$\Delta H_3$ – Enthalpy of combustion √1
(b) $\Delta H_3 = \Delta H_1 + \Delta H_2$ √1 (3)

8. - Hydrogen gas √1
- It is lighter than √ ½ $CO_2$. Hence moves faster √ ½ (2)

9. - Yield increases √
- Forward reaction is favoured √ / equilibrium shift to the right. (2)

10. I √1
Because manganese (IV) √1 oxide catalyses the reaction. Hence increasing its rate. (2)

11. (a) (i) B and C √1
(ii) A √1
(iii) E √1
(b) F √1 (between C and D ) ( 4)

12. (a) A – $SO_4^{2-}$ √
B – $HCO_3^-$ √

(b) (1) Boiling √ ½
(2) Distillation √ ½
(3) Addition of sodium carbonate (3)

13. (a) Mass of comp = 3 x 12 + 6 + 16
= 36 + 6 + 16
= 58 √ ½

n = $\frac{116}{58}$ = 2 √ ½

M.F = $(C_3H_6O)_2$ √ ½

= $C_6H_{12}O_2$ √ ½ (3)

(b) O ⟶ 16

Percent of Oxygen = $^{16}/_{58}$ x 100% √ ½

= 27.586% √ ½

14. (a) X – Nitric (V) acid √1

L – Sodium carbonate solution / $K_2CO_3$ solution / ammonium carbonate solution

(b) Neutralization reaction √ 1

(c ) $Cu^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} \longrightarrow CuCO_{3(s)}$ √1 (4)

15. (a) Conical flask √1

(b) It has a wide base √ ½ and narrow √ ½ mouth to avoid spilling of solution when swirled (2)

16. 384g x 192g x 96g x 48g

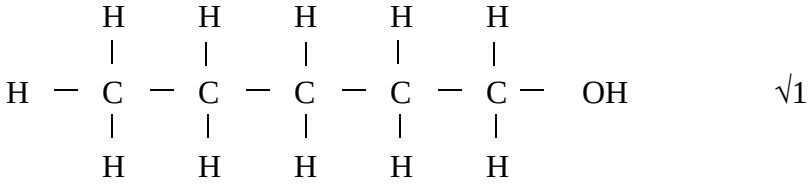
3x = 270 days √1

x = 90 days

∴ Half-life of the element : 90 days √1 ( 2 )

17. (a) (i) Pentan-1-ol √1

(ii)




√1

(b) $2C_5H_{11}OH_{(l)} + 15O_{2(g)} \xrightarrow{\text{Heat}} 10CO_{2(g)} + 12H_2O_{(g)}$ √1

18. (a) Molar enthalpy of solution is the enthalpy change that occurs when one mole of a substance dissolves in a solvent to give an infinitely dilute solution √1.

(b) ΔH solution = $\Delta H_1 + \Delta H_2 + \Delta H_3$

= + 766 – 390 – 381 √1

= -5kJmol$^{-1}$ √1

19. (a) - Downward delivery / upward displacement of Chlorine / $SO_2$ / $CO_2$

(b) Gas is denser than air

20. $2NaOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$

NaOH : Molarity = $\frac{4g/L}{40g}$ = 0.1M √ ½

No. of moles in $20cm^3$ of NaOH cont. $^{20}/_{1000}$ x 0.1 moles
No. of moles in $8cm^3$ of $H_2SO_4$ cont. ½ x $^{20}/_{1000}$ x 0.1M √ ½

$1000cm^3$ will be 10

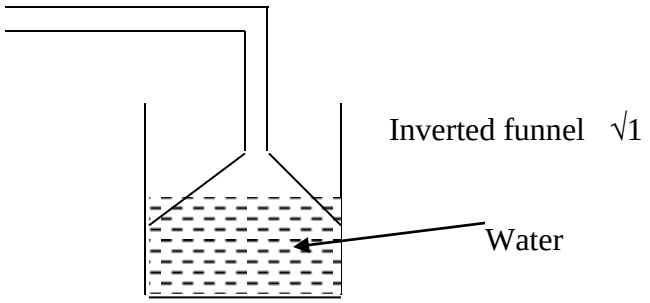
$\frac{1000}{1000}cm^3 \times \frac{1}{2} \times \frac{20}{1000} \times \frac{0.1M}{8}$ √ ½

1

$= {}^1/_8$ molar

= 0.125M √1 ½

21. (a)




(b) White precipitate was √ ½ formed which dissolved on warming √ ½ (2)

22. (a) (i) Lead (II) nitrate √1
(ii) Lead (II) oxide √1
(iii) Lead (II) hydroxide √1

(b) The precipitate disappears √1 due to the formation of $[ Pb (OH)_4 ]^{2-}$ complex
Or the precipitate disappears due to formation of complex ions. (4)

23. $2s + 3x – 2 = -2$
$2s + -6 = -2$
$2s – 6 + 6 = -2 + 6$ √
$2s = +4$
$S = + 2$ √ ( 2)

24. (a) III √1

(b) IV √ ½ and I √1
It is amphoteric √1 (3)

25. Monomer $CH = CH_2$ √
|
CH

Mass of monomer
= 12 + 14 + 12 +1 + 12 + 2
= 26 + 13 + 14
= 26 + 27 √
= 53

No. of monomer $\frac{=5194}{53}$ √

= 98 manomers (3)

26. - It doesn't support burning √
- It is denser than air √ (2)

27. (a) J and L half cells √1

(b) e.m.f = 0.84 – ( -0.76) √ ½
= 0.84 + 0.76 √ ½
= 1.6v

(c ) $J(s) / J^{2+}_{(aq)} // L^{2+}_{(aq)} / L_{(s)}$ √1 (3)

28. -Iron wool would turn brownish due to oxidation √1
- Water level in the test-tube will rise : Due to consumption of oxygen √1 (2)

29. In pure water √ ½ bulb does not light because no ions present √ ½ ( 1 mark )
Or
Pure water is a non-electrolyte
In copper (II) sulphate bulb √ ½ lights because free ions are present or
Copper (II) sulphate is a good electrolyte and has mobile ions.
( 3 marks )

Name _____ Index No. _____

Candidate's signature _____

Date _____

**233/2**
**CHEMISTRY**
**PAPER 2**
**THEORY**
**JULY 2011**
**2 HRS**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 2**
**THEORY**
**2 HRS**

**INSTRUCTION TO CANDIDATES**

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| QUESTIONS | MAXIMUM SCORE | CANDIDATE'S SCORE |
|---|---|---|
| 1 | 12 | |
| 2 | 15 | |
| 3 | 11 | |
| 4 | 12 | |
| 5 | 10 | |
| 6 | 10 | |
| 7 | 10 | |
| TOTAL CORE | 80 | |

***This paper consists of 13 printed pages***

***Turn Over***

1. Study the information in a table below and answer the questions that follow.
The letters do not represent the symbol of elements.

| Element | Atomic number | Melting point ($^0$C) |
|---|---|---|
| P | 11 | 97.8 |
| Q | 13 | 660 |
| R | 14 | 1410 |
| S | 17 | -40.6 |
| T | 19 | 63.7 |

(a) Write the electron arrangements for the ions formed by elements Q and S. ( 2 marks )

_____

_____

(b) Select an element which is

(i) The most reactive non-metal _____ ( 1 mark )

(ii) Can react with both acids and bases _____ ( 1 mark )

(c ) In which period of the periodic table does element T belong? ( 1 mark )

_____

_____

(d) Element T loses its outermost electron more readily than P. Explain. ( 2 marks )

_____

_____

_____

(e) Using dots (.) and crosses (x) to represent outermost electrons show bonding in the compound formed when R reacts with S. ( 2 marks )

(f) Explain why the melting point of element Q is higher than that of element P. ( 1 mark )

_____

_____

_____

(g) Describe how a solid mixture of the sulphate element T and lead sulphate can be separated into solid samples. ( 2marks )

_____

_____

_____

2. The diagram below represents the extraction of sulphur by Frasch process.
Study the diagram and answer the questions that follow.

L N M Sulphur deposists

(a) Name the substances that pass through L, M and N. ( 1½ marks )

_____

_____

_____

(b) What is the purpose of the substances that pass through L and M respectively L. ( 1 mark)

Through L:

_____

_____

_____

Through M :

_____

_____

_____

(c ) The properties of the two allotropes of sulphur represented by letters A and B are given in the table below. Study it and answer the questions that follow.

| | A | B |
|---|---|---|
| Appearance | Is bright yellow | Is pale yellow |
| Density $gcm^{-3}$ | 1.98 | 2.08 |
| M.P ($^0C$) | 119 | 113 |
| Stability ($^0C$) | Above 96 | Below 96 |

(i) Identify allotropes A and B. ( 1 mark )

A _____

B _____

(ii) What are allotropes ? ( 1 mark )

_____

_____

_____

(d) Give any two uses of sulphur . ( 1 mark )

_____

_____

_____

(e) The equation below shows the oxidation of sulphur (IV) oxide to sulphur (VI) oxide in the contact process

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ ; $\Delta H = -196kJ$

(i) Name a catalyst for this reaction _____ ( 1 mark)

(ii) State and explain the effect on the yield of sulphur (VI) oxide when

I) Pressure is increased. ( 1 ½ mks )

_____

_____

_____

II) Temperature is increased. ( 1 ½ mks )

_____

_____

_____

(iii) Describe how sulphuric (VI) acid is formed from sulphur (VI) oxide in the contact process. Use equations where possible. ( 2 ½ mks )

_____

_____

_____

_____

_____

_____

(f) State one environmental effect of having sulphur (VI) oxide in the atmosphere. ( 1 mark )

_____

_____

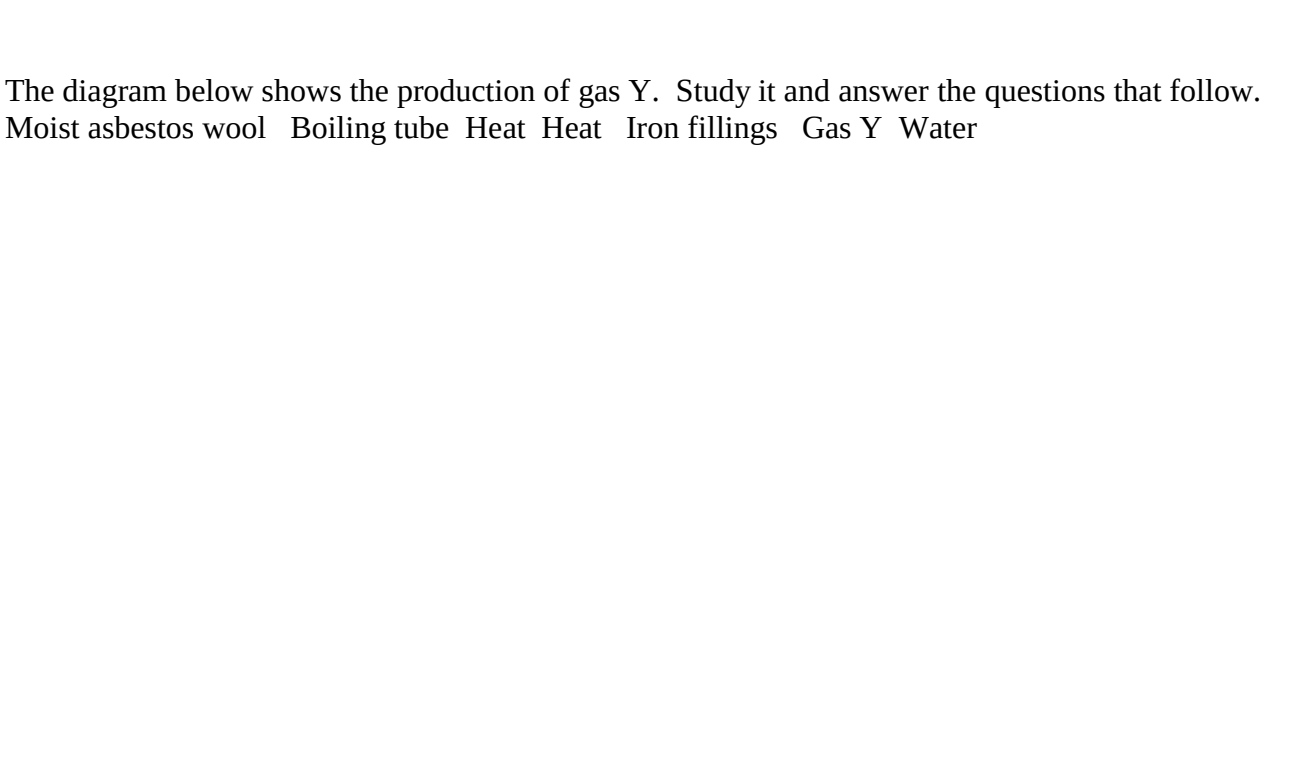
(g) If all the sulphur (VI) oxide produced was absorbed in concentrated sulphuric (VI) acid to form oleum.

$H_2SO_{4(l)} + SO_{3(g)} \longrightarrow H_2S_2O_{7(l)}$

Calculate the mass of oleum that was produced if 1050kg of $SO_{3(g)}$ are produced per day.

(S = 32, O = 16, H = 1 ) ( 2 marks )

3. The diagram below shows the production of gas Y. Study it and answer the questions that follow.




(a) Identify gas Y _____ ( 1 mark )

(b) Write a balanced equation for the reaction that produces gas Y. ( 1 mark )

_____

_____

_____

(c ) Describe a confirmatory test for gas Y. ( 1 mark )

_____

_____

_____

(d) State one property of gas Y which makes it possible for the gas to be collected as shown in the diagram. ( 1 mark )

_____

_____

_____

(e) State two uses of gas Y. ( 2 marks )

_____

_____

_____

_____

(f) A mixture of zinc (II) carbonate and potassium chloride was shaken with excess water and filtered. Which substance is the

(i) Residue _____ ( 1 mark )

(ii) Filtrate _____ ( 1 mark )

(iii) The dry residue was heated strongly in a test tube.

I) State what was observed. ( 2 marks )

_____

_____

_____

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

_____

_____

_____

4. Seven portions of $50cm^3$ of 2M solution hydroxide were placed in an insulated beaker and their temperatures noted. Different quantities of aqueous hydrochloric acid were added in each beaker (All at the same temperature) and the temperature rise in each case was observed. The heat change in each case was then determined. The results were recorded in a table as shown below.

(a)

| Beaker | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Volume of $NaOH_{(aq)(}cm^3)$ | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |
| Volume of $HCl_{(aq)}$ $cm^3$ | 20.0 | 40.0 | 60.0 | 80.0 | 100. | 120.0 | 140.0 |
| Heat evolved (kJ) | 1.1 | 2.2 | 3.4 | 4.5 | 5.6 | 5.6 | 5.6 |

(a) Plot a graph of heat change ( y axis ) against the volume of hydrochloric acid. ( 3 marks )

(b) Determine the number of moles in $50cm^3$ of the sodium hydroxide solution. ( 1 mark )

(c ) From the graph determine the volume of the acid required to completely neutralize $40cm^3$ of 2M sodium hydroxide. ( 1 mark )

(d) What is the concentration in moles per litre of the hydrochloric acid ? ( 2 marks )

(e) Calculate the molar heat of neutralization for the reaction. ( 2 marks )

(f) Draw a labelled energy level diagram for the neutralization reaction of aqueous sodium hydroxide and hydrochloric acid. ( 2 marks )

5. The diagram below shows the Downs cell used in the extraction of sodium metal from sodium chloride NaCl.

Sodium Molten sodium chloride Carbon anode Iron cathode

(i) Sodium chloride has a melting point of $801^0$C but the electrolysis is carried out at about $600^0$C. State briefly how this is achieved. ( 1mark )

_____

_____

_____

_____

(ii) Write down the equations of the reactions that occur at the electrodes. ( 1 mark )

_____

_____

_____

(iii) Name one use of by-product obtained in this process. (1 mark )

_____

_____

_____

(iv) Name the ore from which aluminium is

(i) Extracted. ( 1 mark )

_____

_____

_____

(ii) Explain how the ore is purified giving equations where necessary. ( 3 marks )

_____

_____

_____

_____

_____

_____

(iii) The ore free of impurities is electrolysed at $900^0$C yet its melting point is above $2000^0$C. Explain how this is achieved. ( 1 mark )

_____

_____

_____

_____

(iv) The anode used in the cell for extraction of aluminium, needs constant replacement . Explain why? ( 1 mark )

_____

_____

_____

6. Alkanes, alkenes and alkynes are hydrocarbons that can be obtained from crude petroleum.

(a) What is meant by hydrocarbons ? ( 1 mark )

_____

_____

_____

(b) Draw and name the third member of the alkene homologous series. ( 2 marks )

Structure

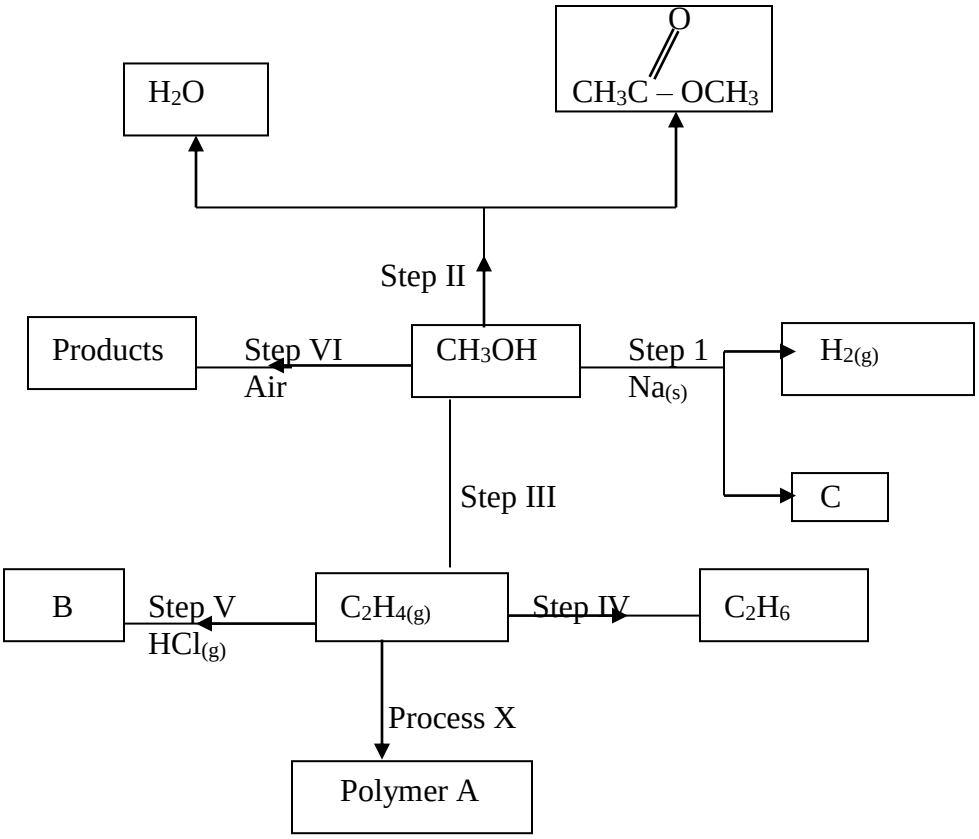
Name

_____

_____

_____

(c ) Study the flow chart below and answer the questions that follow.




(c ) Name;

(i) The type of reaction that occurs in step II. ( 1 mark )

_____

_____

_____

(ii) Substance B _____ ( 1 mark )

(d) Give the formula of substance C. ( 1 mark )

_____

_____

_____

(e) Give the reagent and the conditions necessary for the reaction in step (IV. ( 2 marks )

Reagent :

_____

_____

_____

Conditions:

_____

_____

_____

(f) (i) Name process X _____ (1 mark )

(ii) Give one disadvantage of the continued use of polymer A. ( 1 mark )

_____

_____

_____

7. (a) At $25^0$C, 50g of a salt X were added to 100g of water to make a saturated solution.

What is meant by a saturated solution ? ( 1 mark )

_____

_____

_____

(b) The table below gives the solubilities of salt X at different temperatures.

| Temperature ($^0$C) | 12 | 20 | 28 | 36 | 44 | 52 |
|---|---|---|---|---|---|---|
| Solubility g/100g water | 22 | 31 | 42 | 55 | 70 | 90 |

(i) Plot a graph of the solubility of salt X (Vertical axis against temperature ) ( 3 marks )

(ii) Using the graph,

I) Determine the solubility of salt X at $15^0$C. ( 1 mark )

II) Determine the mass of salt X that remained undissolved given that 80g of salt X were added to 100cm$^3$ of water and warmed to $40^0$C. ( 2 marks )

(c ) Determine the molar concentration of salt X at $15^0$C. (Assume that there is no change in density of water at this temperature; molar mass of salt X is 101) ( 3 marks )

**233/2**
**CHEMISTRY**
**PAPER 2**
**THEORY**
**JULY 2011**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 2**
**THEORY**

**MARKING SCHEME**

1. (a) $Q^{3+}$ 2.8
$S^{-}$ 2.8.8

(b) (i) Most reactive non metal Q
(ii) Element Q (amphoteric )

(c ) Period four (4) √ ( 1 mark )

(d) T has a larger atomic radius than P √1. Its outermost electron is not tightly held by the nucleus √1 ( 1 marks )

(e) S S S R S

1 mark for labelling R and S.
1 mark for showing correct electronic distribution

(f) The metallic bond in Q is stronger than that of P √ ½ because it has more valence electron √ ½

(g) Add water in the mixture and stir √. Shake the mixture well √ ½ . Filter the mixture √ ½ . Dry the mixture to obtain lead (II) sulphate √ ½ . Evaporate or crystallize the filtrate to obtain the sulphate of T √ ½

2. (a) L – hot compressed air √ ½
M – Super heated water √ ½
N – Molten sulphur √ ½

(b) L – Forces out the molten sulphur √ ½
M – Melts the sulphur √ ½

(c ) (i) A – Monoclinic sulphur √ ½
B – Rhombic sulphur √ ½

(ii) Allotropes are different forms of the same element without change of state √1.

(d) - Used in the manufacture of sulphuric (VI) acid. √ 1
- Used as a fungicide
- Used in manufacture of a bleaching agent used in paper industry to bleach wood pulp
- Used in vulcanization of rubber.
- Used in manufacture of dyes and fire works.

(e) (i) - Vanadium (V) oxide √
- Platinum

(ii) I) Yield increases √ ½ ; more molecules are forced to combine together hence √ 1increasing the yield // producing more sulphur (VI) oxide
II) Yield decreases √ ½ ; the extra heat decomposes the sulphur (VI) oxide √1 equilibrium shifts to the left // backward reaction is favoured.

(iii) - Sulphur (VI) oxide is <u>dissolved in concentrated</u> √ 1 $H_2SO_4$ to form oleum. then oleum is <u>diluted with water</u> to make sulphuric (VI) acid √ ½

$$SO_{3(s)} + H_2SO_{4(l)} \longrightarrow H_2S_2O_{7(l)} \surd ½$$

$$H_2S_2O_{7(l)} + H_2O_{(l)} \longrightarrow 2H_2SO_{4(aq)} \surd ½$$

(f) - Causes acid rain
Rej: Acidic rain
- It is poisonous // toxic // harmful
Rej: It causes lung cancer

(g) Mole ratio $H_2S_2O_7 : SO_3$ is 1 : 1
No. of moles of $SO_3$ = $\frac{1050000}{80}$ = 13125 moles √
Mass of oleum
13125 x 178 = 2336250g √ ½
= 2336.25kg

3. (a) Hydrogen √1

(b) $3Fe_{(s)} + 4H_2O_{(g)} \longrightarrow Fe_3O_{4(g)} + 4H_{2(g)}$
State Symbols missing ( ½ mark )
Unbalanced 0 mark

(c ) Introduce a burning wooden splint √ ½ into a test tube. If it turns with a pop sound, the gas √ ½ is hydrogen.

(d) It is insoluble or slightly soluble in water √1 ( 1 mark )

(e) - Manufacture of hydrochloric acid √1
- Manufacture of ammonia √1
- Hardening of oils to margarine ( hydrogenation)
- Oxy-hydrogen flame for cutting and welding steel.

Any two ( 2 marks )

(f) (i) Zinc (II) carbonate √ ( 1 mark )

(ii) Potassium chloride √ ( 1 mark )

(iii) I) Solid changed to yellow when hot and turned white when cold

II) $Zn\,CO_{3(s)} \longrightarrow ZnO_{(s)} + CO_{2(g)}$ √1

4. (b) $1000cm^3$ contain 2 moles

$50cm^3$ contain = $\frac{2 \text{ mol} \times 50cm^3}{1000cm^3}$ √ ½ = 0.1 moles √ ½

(c ) $100cm^3$ ( 1 mark )

(d) $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$ √ ½

Mole ratio NaOH : HCl

$1000cm^3$ contain 0.1 moles

$1000cm^3$ contain $\frac{0.1 \text{ mol} \times 1000cm^3}{100cm^3}$ √1 = 1.0 moles

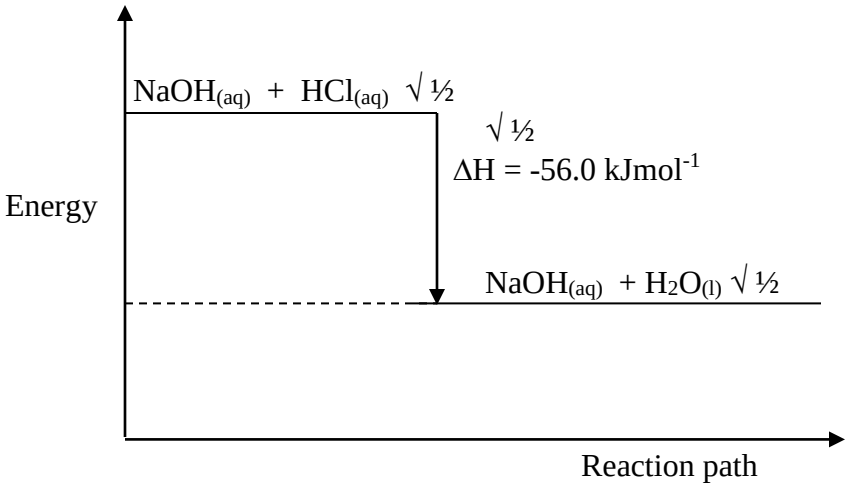
Molarity = 1.0M √ ½ ( 2 marks )

(e) 0.1 moles liberate 5.6kJ

1 mole liberates $\frac{5.6}{0.1}$ kJ √1 ½ = 56.0

$\Delta H = -56\ kJmol^{-1}$ √ ½ ( 2 marks )

(f)




( 2 marks )

Labelling of axes ( ½ mark )

A GRAPH OF HEAT CHANGE AGAINST VOLUME OF HCl

7 6 5 4 3 2 1 20 40 60 80 100 120 140 Volume HCl ($cm^3$) Heat change

7 points 1 mark
6 points ½ mark
Plot 1 mark
Curve 1 mark
Scale 1 mark
Max 3 marks

5. (a) (i) Addition of calcium chloride to lower temperature ( 1 mark )

(ii) $Na^{+}_{(l)} + e^{-} \longrightarrow Na_{(l)}$

$2Cl^{-}_{(l)} + 2e^{-} \longrightarrow Cl_{2(g)}$ ( 2 marks )

(iii) $Cl_{2(g)}$ Manufacture of hydrochloric acid / PVC pipes / disinfectant. ( 1 mark )

(b) (i) Bauxite ( 1 mark )

(ii) Ore is dissolved in hot concentrated sodium hydroxide and then filtered √1

$2NaOH_{(aq)} + Al_2O_{3(s)} + 3H_2O_{(l)} \longrightarrow 2NaAl(OH)_{4(aq)}$

Pure $Al(OH)_3$ is precipitated by bubbling carbon (IV) oxide

$2NaAl(OH)_4 + CO_2 \longrightarrow Na_2CO_3 + 2Al(OH)_3$ √1

The precipitate is then heated strongly

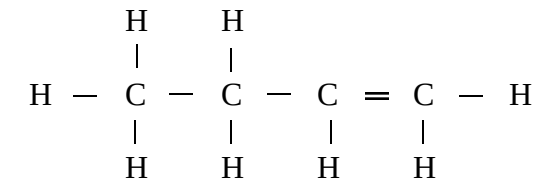
$2Al(OH)_{3(s)} \longrightarrow Al_2O_3 + 3H_2O_{(g)}$ √1 (3 marks )

(iii) The pure ore is dissolved in molten cryolite at $900^0$C. ( 1 mark )

(iv) It is constantly corroded by the discharged oxygen at the high temperatures decreasing its mass. ( 1 mark )

6. (a) Hydrocarbons are organic compounds that consists of carbon and hydrogen atoms only.

(b)



Name: But-1-ene

(c ) (i) Esterification // condensation

(ii) Chloroethane

(d) $CH_3ONa$

(e) Reagent;

Hydrogen gas √ ½

<u>Conditions</u>

Temperatures $150^0$C – $250^0$C √ ½

Pressure of 200 – 250 atmospheres √ ½

Catalyst : Nickel √ ½

Reject conditions if reagent is not named // given

(f) (i) Polymerisation

(ii) - Pollute the environment

- Produce poisonous gases when burnt

7. (a) - Is a solution that can not dissolve any more solute at a specific temperature.

(b) (i) Marking points
- Labelling of the two axes √1
- All points correctly plotted √1
  Five points correctly plotted √ ½
  4 and below points plotted – award zero
- Curve covering at least ¾ of grid
- Penalise fully if curve is extended to zero.
- If axes are inverted – award max 2 marks

(ii) I) Value read from the graph ±1
- Units must be correct, i.e, g/100g water
* If units are missing – peanalise ½ mark
* If value not shown how it was obtained from the graph – award zero.

II) Mass dissolved = value read from graph ±1.
∴ mass undissolved = 80 – value read from the graph
- Units should be in g ; if missing penalize ½ mark

(c ) R.M.M of X = 101
No. of mol of X in 100g water = $^{25}/_{101}$ = 0.2475 mol

No. of mol of X in 1000g water = 0.2475 x 1000
= 2.475M

Or

$$\frac{25}{101} \times \frac{1000}{100} = 2.475M$$

A GRAPH OF SOLUBILITY OF SALT x AGAINST TEMPERATURE
96 84 72 60 48 36 24 12 10 20 30 40 50 60
SOLUBILITY g/100g water TEMP ($^0$C)
Scale - 1 mark
Curve - 1 mark
Plot - 1 mark
6 point - 1 mark
5 points - ½ mark

Max ( 3 marks )

Name _____ Index No. _____

Candidate's signature _____

Date _____

**233/3**
**CHEMISTRY**
**PAPER 3**
**PRACTICAL**
**JULY 2011**
**2 ½ HRS**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 3**
**2 ½ HRS**

**INSTRUCTION TO CANDIDATES**

- Write your name and index number in the spaces provided above.
- Answer ALL the questions in the spaces provided in the question paper.
- You are not allowed to start working with apparatus for 15 minutes of the 2 ½ hours allowed for the paper. This time is to enable you to read the question paper and make sure you have all the apparatus and chemicals you need.
- All working must be clearly shown.
- Mathematical tables and electronic calculators may be used.
- All working must be clearly shown

**FOR EXAMINER'S USE ONLY**

| QUESTIONS | MAXIMUM SCORE | CANDIDATE'S SCORE |
|---|---|---|
| 1 | 22 | |
| 2 | 8 | |
| 3 | 10 | |
| TOTAL CORE | 40 | |

***This paper consists of 7 printed pages***

***Turn Over***

1. You are provided with;
   - Magnesium ribbon, solid E
   - 0.7M sodium hydroxide, solution F.
   - Sulphuric (VI) acid, solution G.

   You are required to determine the concentration of sulphuric (VI) acid in moles per litre.

Procedure A

- Using a burette, place 50.0$cm^3$ of sulphuric (VI) acid, solution G in a 100ml beaker.
- Stir the solution gently with a thermometer and measure its temperature after every half-minute.
- Record the values in table 1 below.
- Fold solid E and place it into solution G at exactly 1 ½ minutes
- Stir the mixture gently with the thermometer and measure the temperature of the mixture after every half minute and record the values in table 1.

(Retain the mixture for use in procedure B)

Table 1

| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ¼ | 4 | 4 ½ | 5 | 5 ½ | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature($^0$C) | | | | | | | | | | | | | |

( 4 marks )

(a) (i) Plot a graph of temperature (y-axis) against time. ( 3 marks )

(ii) Using the graph determine the highest change in temperature, $\Delta T$. ( 1 mark )

(iii) Calculate the heat change for the reaction given that the specific heat capacity of the mixture is 4.2$kJg^{-1}k^{-1}$ and that the density of the resulting solution is 1$g/cm^3$. ( 2 marks )

(iv) Given that the molar heat of reaction of sulphuric (VI) acid is 323kJmol$^{-1}$, calculate the number of moles of sulphuric (VI) acid that were used during the reaction ( 2 marks )

Procedure B

- Rinse the burette thoroughly and fill it with sodium hydroxide, solution F.
- Transfer all the contents of the 100ml beaker used in procedure A into a 250ml volumetric flask. Add distilled water to make up to the mark. Label this solution H.
- Using a pipette and a pipette filler, place 25.0cm$^3$ of solution H into a 250ml conical flask. Add two drops of phenolphthalein indicator and titrate against sodium hydroxide, solution F.
- Record your results in table 2 below.
- Repeat titration two more times and complete table 2.

Table 2

| | I | II | III |
|---|---|---|---|
| Final burette reading (cm$^3$) | | | |
| Initial burette reading (cm$^3$) | | | |
| Titre (cm$^3$) | | | |

( 3 marks )

Calculate the;

(a) Average volume of solution F used. ( 1 mark )

(b) The number of moles of:

(i) Solution F used. ( 1 mark )

(ii) Sulphuric (VI) acid in 25.0$cm^3$ of solution H. (1 mark )

(iii) Sulphuric (VI) acid in 250$cm^3$ of solution H. ( 1 mark )

(c ) (i) The total number of moles of sulphuric (VI) acid in 50$cm^3$ of solution G. ( 1 ½ marks)

(ii) The concentration of the original sulphuric (VI) acid, solution G in moles per litre. ( 1 ½ marks)

2. You are provided with solid K. Carry out the tests below and record your observations and inferences in the spaces provided. Divide solid K into two halves.

(a) Place one portion of solid K in a clean dry test-tube. Heat it gently then strongly.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(b) Place the other portion of solid K in a boiling tube, add 10cm$^3$ of distilled water and shake well until the solid dissolves.

(i) To 1cm$^3$ of solution K, add 2.0M sodium hydroxide drop wise until in excess.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(ii) Place another 1cm$^3$ of solution K in a test tube and add 3 drops of 2.0m sulphuric (VI) acid.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(iii) To another 1cm$^3$ of solution K in a test-tube, add 4 drops of 2.0M lead (II) nitrate solution and heat the mixture.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

3. You are provided with liquid J. Carry out the tests below and record your observations and inferences in the spaces provided.

(a) To 1cm$^3$ of liquid J in a test-tube add 1cm$^3$ of distilled water and shake thoroughly.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(b) To 1cm$^3$ of liquid J in a test-tube, add three drops of bromine water.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(c ) To 2cm$^3$ of liquid J in a test-tube, add 1cm$^3$ of acidified potassium dichromate (VI). Warm the mixture gently and allow it to stand for a minute.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(d) To 2cm$^3$ of liquid J in a test-tube, add a small solid sodium hydrogen carbonate.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

(e) To 2cm$^3$ of liquid J in a test-tube, add 2cm$^3$ of ethanol followed by a few drops of concentrated sulphuric (VI) acid.

| Observations | Inferences |
|---|---|
| | |

(1 mark ( 1 mark )

**233/3**
**CHEMISTRY**
**PAPER 3**
**PRACTICAL**
**JULY 2011**

**KIBWEZI SECONDARY SCHOOLS EXAMINATION**
**CHEMISTRY**
**PAPER 3**

**MARKING SCHEME**

1. Procedure A

Marks distribution

- Complete table ( 1 mark )

Penalties

- Penalise ½ mark once for any space not filled
- At least 6 points should be given.
- Otherwise penalize fully.
- Penalise ½ mark once for unrealistic temperature reading ( less than $10^0$C or greater than $40^0$C) as initial temperature.
- If temperature readings are all constant from t =0 min to t = 5 mins, penalize ½ mark.
- Use of decimals – 1 mark

Conditions

- Accept temperature readings only if consistently given as either whole number or to 1 decimal place

Note: The decimal place has to be either 0 or 5.

Accuracy ( 1 mark )

- Compare the teacher's value to student's temperature reading. Should be within $\pm 1^0$C.

Trends ( 1 mark )

- If temperature reading from minute 2 rises to a maximum.

Graph

Marks distribution

- Labelling of axes ( 1 mark )

Penalties

- Penalise fully for inverted axes
- Penalise fully if wrong units are used.

Scale ( conditions )

- Area covered by graph should be at least $^2/_3$ of the grid provided.
- Scale interval must be consistent.

Plotting

- If 10 to 12 points are correctly plotted. ( 1 mark)
- If 7 to 9 points correctly plotted ( 1 mark)
- If less than 7 points correctly plotted ( 0 mark )

(ii) Maximum change in ΔT ( 1 mark )

Conditions

- Accept if the ΔT value is shown how it was obtained from the graph.

(iii) $\Delta H = 50 \times 4.2 \times$ ans (ii) √1 = correct answer √1

Or

$\Delta H = \frac{50 \times 4.2 \times \text{ans}}{100}$ √1 (ii) = correct answer √1

Note:

- Accept the correct transfer of ΔT even if rejected at (ii) above.
- Units may not be shown but if shown must be correct ($kJmol^{-1}$)

(iv) $\frac{\text{Answer (iii)}}{323}$ √1 = correct answer √1

Or

$\frac{\text{Answer (iii)}}{323000}$ √1 = correct answer √1

Note

- Accept answer given to at least 4 decimal places.

**Procedure B**

Marks distribution

- Complete table – 1 mark
- Complete table with 3 consistent titrations.
- Only 2 titrations done – ( ½ mark )
- Only 1 titration done – ( 0 mark )

Penalties

- Wrong arithmetic.
- Inverted table
- Burette reading beyond $50cm^3$.
- Unrealistic titre values if below $1.0cm^3$.
- Use of decimals – tied to the 1st and 2nd rows only. ( 1 mark )

Conditions

- Accept 1 or 2 decimal places consistently used.
- If 2 decimal places are used the 2nd decimal place must be a 0 or 5.

Accuracy √1 ( 1 mark )

Compare candidates value with teacher's value.

Conditions:

Values must be within $\pm 0.1cm^3$.

Principles of averaging ( 1 mark )

Values averaged must be shown and must be within ±0.2 of each other

Note

- If 3 values are possible and only 2 are averaged ( 0 mark )
- If 3 titrations are done and are inconsistent and averaged ( 0 mark )

Final answer. Tied to correct average titre. ( 1 mark )

(b) (i) Moles of solution F used = $\frac{0.7 \times \text{titre value}}{1000 \quad \surd 1}$

= correct ans. √1

(ii) Mole ratio of $H_2SO_4$: NaOH = 1 : 2 √ ½

∴ moles of $H_2SO_4$ = Ans (i) x ½ √ = correct ans √ ½

(iii) Moles of $H_2SO_4$ in 250$cm^3$ of solution H

= $\frac{\text{ans (ii)} \times 250 \surd}{25}$ = correct ans √ ½

Or

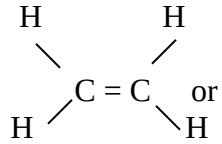
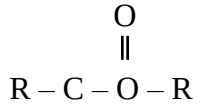
Ans (ii) x 10 = correct ans

(c ) (i) answer A

(ii) Ans $\frac{\text{c (i)} \times 1000}{50}$ = correct ans

| | | |
|---|---|---|
| 2. | (a) Colourless liquid condenses on cooler parts of the test tube<br>White residue<br>Any 2 – ½ mark each<br>Reject – water / moisture forms on cooler parts of the test tube | Hydrated salt / water of crystallization ( 1 mark ) |
| | (b) (i) White precipitate ½ mark<br>Insoluble in excess √ ½ mark | $Ca^{2+}$ or $Mg^{2+}$ likely to be present ( 1 mark )<br>Note<br>Ignore mentioning $Ba^{2+}$<br>Accept mention of $Al^{3+,}$ $Pb^{2+}$ or $Zn^{2+}$ as absent for 1 mark |
| | (ii) No white precipitate is formed √1<br>Reject<br>No observable change<br>No precipitate formed | Presence of $Mg^{2+}$ 1 mark<br>Note<br>Accept absence of $Ca^{2+}$ for ½ mark |
| | (iii) White precipitate √ dissolves on boiling √ 1 mark<br>Reject<br>Dissolve in excess | $Cl^-$ present 1 mark<br>Tied to dissolving on boiling<br>penalize fully for any contradictory ion. |
| | 9 marks | |

3.

| | |
|---|---|
| (a) Liquids are miscible / no separation / no separate layers.<br>Accept: Dissolves in water / forms a solution<br>Reject: No observable change / no change ( 1 mark ) | Polar compound / polar organic compounds<br>( 1 mark ) |
| (b) Colour of bromine water remain / no decoloirization.<br>( 1 mark ) | Absence of  or<br>- C ≡ C –<br>- Saturated compound present<br>- Alkene / alkyne absent<br>- Reject: C = C / C ≡ C<br>(1 mark) |
| (c ) Orange colour persist / remain the same √<br><br>Reject: Yellow colour persists<br>Accept: √ Orange colour of the dichromate does not turn / change to green for √ (1 mark ) | Absence of R – OH √ (1 mark )<br><br>Note: Penalize for any other contradictory functional group. |
| (d) Effervescence occurs / bubbles formed / fizzing<br>Reject: hissing.<br>( 1 mark ) | Presence of – COOH / $H^+$ / $H_3O^+$<br>Accept: acidic compound ( 1 mark )<br>Organic acid / carboxylic acid / acidic solution for<br>( 1 mark) |
| - A sweet smell produced √<br>( 1 mark) | - Presence of an ester<br>  <br>  <br>- Presence of - C – OH in J<br>(1 mark) |