NAME …….. INDEX NO ……..

Candidates signature ……..

Date ……

GATUNDU SOUTH SUB-COUNTY FORM FOUR 2015 EVALUATION MARKING SCHEME

233/1

CHEMISTRY

PAPER 1

(THEORY)

TIME; 2HRS

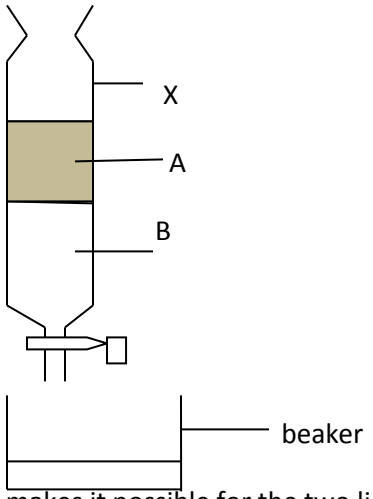
Instructions;

- Answer all the questions in the space provided
- Mathematical tables or electronic calculators may be used
- All working must be clearly shown where necessary
- Candidates may be penalized for not following instructions in this paper

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1-28	80	

THIS PAPER CONSISTS OF 13 PRINTED PAGES

1. The diagram below represents a method of separation used to separate two liquids A and B. use it to answer the questions that follow



a) Name two properties that makes it possible for the two liquids to be separated. (2mks)

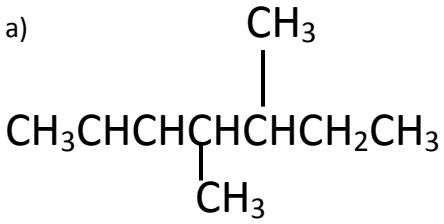
- *Different densities* ✓
- *Are immiscible* ✓

b) Give one alternative method that may be used to separate the two liquids. (1mk)

- *Decantation/use of a dropper* ✓

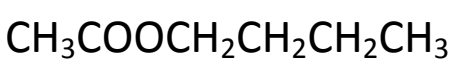
2. Name the following organic compounds (2mks)

a)



4,5-dimethylhept-2-ene ✓

b)



butylethanoate ✓

3. Name the following processes;
   a) When anhydrous calcium chloride is left in an open beaker overnight a solution was formed. (1mk)
      - *deliquescence* ✓
   b) When sodium carbonate decahydrate crystals are left in an open beaker for some days it turned into a powder. (1mk)
      - *efflorescence* ✓

4. In 35 seconds, it was found that $140cm^3$ of nitrogen (N_2) had diffused through a strip of porous porcelain. How long will it take $400cm^3$ of carbon (IV) oxide to diffuse through the same strip of porous porcelain (3mks)

35s ……..$140cm^3$? ✓

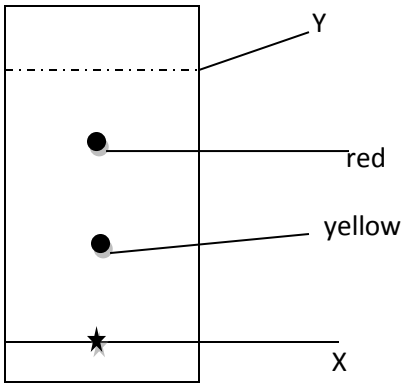
? $400cm^3$

$\frac{35\times400}{140}$ =100sec ✓

$\frac{X}{100} = \sqrt{\frac{44}{28}}$ ✓

X =125.4 sec ✓

5. The chromatogram below shows the constituents of a flower extract. Study it and answer the questions that follow



   a) Explain the different positions of red and yellow pigments. (2mks)
      - *The red dye is highly soluble and less sticky* ✓
      - *The yellow dye is less soluble and highly sticky* ✓

b) What does lines X and Y represent (1mk)

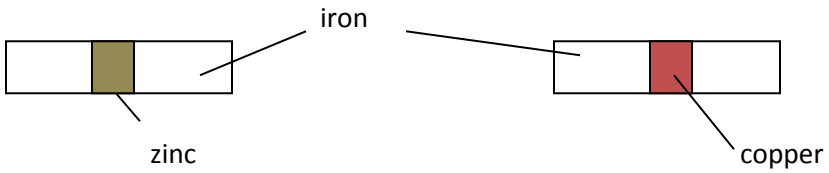
X – base line/origin ✓

Y –solvent front ✓

6. Name the chief ore of iron and write its formula (2mks)

Iron pyrites ✓ *($Fe_2O_3.3H_2O$)* ✓

7. In an experiment, two pieces of iron sheets were wrapped in each case with zinc and copper metal sheets as shown below. They were left in the open for some months.



(I) (II)

State and explain the observations made in the experiments; (3mk)

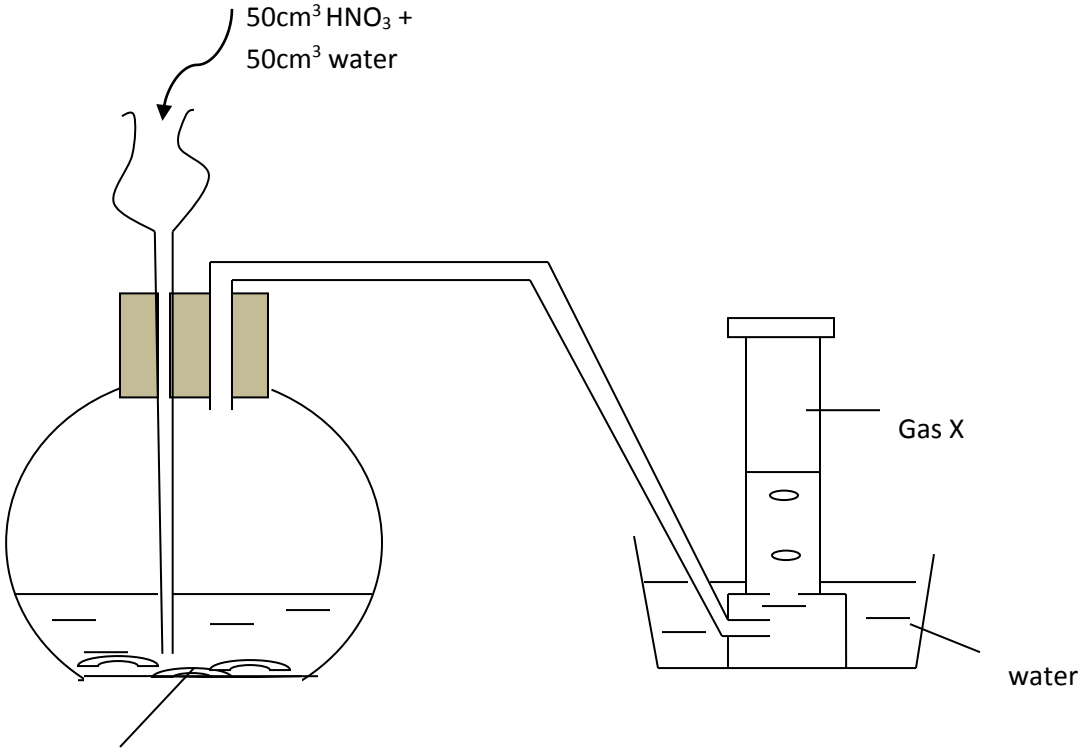
(I) No rusting. Zinc is above iron in the reactivity series ✓ ✓

(II) Rusting occurs. Iron is more reactive than copper ✓ ✓

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

- *Sodium is larger than magnesium. Magnesium has a higher nuclear charge than sodium and its outer energy level is more attracted towards the nucleus compared to sodium.* ✓ ✓ ✓

9. The set up below was used to prepare gas X. study it and answer the questions that follow;



a) Name gas X - *nitrogen(II) oxide* ✓ (1mk)

b) Write an equation for production of gas X in the set up (1mk)

$HNO_{3\,(aq)} + Cu_{(s)} \xrightarrow{\checkmark} Cu(NO_3)_{2\,(aq)} + H_2O_{(l)} + NO_{(g)}$

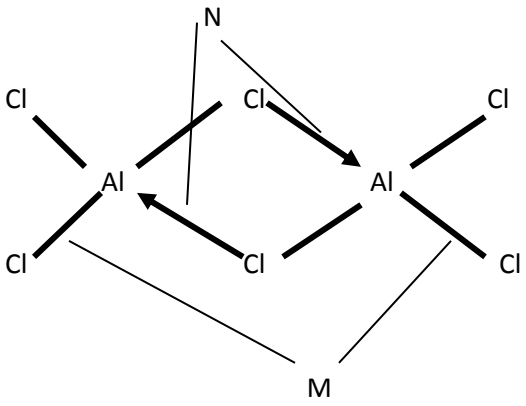
c) It's hard to test whether gas X supports burning using a glowing splint. Explain. (1mk)

Readily combines with oxygen to form nitrogen (IV) oxide ✓

10. 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)

$[Cu(NH_3)_4]^{+2}$ ✓ *tetra-amminecopper (II) ion* ✓

11. The diagram below represents the structure of aluminium chloride.



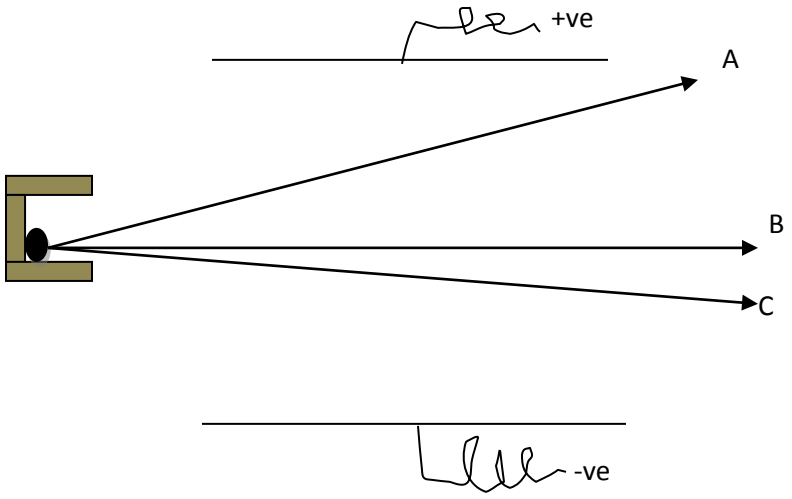
a) Identify the bonds labeled M and N. (2mk)

- *M -covalent* ✓
- *N –dative/coordinate* ✓

b) What is the difference between bonds M and N (1mk)

- *Covalent bond involves sharing of electrons donated by both. In dative the shared pair is donated by one.* ✓

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



a) Name particles A and B

i) A -beta ✓ *(1mk)*

ii) B-gamma ✓ *(1mk)*

b) What property of B makes it not to be deflected by magnetic/electric field (1mk)

- *Has no charge* ✓

13. The table below shows the first ionization energies of elements Y and Z.

Element	**Ionization energy kJ/mol**
Y	494
Z	418

a) What is ionization energy? (1mk)

- *The minimum energy required to remove **one mole** of electrons from the outermost energy level of atoms in gaseous state.*

b) Which of the two elements is the most reactive? Explain (2mks)

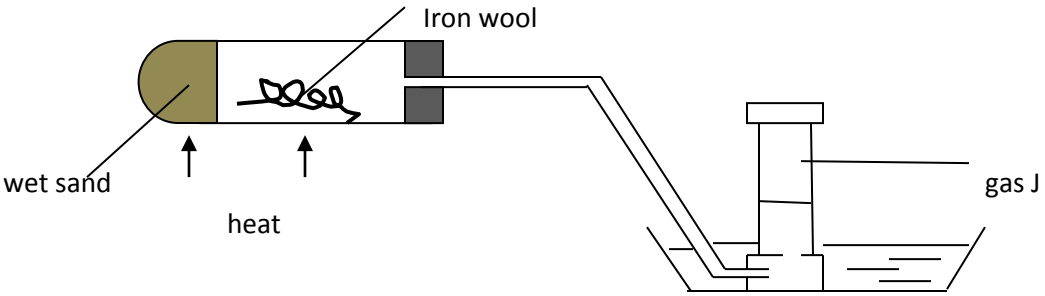
- *Z. lower ionization energy*

14. The standard enthalpies of combustion of ethyne (C_2H_2), carbon (c) and hydrogen (H_2) are -1300,-394 and -286 kJ/mol respectively. Calculate the enthalpy of formation of ethyne. (3mks)

Cycle/energy diagram ……..

2(-394) +(-286) +1300 =+226kJ/mol

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



a) Name gas J (1mk)

- *hydrogen*

b) Explain why its important to heat the wet sand before heating the iron wool. (1mk)

- To drive out air in the tubes

c) Name the product formed in the combustion tube. (1mk)

- *Tri-iron tetraoxide*

16. An element X has a relative atomic mass of 44. When a current of 0.5 A was passed through the molten chloride of X for 32 minutes and 10 seconds, 0.22g of X were deposited at the cathode

Determine the charge on an ion of X (1F=96,500c) (3mks)

Q=it =0.5× (32×60+10)=965c

965c …… 0.22g

? ……. 44g

193000c

$\frac{193000}{96500}$ = 2F charge = +2

17. Study the reaction below and answer the questions that follow

$2NO_2$ (g) $\rightleftharpoons$ N_2O_4 (g) ΔH = -ve

a) State and explain the observation made when a mixture at equilibrium is heated. (2mks)

- *Brown colour intensifies. The equilibrium shifts to the right to consume the excess heat.*

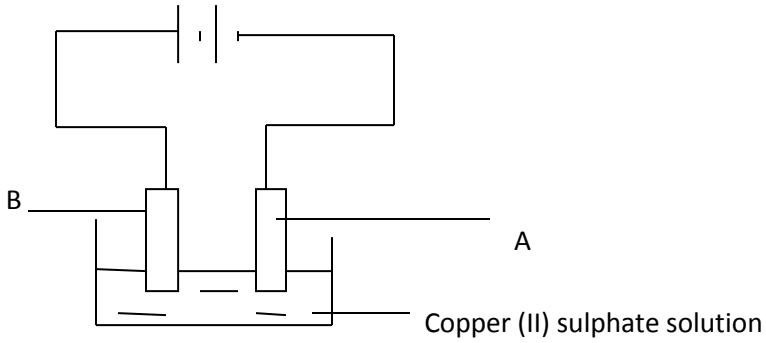
b) *If pressure is exerted at the mixture at equilibrium, what* ***observation will be made? (1mk)***

- ***Yellow colour intensifies***

18. State and explain the trend in the boiling points of group (VII) elements down the group. (2mks)

- *Increases down the group. Molecular mass and size increases down the group. Intermolecular forces of attraction increases down the group*.

19. The diagram below shows electrolysis of dilute copper (II) sulphate solution using copper electrodes;



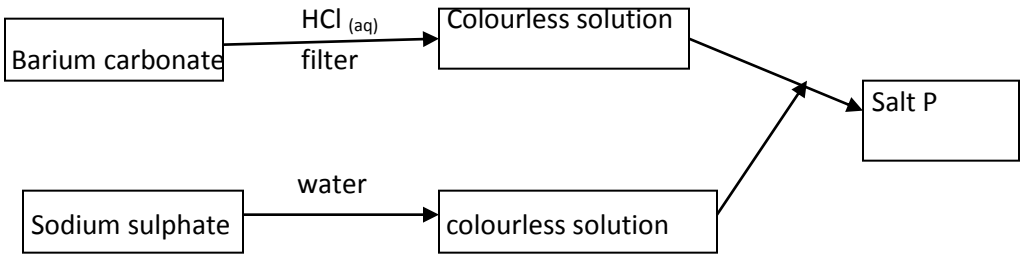
a) State the observations made at electrode A and B (2mks)

A- A brown solid is deposited/ mass increases ✓
B- Becomes depleted/ goes into the solution ✓

b) Write the equation of reaction at electrode A (1mk)

$Cu^{2+}_{(aq)} + 2e^{-} \longrightarrow Cu_{(S)}$ ✓

20. The flow chart shows a process of preparation of salt P.



a) Name salt P. *barium sulphate* ✓ (1mk)

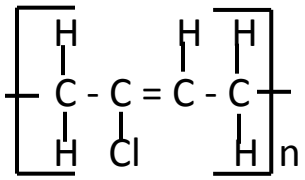
b) What type of reaction takes place in the formation of salt P. (1mk)

- *Precipitation/double decomposition* ✓

c) Write the equation for the reaction that forms salt P. (1mk)

$BaCl_{2(aq)} + Na_2SO_{4\ (aq)} \longrightarrow BaSO_{4\ (S)} + 2\ NaCl_{\ (aq)}$ ✓

21. The structure of synthetic rubber is shown below;



a) Determine the relative molecular mass of a polymer made of 250 monomers (2mks)
(c=12,H=1 and Cl=35.5)

RFM =88.5 ✓

88.5×250=22125 ✓

b) Give one advantage of natural polymers over synthetic ones. (1mk)

- *Are biodegradable* ✓

22. 0.92g of ethanol were found to burn in excess air producing a temperature rise of 32.5^{o}C in 200cm^3 of water(C=12.0,H=1.0, O=16.0) Density of water is 1g/cm^3, specific heat capacity of water is 4.2KjKg^{-1}K^{-1}

(a) Write the equation for the combustion of ethanol (1mk)

$C_2H_5OH_{\ (l)} + 3\ O_{2\ (g)} \longrightarrow 2CO_{2\ (g)} + 3\ H_2O_{\ (l)}$ ✓

(b) Determine the molar heat of combustion of ethanol (2mks)

$\frac{200\ kg \times 4.2\ kJ/kg/K \times 32.5K}{1000} = 27.3kJ$ ✓

0.92 ……..27.3kJ *=1365Kj/mol* ✓

46g ……? ✓

23.

a) The formula for cane sugar is ($C_{12}H_{22}O_{11}$). Use an equation to show what happens when sugar is added to conc. Sulphuric (VI) acid (1mk)

$C_{12}H_{22}O_{11\ (s)} \xrightarrow{H_2SO_{4\ (l)}} 12\ C_{(s)} + 11H_2O_{(l)}$ ✓

b) What name is given to the type of reaction above? (1mk)

- *dehydration* ✓

c) Calculate the oxidation state of sulphur in sodium thiosulphate ($Na_2S_2O_3$) (1mk)

2+x-6=0 ✓ *x=+4* ✓

24. Iron (III) chloride can be prepared in the laboratory by passing dry chlorine gas over hot steel wool.

a) Name the above method of preparing salts (1mk)
Direct synthesis ✓

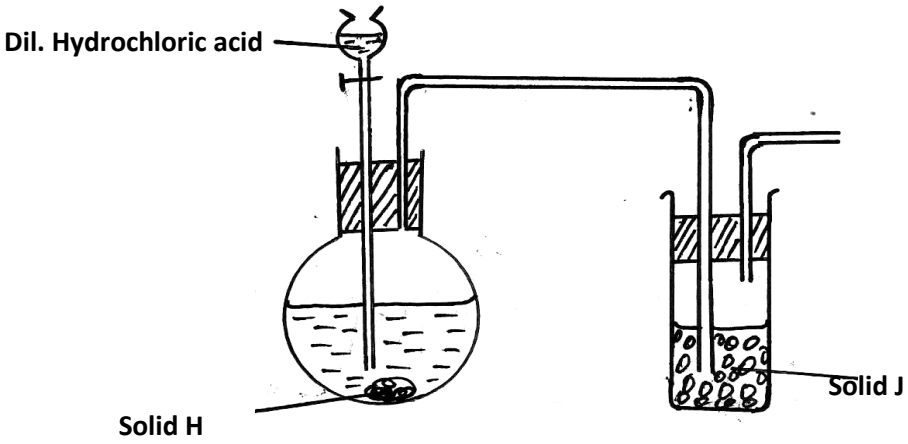
b) Why should we prepare the salt in a dry environment? (1mk)

- *Iron (III) chloride reacts with water vapour* ✓

c) A solution of iron (III) chloride in water changes a blue litmus paper to red. Explain. (1mk)

- *Iron (III) chloride is hydrolysed by water to form HCl acid* ✓

25. The set-up below was used to prepare dry sample of hydrogen Sulphide gas



(a)(i) Complete the diagram to show how the gas was collected (2mks)

Drying agen ✓ *collection* ✓

(ii) Identify the following

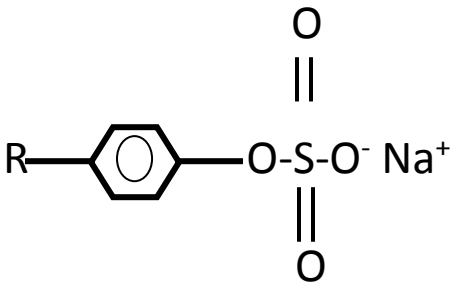
I: Solid H ($^1/_2$mk)

- *Iron (II) sulphide* ✓

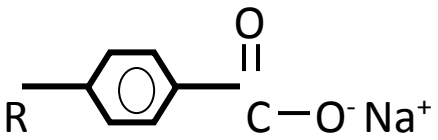
II.Solid J ($^1/_2$mk)

- *Anhydrous calcium chloride* ✓

26. Study the structures below and answer the questions that follow.



structure A



structure B

a) Which structure represents a detergent suitable for washing in water containing calcium ions? (1mk)

- *A*

b) Give one advantage of continued use of detergent B over A (1mk)

- *biodegradable*

c) Name the process of manufacturing detergent B (1mk)

- *saponification*

27. Aluminium is used in making cooking vessels and overhead cables. State the property of aluminium that makes it suitable for the two uses separately.

Cooking vessels. (½ mk)

- *Malleable/ not easily corroded*

Overhead cables (½ mk)

- *ductile*

(b) Explain why it is not advisable to clean surfaces of cooking vessels made of aluminium using wood –ash solution (2mks)

- *Has a coat of aluminium oxide which is amphoteric which reacts with woodash (basic)*

28. 10g of an oxide of sodium contains 5.9g sodium. Its molar mass is 78. Determine its molecular formula.

(3mks)

Na	O	
		NaO
5.9	4.1	
		$39n = 78$
0.2565	0.2565	$n=2$
1	1	Na_2O_2

29. Differentiate between the terms atomic number and mass number (2mks)

- Atomic number – number of protons
- Mass number- protons + neutrons

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GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

233/2
CHEMISTRY
PAPER 2
THEORY
JULY/AUGUST 2015

MARKING SCHEME

1. a) (i) Hydrogen
   (ii) Reducing agent
   (iii) Tube I $CUSO_4 5H_2O \longrightarrow CUSO_{4(s)} + 5H_2O$

   Tube II $3Fe_{(s)} + 4H_2O_{(g)} \longrightarrow Fe_3O_4 + 4H_{2(g)}$

   b) (i) Blue solid turns white/colourless liquid; loss of water of crystallization.

   Combustion III
   Black solid turns brown. copper (ii) oxide reduced to copper metal.

   c) (i) To produce steam
   (ii) hydrogen
   (iii) water
   (iv) Decrease the freezing point of water
   (v) Hydrogen is flammable

2. a) (i) Metal K - zinc
   (ii) Acid A- dilute sulphuric (vi) acid
   (iii) Salt C- zinc sulphate

   b) (i) A solution that cannot dissolve any more of solute at given temperature.

   (ii) Allow crystallization.

   (iii) Dip a glass rod when heating. Allow solution on glass rod to cool. Formation of crystal.

   c) To ensure all the acid have reacted.

   d) Filtration: To remove excess metal K.

   e) W1 Zinc hydroxide
   W2 Barium sulphate
   S1 Tetra ammine zinc (ii) hydroxide

   f) Step I $Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$

   $Zn(OH)_{2\,(s)} + 4NH_{3(aq)} \longrightarrow (Zn(NH_3)_{4(aq)}^{2+} + 2OH^-_{(aq)}$

3. a(i) It can exist in several forms without change of state.

(ii)

Rhombic	Monoclinic
Octahedral	needle like
Melting point 114^o C	melting point 119^o C
Stable below 96^o C	Stable above 96^o C

Any 2 correct answers

(iii) Brown fumes, pale yellow liquid or colourless liquid.

Equation

$$S_{(s)} + 6HNO_3 \longrightarrow H_2SO_{4(aq)} + 6NO_{2(g)} + 2H_2O_{(l)}$$

b) I. (i) A Sulphur
B Oxygen

(ii) X burner/Roaster
Y Absorption tower

II. (i) Dust particles, carbon (iv) oxide/water vapour

(ii) To avoid poisoning of the catalyst.

(iii) Platinum/vanadium (v) oxide.

(ii) High pressure
Low temperature 400 – 500 ^{o}C

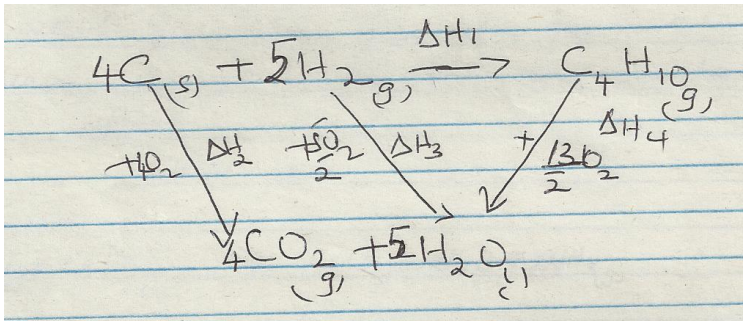
4. a) This is heat absorbed/evolved/heat change when one mole of any substance is formed from its constituent elements.

b) (i) $4C_{(s)} + 5H_{2(g)} \longrightarrow C_4H_{10(g)}$

(ii) $C_4H_{10(g)} + {}^{13}/_2O_{2(g)} \longrightarrow 4CO_{2(g)} + 5H_2O_{(l)}$

c) (i) Hess's law states that the enthalpy change is the same in converting reactant to product regardless of the route followed.

(ii)



(iii) $\Delta H_1 = \Delta H_2 + \Delta H_3 - \Delta H_4$

4(-393) + 5(-286) – (-2877)
= -3002 + 2877
-125Kj/Mol

d) ΔH_1 lattice energy
ΔH_2 hydration energy

(ii) $\Delta H_{sol} = \Delta H_{lattice} + \Delta H_{hydration}$

= 690 + (-322 + -364)
= 690 – 686
- 4Kj/Mol

5. a) The flask should have been in a sloppy position <u>reason</u> - to prevent water that condenses in the cooler parts from flowing back into the hot flask
- method of collection of the dry gas.
<u>Reason</u>; ammonia is less dense than air hence escapes upwards. .

b) Calcium oxide

c) $2NH_4Cl_{(s)} + Ca(OH)_{2(s)} \longrightarrow CaCl_{2(s)} + 2H_2O_{(l)} + 2NH_{3(g)}$

d (i) Finely divided iron (ii) A NO
unit I B NO_2

(iii) $NH_{3(g)} + HNO_{3(aq)} \longrightarrow NH_4NO_3$

RFM NH_4NO_3 = 14 + 4+ 14 + 48 = 80g

Moles = $\frac{1000,000g}{80}$ = 12,500

Moles of HNO_3 = 12,500 RFM = 1 + 14 + 48 = 63g

12,500 = m/63 63 x 12,500 = 787,500g = 787.5kg

(iv) Easily decomposes in light hence the dark bottles prevent exposure.

6. (i) Cuprite/chalcocite/malachite any 2 correct

(ii) Froth flotation
Use: Concentrate the ores

(iii) $2CuFeS_{2(s)} + 4O_{2(g)} \longrightarrow 3SO_{2(g)} + 2FeO_{(s)} + CU_2S_{(s)}$

b) (i) Anode: Impure copper
Cathode: pure copper
Electrolyte: Copper (ii) Sulpahte

(ii) Anode: $Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e$

Cathode $Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)}$

(iv) 64g – 2 moles of e-
1 mole – 96500c
32g 1 mole i.e.
96500 = 10 x t
9650 sec = t

c) – Making copper wires and contact in switches
- making soldering instruments
- Manufacture of alloys
- Making coins and ornaments

Any 1 correct

GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

CHEMISTRY PAPER 3 PRACTICAL

MARKING SCHEME

TABLE 1

Complete table ----------1mrk

(i)Complete the table with 3 titrations done –(1mrk)

(ii) Incomplete table with 2 titrations done ---(1/2mrk)

(iii)Incomplete table with 1 titration done –(0mrk)

Penalties

I. Wrong table
II. Inverted table
III. Unrealistic value

Penalize ½ mark for each to a maximum of $1/_2$mrk

Decimals ----------1mrk

(Tied to the first and second row only)

Conditions

Accept either 1or 2 decimals points used consistently

If the 2 nd decimal point is used . can only be o or 5

Accuracy -------1mrk

Compare any titre value in the 3rd row with the school value (sv)

Conditions

I. If with or $\pm$0.1cm^3 of sv ---1mrk
II. If within $\pm$0.2cm^{3}of sv ---$1/_2$ mark
III. Beyond $\pm$0.2cm^3 of sv -----omrk

NB/ if there is wrong arithmetic in the table compare the sv with the correct value and credit accordingly.

Principle of averaging ----1mrk

Value average must be shown and must be within $\pm$0.2 cm^3 of each other conditions.

I. 3 values averaged and consistent -1mrk
II. 3 values done and only 2 possible averaged –1mrk

III. 2 titrations done and averaged -1mrk
IV. 2 titrations done and inconsistent -0mrk
V. 3 titrations done and impossible but only two averaged -0mrk

Final accuracy -1mrk

Compare with the (sv)

I. If within +_0.1 of sv-1mrk
II. If within +_0.2 of sv -1/2mrk
III. If beyond +_0.2 of sv -0mrk

NB// If the candidate has averaged wrong values pick the correct value if any ,average and credit accordingly

(i) 106 of $Na_2 CO_3$ =1mole

8 g x $\frac{8x1}{106}$

=0.0755M $Na_2 CO_3$

ii)In 1000cm^3 of Na_2CO_3=0.0755Moles

in 25 cm3 =$\frac{25x0.0755}{1000}$

=0.00189moles ½

$Na_2 CO_{3(aq)} + Na_2 CO_{3(aq)}$----------$Na_2SO_{4\,(aq)} + CO_{2(g)} + H_2O(l)$

Ratio $Na_2CO_3 . H_2 SO_4$

1 1

0.00189.0.00189 ½

17.0cm^3=0.00189

In 1000cm^3= $\frac{1000x0.00189}{17}$ ½

=0.1112M ½

iv) Concentration of sulphuric (vi) acid

in 1000cm^3 …… 0.1112

250cm^3 ……..?

$\frac{0.1112 \times 250}{1000}$ = 0.0278moles

in 25cm ^{3}=0.0278moles

in 1000cm^3= ?

$\frac{0.0278 \times 1000}{25}$=1.112M ½

Conditions

I. If units given they should be correct however if not given ignore.
II. Molarity should be given to at least 3 decimals place otherwise penalize ½ marks for the answer.
III. Numbers of moles should be given to at least 4 decimal places, otherwise penalize ½ mark for answer.

TABLE II

a) Complete table -1mrk

5-6 experiments done -1

4 experiments done -1/2 mark

Less than 4 experiments done -0mrk

Penalties

I. Penalize ½ mark for inverted table
II. Penalize fully for unrealistic temperature readings i.e. Above50^{0}c or below 10^{0}c .

Decimals -1mark

The first digit after the decimal must be a zero or 5 otherwise penalize fully.

C) Accuracy -1mark

Accuracy is pegged on the candidate initial temperature reading

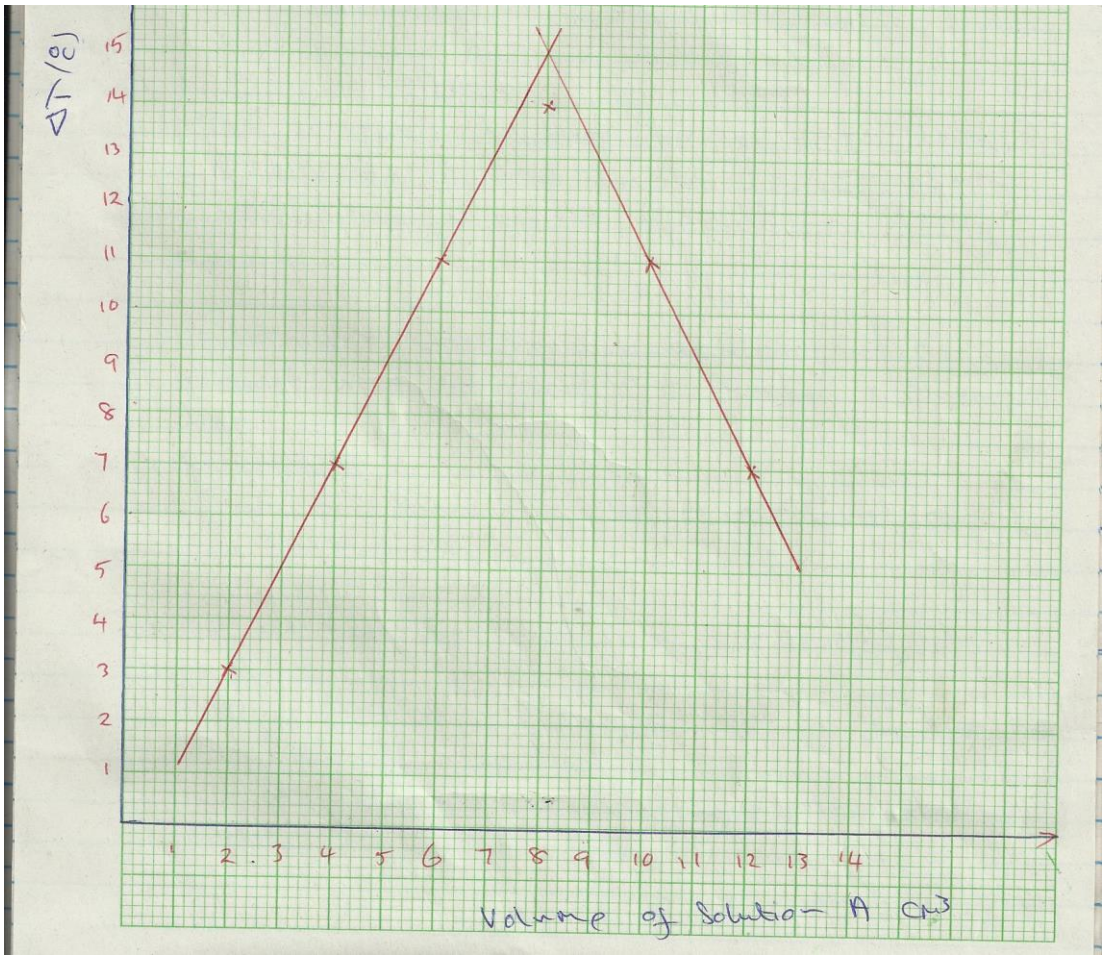
Conditions

I. Award 1 mark if the candidate value is within $\pm$2units the school value.
II. The initial temperature reading should be the same for all the six experiments otherwise penalize fully.
III.

D) Trend -1mrk (tied to ΔT)

I. Award1mark for a continuous rise followed by continuous drop.
II. Award 1mark for a continuous rise, a constant then followed by continuous drop

GRAPH-3mks



a) Labeling – ½ mrk
The vertical and horizontal axis must be correctly labeled with correct unit otherwise penalize fully
Scale – ½ mark
The actual plot must cover at least seven big squares on the vertical axis and at least 8 big squares on the horizontal axis, otherwise penalize fully.

c)Plotting
5-6 correct plotted points -1mark
4 correctly plotted points- ½ mark
Less than 4 points plotted – 0mark

Line -1mrk

A straight line showing a continuous rise followed by a line showing a continuous drop.
Condition the two lines must be extrapolated above the last point.
I i) The Δt must be read from a correctly drawn graph.
ii) ΔT is correctly shown on the graph but not, award accordingly.
The graph must be extrapolated above the last point.
II The volume of A must be read from a correctly drawn graph .
-The reading must be shown the graph

(iii) I $\frac{\text{Answer in (ii) above x answer (iv) in procedure A}}{100}$ ½

=correct answer 1 ½

II $\Delta H = mc\Delta T$

$= \frac{16}{1000} \times 4.2 \times \Delta T$ (answer (ii)I above)1 ½

=correct answer ½

$= \frac{\text{1xcorrect answer above}}{\text{Answer (iii)I above}}$ ½

=correct answer ½

QUESTION 2-SOLID G

Observations	inferences
a)Colorless droplet on the cooler parts of the test tube 1 mark	Hydrated compound G contain water of crystallization
b) I)No white precipitate 1 mark	Ca^{2+},Mg^{2+},Pb^{2+},Al^{3+}.Zn^{2+},absent 1mrk
II White precipitate.	CO_3^{2-} ,SO_4^{2-},SO_3^{2-} Present (3 ions -1mrk ,2 ions- ½ mark 1 ion –o mark)
I White precipitate dissolves 1mrk	CO_3^{2-},SO_3^{2-} Present 1mrk(2 ions -1mrk,1 ion-0mrk)
Iv) Orange colour of $K_2Cr_2O_7$ Persists ½ mark	CO_3^{2-}present ½ mark

NB// 1 Penalise ½ mark for every contradictory ions to a maximum of I mark .

2 For the inference to be correct ,the observation must be correct .

QUESTION 3-Solid T

a) Burns with a smoky /sooty flame ½ mark ¸C=Ç′ present,-C=C- ½

b) Effervescence /bubbles ½ -$COOH^-$ present ½

ii)PH=4 or 51mrk Weakly acidic 1mrk

ii) Purple KM_nO_4turns colourless - C=C- present,-C=C-

iii) Orange colour of $K_2 Cr_2 O_7$ ROH absent 1mrk

NB//1 Penalize fully for- C=C- and C≡ or H-C=C-C-H and H-C≡C-H

2 The pH value should not be range of values.

3 Penalize fully for weak acid in the inference of b(ii)