KABONDO DIVISION JOINT EXAMINATION (2015)

CHEMISTRY PAPER 1 233/1 MARKING SCHEME

1 a) The composition of the extract continuously changes with time so the acid or base and also changes with colour with time.

b) Universal indicator (1mk)

c) A strong acid is one that dissociate fully in aqueous solution A weak acid is one which dissociate partially in aqueous solution.

2 a) Are atoms of the same element with the same atomic number but different mass number. (1mk)

b) 18 – 8 = 10 neutrons (1mk)

3 -$2Mg_{(s)}$ + O2(g)→$2MgO_{(s)}$ (1mk)

-3Mg(s) + N2(g)→$Mg_3N_{2(s)}$ (1mk)

4 Molar mass of $Al_2(SO_4)_3$ = 27 x 2 + (32 x 3) + (16 x 4 x 3) = 342

Moles of $Al_2(SO_4)_3$ in $1000cm^3$ = $\frac{29.1}{342} = 0.0851\ moles$ ✓ ½

Moles of $Al_2(SO_4)_3$ in $350cm^3$ = $\frac{350x0.0851}{1000} = 0.02979\ moles$

$Al_2(SO_4)_{3(aq)} \rightarrow 2Al^{3+}_{(aq)} + 3SO_4^{2-}{}_{(aq)}$

1 mole of $Al_2(SO_4)_3$ produce 3 moles of SO_4^{2-} ions

$\therefore 0.02979\ moles \rightarrow 0.02979\ x 3 = 0.08937\ moles\ of$ SO_4^{2-} ions

Number of SO_4^{2-} ions = 0.08937 x 6.0 x 10^{23} = ✓5.36 x 10^{22} ions.

5 a) Ammonium Carbonate (1mk)

b) $(NH^4)_2\ CO_{3(S)}\ 2NH_{3(g)} + CO_{2(g)} + H_2O_{(l)}$ (1mk)

6 a) Copper(II) Sulphide.

b) $Fe^{3+}_{(aq)} \rightarrow Fe^{2+}_{(aq)} + e^-$ (1mk)

c) Reducing agent (1mk)

7 a) Yellow solid changes to✓ orange then to grey✓1 (2mks)

b) $CO_{2(g)} + CO_2(OH)_{2(aq)} \rightarrow CaCO_{3(s)} + H_2O_l$ (1mk)

8 a) Only remove temporary✓1 water hardness and not permanent water hardness. (1mk)

b) - Calcium hydrogen Carbonate(1mk)
- Magnesium hydrogen carbonate

c) - Wastes soap due to formation of scum

9 a) But-1-en(1mk)

b)

10 a) $[Z_n(NH_3)_4]^{2-}$ (1mk)

b) Chloride ion (1mk)

c) An alkali is a soluble base (1mk)

11 a) 60g per 100g of water;total mass of saturated solution = 16g

$\therefore$ 160g of saturated solution$\rightarrow$13g of KM_nO_4

80g of saturated solution$\rightarrow \frac{80x60}{160} 30g$ ✓ ½ of KM_nO_4 1mk

$At\ 20^0C:$

b) $113g\ of\ saturated solution \rightarrow 13g\ of\ KM_nO_4$ ✓ ½

$\therefore 80g\ of\ saturated solution \rightarrow \frac{80x13}{113} = 9.204g$

At 90^0C:

80g of saturated solution $\rightarrow$30g of KM_nO_4

At 20^0C:80g of saturated solution $\rightarrow$9.204g

Mass of KM_nO_4 crystalizes out

30-9.204g ✓ ½ (2mks)

12 a) Concentrated Sulphuric (iv) acid has no ions ✓ ½ (it is covalent) 2M of Sulphuric (vi) acid has H^+ ions and $SO4^{2-}$ ions ✓ ½ (1mk)

b) A substance in molted form conducts electricity but contains only two specifically one type of cation ion and specially one type of anion.(1mk)

13 Quantity of electricity Q=It

=0.5x[(20x60)+20]

=610c ✓ ½

96500c$\rightarrow$ 1 Faraday ✓ ½

610 $\rightarrow \frac{0.00632124488}{0.278} = 2.0009$

The change on the ion is +2 ✓ ½ (2mks)

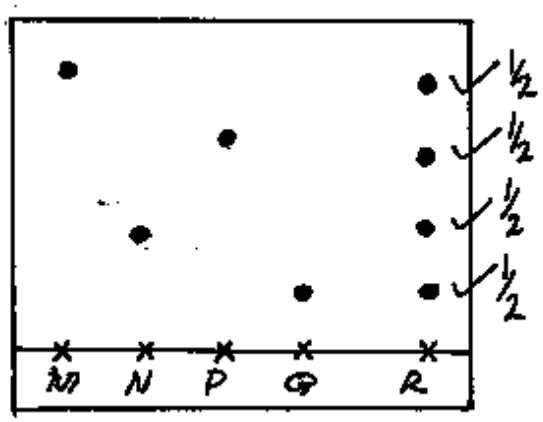
14 a) - Diamond ✓ ½

- Graphite ✓ ½ (1mk)

b) $CO_{2(g)}+C_{(s)} \rightarrow 2CO_{(g)}$ (1mk)

15 a) Q

b)



16 a)

$(C_2H_3)x = 54$ ✓ ½

$x[12x2 + 3x1] = 54$

$24x+3x=54$

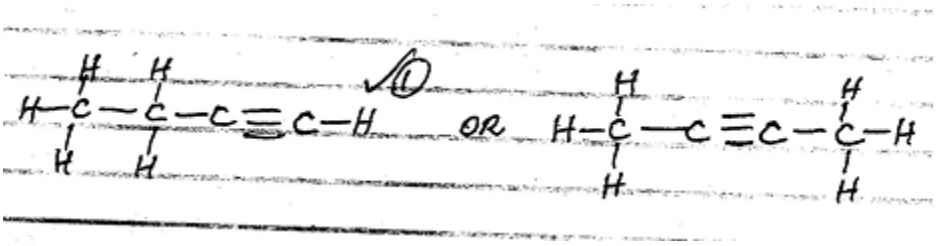
$24x=54$

$x = {}^{54}/_{27}$

$x=2$

$(C_2H_3)2 = C_4H_6$ ✓ ½ (1mk)

b)



c) Alkyne ✓ 1

17 - Surface area of $CaCO_3$ ✓1
- Concentration of HCl ✓1
- Temperative increase ✓1

18 a) Magnesiun metal has storage metalic✓ ½ bond than sodium in its

giant metallic✓ ½ structure due to increase in number of delocalized electrons in magnesium✓1 (2mk)

b) Iodine has strong vander walls✓ ½ forces in its molecular structure,chlorine has weak vander waals✓ ½ forces in its molecular structure.(1mk)

19 a) Sodium chloride or any other chloride of metal. (1mk)

b) Delivery tube to dissolve $HCl_{(g)}$ in water (1mk)

c) $N_aCl(s)+H_2SO4(l)\rightarrow NaHSO_4(s)+HCl_{(g)}$ (1mk)

20 a) When gases react they do so in volumes which are in whole number ratio and to the volume of the products if gaseous at constant temperature and pressure.

b) $C_xH_{y(g)}+O_{2(g)}\rightarrow CO_{2(g)}+H_2O_{(g)}$ ✓ ½

$10cm^3$ $30cm^3$ $20cm^3$

Their volumes to mole ratio

$C_xH_{y(g)}+O_{2(g)}\rightarrow CO_{2(g)}+H_2O_{(g)}$ ✓ ½

1mole 3moles 2moles

$C_xH_{y(g)}+3O_{2(g)}\rightarrow 2CO_{2(g)}+H_2O_{(g)}$ ✓ ½

Then 2 atoms of carbon were present in CxHy and 4 atoms of Hydrogen.

$C_2H_{4(g)}+3O_{2(g)}\rightarrow 2CO_{2(g)}+2H_2O_{(g)}$

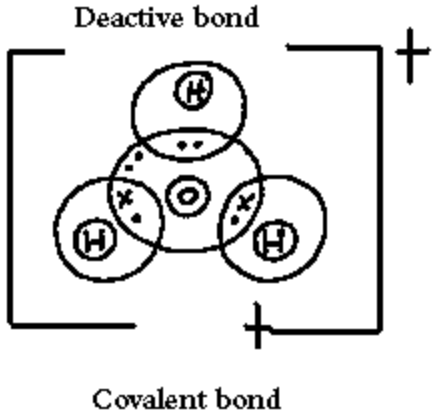
Thus x = 2✓ ½ (2mks)

21 - React excess✓ ½ Lead metal with dilute nitric(v) acid.Then filter of the unreacted lead metal to Lead (II) nitrate as filtrate.Add a solution of sodium chloride to the filtrate.A white precipitate forms✓ ½ which is Lead (II) chloride.Filter the precipitate✓ ½ and wash it with distilled water then dry it between filter paper. (3mks)

22 a) 8 (1mk)

b) - Group 6 (1mk)
- Period 2 (1mk)

23 Structure and bonding



24 a) Bubbles are observed (1mk)

b) i) $CO_{2(g)}+2KOH_{(aq)}\rightarrow K_2CO_{3(aq)}+H_2O_{(l)}$ (1mk)

ii) $2H_{2(g)}+O2_{(g)}\rightarrow 2H_2O_{(g)}$ (1mk)

25 - Molar mass of NaOH = 40✓ ½
Moles of NaOH per littre = $^4/_{40}$ = 0.4M ✓ ½
Moles of NaOH reacted = $\frac{20x0.1}{1000} = 0.002$ ✓ ½

$H_2SO_{4(aq)}+2NaOH_{(aq)}\rightarrow Na_2SO_{4(aq)}+H_2O_{(l)}$ ✓ ½
2moles of NaOH react with 1mole of H_2SO_4
Moles of H_2SO_4 reacting $= \frac{0.002}{2} = 0.001 moles$ ✓ ½
Molarity of the acid $= \frac{1000x0.001}{8} = 0.125M$ ✓ ½ (3mks)

26 ΔHydr of $CaCl_2$ = ΔHydr Ca^{2+} + ΔHydr Cl^-
=-1562+(-364x2)
=-1562+-728
=-2290Kjmol^{-1}✓ ½

ΔHsol = ΔHlaqH+ΔHydr
ΔHlath = ΔHsol-ΔHydr✓ ½
= -82.9 = (-2290)✓ ½

= -82.9+2290
= $+2207.1 Kjmole^{-1}$ ✓ ½ (2mks)

27 a) Concentrated Sulphuric(VI) acid //$H_2SO_{4(l)}$ (1mk)

b) The experiment should be done in a fume chamber or in open air✓1
The gas (NO_2) is poisonous✓1 (2mks)

28 a) $Sn(s) /Sn^{2+}_{(aq)} //Cu^{2+}_{(aq)} /Cu(s)$ (1mk)

b) $Sn(s)+Cu^{2+}_{(aq)} \rightarrow Cu_{(s)}+Sn^{2+}_{(aq)}$ (1mk)

c) E^{θ} cell = E^{θ} reduced E^{θ} oxidation
= +0.34 – (-0.14)✓ ½
= +0.34++0.14
= +0.48v✓ ½ (1mk)

29 a) Produce heat energy to decompose $CaCO_3$// Produce Carbon(iv) Oxide when burnt in the kiln. (1mk)

b) Cold water cools the carbonator (1mk)

c) Recovers ammonia used in the initial stages(1mk)

30 a) C_2H_6 did not have effect on acidified potassium manganate(VII)✓1 which C2H4 turned purple potassium manganate(VII) to colourless✓1 (2mks)

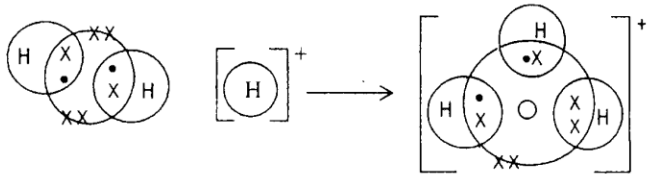
b) - manufacture of plastics (any one) (1mk)
- manufacture of ethanol
- used in ripening of fruits
- preparation of ethan – 1,2 –diol.

KABONDO JOINT EXAMINATION - 2015
233/2 – CHEMISTRY MARKING SCHEME PAPER

1. (a) (i) W and Y ✓ they have three energy level. ✓ (2mks)
(ii) Group III ✓ (1mk)
(iii) XW_2 ✓1mk
(iv) Ionic/Electrovalent. ✓ There is transfer of electrons from X to W from X^{2-} and W^- respectively. The electrostatic attraction between X^{2+} and W^- constitutes the ionic bond. ✓ (2mks)

(b) (i) A type of covalent bond in which the shared pair of electrons forming the bond is contributed by only one of the combining atoms. ✓ (1mk)

(ii)



(e) I Aluminium chloride hydrolyses ✓½ in water to form an acidic solution ✓½ while sodium chloride dissolves to form a neutral solution. ✓½ (1✓½mks)

II Sodium chloride has ionic bonds while aluminium chloride has weak van der waals forces between its molecules. Ionic bonds require a lot of heat energy to break. (✓½mk) a)

2 a) i) butane
ii) Pent-2-ene

b i) C_nH_{2n}
ii) 70
iii) $5x12+2n = 70$
$60+2n = 70$
$2n = 70 - 60$
$N = 5$

c) Step I

Hydrogen ./ Nickel catalyst
Step II
Hydrogen chloride
Step III
1 — chloroethene
ii) $4CH = CH + 5/2\ O_2(g) \_\_\_\_ 4\ CO_2 + 2H_20$
Penalise ½ for wrong or missing symbols
Award zero of
iii) Continued use of product formed in a step III Pollutes environment since they are non broilegible

3 (a) Oxygen√1 and Nitrogen. √1

(b) (i) $CO_{2(g)} + NaOH_{(aq)} \longrightarrow NaHCO_3^{(aq)}$ √ √ (1mk)
(ii) $2CU_{(s)} + O_{2(g)} \longrightarrow 2CuO(s)$ √√ (1mk)
(iii) $3Mg_{(s)} + N_{2(g)} \longrightarrow Mg_3N_{2(g)}$ √√ (1mk)

(c) - Neon / Argon / Helium√ (1mk)
- They are stable and thus unreactive. √ (1mk)

(d) Dust √ (1mk)

(e) Concentrated potassium hydroxide. √ (1mk)

(f) Oxygen

Uses
- Used in deep sea diving.
- Used in hospitals by patients with breathing difficulties.
- Used in high altitude flying.
- Used in mountain climbing.
- Used for purification of crude oil.
- Used in welding flames.
- Used in burning fuel to propel rockets.
- Used in preparation of explosive mixture e.g. petrol, charcoal and oxygen)/
NB Any three

4. (a) (i) I $Zn(OH)_2$ (1mk)
II Zinc chloride (1mk)
III Zinc oxide (1mk)

(ii) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_2$ (1mk)

(iii) A white precipitate which dissolves in excess ammonia solution observed. ✓(1mk)

(b) (i) Hydrogen ✓(1mk)

(ii) To provide a large surface area over which the gas dissolves in water. ✓(1mk)

(iii)
- From electrolysis of aqueous sulphuric (VI) acid.
- From electrolysis of brine.
- Cracking of alkanes.
- A by-product of petroleum industry. (Any 1mk)

(iv)
- Removing rust from Iron/decaying of iron before galvanizing and other metals before electroplating.
- Sewage treatment.
- Making dyes.
- Manufacture of silver chloride used on photographic films. (Any 1mk)

7. Tap water contains dissolved $CaHCO_3$ so when it is boiled $CaCO_3$ is deposited as the white precipitate. $\surd^1$

OR $Ca(HCO_3)_2 \longrightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$

(b) (i) Add anhydrous sodium carbonate to the water sample until in excess while stirring. Filter to obtain $CaCO_3$ and $MgCO_3$ as residues and softened water sample as the filtrate.

(ii) $Na_2CO_{3(aq)} + CaCl_{2(aq)} \longrightarrow CaCO_{3(g)} + 2NaCl_{(aq)}$

106g $\longrightarrow$ 111g

? $\longleftarrow$ 0.25g

$0.25g \times \frac{106}{111g} =$ 0.238g of anhydrous sodium carbonate will be required to soften 1 litre containing 0.25g of calcium chloride.

$Na_2CO_{3(aq)} + MgSO_{4(aq)} \longrightarrow MgCO_{3(s)} + Na_2SO_{4(aq)}$

106g $\longrightarrow$ 120

? $\longleftarrow$ 0.24g

$106 \times \frac{0.24g}{120g} =$ 0.212g of anhydrous sodium carbonate will be required to soften 1 litre containing 0.24g of Magnesium sulphate

Therefore anhydrous sodium carbonate required will be 0.212g + 0.238g = 0.450g

(iii) - A lot of soap will be used during laundry.
- Form scum which will stain clothes.
- Deposition of fur in boilers, kettles etc. This dissolves and reduces efficiency of the boilers.

(c) (i) Copper metal. $\surd^1$

(ii) $Cu_{(g)} + 4HNO_{3(aq)} \longrightarrow Cu(NH_3)_{4(aq)}^{2} + 2H_2O_{(l)}$

.5 (a) Hydrogen gas ✓1.

(b) Remove magnesium oxide layer ✓1 on the surfaces (1mk)

(c) Bright white light ✓1 or
White powder ✓1

(b) $Mg_{(S)} + H_2O_{(S)} \rightarrow MgO_{(S)} + H_{2(S)}$ ✓1

(e) (i) Brick liners in furnaces. ✓1

(ii) Radio frequency shielding.

(f) Withdraw delivery tube from water before you stop ✓½ heating to prevent sucking back. ✓½

(g) (i) Volume of Gas X at s.t.p.

$V_1 = 96$ $V_2 = 2$

$P_1 = 1$ $P_2 = 1$

$T_1 = 283$ ✓½ $T_2 = 273$

$$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{1 \times 96 \times 283}{1 \times 273}$$ ✓1 = 99.52cm³ ✓½

(ii) Mass of magnesium ribbon used:

Moles of hydrogen gas

1 mole - 22400

? 99.52

$\frac{99.52 \times 1}{22400}$ ✓½ = 0.00444 ✓½

Moles of hydrogen moles of magnesium = 0.00444

∴ Mass = 0.00444 × 24 ✓½ = 0.0166g ✓½

6. (a) X -- Ammonia

(b) Haber process

(c) (i) $2NO_{(S)} + O_{2(S)} \rightarrow 2NO_{2(S)}$ ✓1

(ii) $4NO_{2(S)} + O_{2(S)} + 2H_2O_{(l)} \rightarrow 4HNO_{3(aq)}$ ✓1

(d) Platinum/rhodium ✓1

(e) In presence light H undergoes decomp ✓1

$$HNO_{3(aq)} \xrightarrow{Liquid} NO_{2(s)} + H_2O_{(l)} + O_{2(S)}$$

(f) (i) Blue turns red ✓½ because NO_2 formed dissolve in H_2O to form nitric (V) acid. ✓½

Red remains red because solution in acidic ✓½

(ii) Effervescence

$$C_{(S)} + 4HNO_{3(aq)} \rightarrow CO_{2(g)} + 4NO_{2(g)} + 2H_2O_{(l)}$$

(iii) Sulphur IV oxide and carbon IV oxide. Accept correct formulae

$C_{(S)} + 2H_2SO_4 \rightarrow 2SO_{2(S)} + H_2O_{(l)}$(a)

KABONDOJOINT EVALUATION TEST
CHEMISTRY PP3 MARKING SCHEME

1. a) Moles of Hcl present in $50cm^3 = \frac{50x1}{1000} = 0.05$ moles

i) Complete table (1 mark)
- 3 titrtions done-
- 2 titrations done
- 1 titration done

NB: Penalise ½ mark to a max of ½ mark for;
- inverted table
- wrong arithmetic
- burette readings beyond 50 cm3 except where explained
- Unrealistic (below 1 cm3)

ii) Use of decimals (1 mark)
- 1d.p or 2 d.p throughout
- for 2 d.p the 2nd digit is either 0 or 5 otherwise penalize fully

iii) Accuracy (1 mark)
- Compare to teachers values. If any is within;

0.1 of teachers value
0.2 0f teachers value
Beyond 0.2 of teacher value

iv) Averaging
If 3 averaged within 0.2 of each other
If 2 averaged within 0.2 of each other
If 3 or 2 averaged but outside 0.2 of each other

v) final answer (1 mark)
Compare to teachers average title. If within;
0.1 of teachers value
0.2 of teachers value
Beyond 0.2 of teachers value

c) i) Volume of NaOH = $\frac{\text{Title x } 250}{25}$
= correct ans ½

ii) Moles of NaOH = $\frac{\text{Ans c (i) x } 0.1}{1000}$
= correct ans ½

d) $NaOH\ (aq) + HCL\ (aq) \longrightarrow NaCL\ (aq) + H2O\ (s)$

e) NaOH: Hcl = 1:1
Moles of HCL = Moles Of NaOH = Ans in C (ii)

f) Moles of HCl that reached with CO_3^{2} = 0.05 – Ans ©, ½ mark
Correct aswer ½ mark

OR
Ans (a) – Ans (e) = correct Ans

g) i) CO_32- (aq) + 2H+ Aq $Co_2 + H_2 Oi$

ii) Moles of CO32-= $\frac{\text{Ans (f)}}{2}$
= correct Ans

iii) Molar mass = $\frac{1.5}{\text{Ans g (ii)}}$ = correct answer

2. a) Table 2 (6 marks)
i) Complete table
ii) Accuracy 2.0 c of the teachers 1st value ½

iii) Use of decimals
Accept to 1 d.p or whole number for temp reading for ½
Award o mk if the 2nd decimal point is not zero or 5. Reject 2 d.p

iv) Trend- Temperature readings to decrease continuously
Time to increase continuously

b) Graph (3 marks)
i) Labelled axes ½
ii) Scale ½
NB Area occupied by the actual plots should be at least ½ of the total big squares along the horizontal axis by at least ½ of the total big squares along the vertical axis

iii) Plots

iv) Curve

c) From the graph
d) From the graph

e) The higher the temperature the higher the rate of reaction

3 a)

Observation	Inferences
White powder ½	Fe 2+, Fe 3+ and cu 2=

b)

Observation	Inferences
	Mixture of soluble and insoluble salt

i)

Observation	Inferences
No white precipitate ½	~~Zn^{2+}, Al^{3+}, Pb^{2+}, Mg^{2+}, Ca^{2+}~~

ii)

Observation	Inferences
Yellow flame	Na^{+} ½ present

iii)

Observation	Inferences
White precipate	SO_4^{2-} present

c)

Observation	Inferences
- Effervescence/ hissing sound ½	
- Colorless gas forms white precipitate with calcium hydroxide ½	CO_3^{2-} present ½
- Solid dissolves to give colorless solution	

d) i)

Observation	Inferences
White precipitate ½ soluble in excess	Pb^{2+}, Zn^{2+} or Al^{3+}

ii)

Observation	Inferences
White precipitate insoluble in excess	Pb^{2+} or Al^{3+}

iii)

Observation	Inferences
Yellow precipitate	Pb^{2+} present