PAVEMENT FORM 4 TRIAL 2 EXAMINATION 2021/2022

Kenya Certificate of Secondary Education (K.C.S.E)

CHEMISTRY PAPER TWO MARKING SCHEME

1. **1** (a) Alkaline-earth metals **(1mark)**

(b) B **(1mark)**

(c) (i) A_2B_3 (½mk) (ii) H_2SO_4 **(½mark)**

(d)

Distribution of electrons (1mk) and charges (1mk)

No label (0mk)

(e) D has a smaller atomic size than C//C has larger atomic size than D **(1mark)**

D has more protons than C//D has stronger nuclear charge than C **(1mark)**

(f) H (½mk). Loses electrons most readily/largest atomic radius/weakest nuclear charge (explanation ½mk)

(g) $2A_{(s)} + 6HCl_{(aq)} \rightarrow 2ACl_{3(aq)} + 3H_{2(g)}$ **1mark**

Moles of A = = 0.003moles **½mark**

Mole ratio 1:3

Moles of HCl = 0.003x3 = 0.009moles **½mark**

½mk = 0.45M **½mark**

(h) The melting point increase with increase in atomic number. **1mark**

This is due to increase in the strength of van der waal's forces (inter-molecular forces) **1mark**

2 (a)(i) A fuel is a substance that can be used as a source of energy. **(1 mark)**

OR A substance that produces useful energy when it undergoes a chemical or nuclear reaction.

(ii) Molar mass of C_3H_8 = 12x3+1x8= 44 g mol^{-1} **½mark**

Heating value **1 mark**

= 50 kJ/g **½mark**

(b) (i) molar enthalpy of combustion is the heat change when one mole of a substance is burnt completely in oxygen. **(1mark)**

(ii) $2C(s) + H_2(g) \xrightarrow{+226} C_2H_2(g)$

$2O_2$

- $5/2O_2$ **(1 mark)**

-286

$2CO_2(g) + H_2O(l)$

$\Delta H_{C(ethyne)}$ **= -(+226) + 2(-394)+ (-286)** **(1 mark)**

= -226-788-286

= -1300 kJ mol^{-1} **(1 mark)**

(c) (i) ΔH_{soln}= -(-2237) + (-1650)+ (2X-364) **(1 mark)**

= **-141 kJ mol^{-1}** **(1 mark)**

(ii)

$Ca^{2+}(g) + 2Cl^-(g)$

Energy **(3 marks)**

+2237

$CaCl_2(s)$

Reaction path

3 (a) (i) ***Potassium nitrate (Reject KNO_3)*** **(1mark)**

(ii) ***$(NH_4)_2SO_{4\,(S)} + 2KNO_{3(s)}$*** ***$K_2SO_{4(s)} + 2H_2O_{(l)} + N_2O_{(g)}$*** (1mk)

(iii)***The magnesium ribbon continues to burn with a dazzling flame forming white solid*** **.(1mark)**

This is because burning magnesium produces sufficient heat to dissociate nitrogen (I) oxide into oxygen and nitrogen gases(½mk). The oxygen supports combustion of magnesium to form white magnesium oxide while nitrogen combines with hot magnesium metal to form white magnesium nitride. ***(½mark)***

(iv) I ***$2Mg_{(s)} + O_{2(s)}$*** ***$2MgO_{(s)}$*** **(1 mark)**

II. ***$3Mg_{(s)} + N_{2(g)}$*** ***$Mg_3N_{2(s)}$*** **(1 mark)**

(v) ***$Mg_3N_{2(s)} + 6H_2O_{(l)}$*** ***$3Mg(OH)_{2(s)} + 2NH_{3(g)}$*** **(1mark)**

(b) (i) *Manufacture of nitrogenous fertilizers such as ammonium nitrate.* (any two correct uses)
Manufacture of textile dyes
Manufacture of explosives

(ii)

$HNO_{3(l)} + NH_{3(g)}$ $NH_4NO_{3(s)}$ √ *1mk*

Mole ratio: 1:1:1

Molar mass of ammonia = 17g

Molar mass of ammonium nitrate = 80g √½mk

80g NH_4NO_3 17g

4800000g $\frac{17 \times 4800000}{80}$ = ***1020000g***

√1mk

= 1020kg of ammonia gas. √½mk

4

a)

Total volume of water added(cm^3)	10.0	20.0	30.0	40.0	50.0
Mass of $KClO_3$(g)	5.0	5.0	5.0	5.0	5.0
Temperature at which crystals appear(^0C)	80.0	65.0	55.0	45.0	30.0
Solubility of $KClO_3$(g/100gH_2O)	*50.0*√½	*25.0*√½	*16.7*√½	*12.5*√½	*10.0*√½

NB: *√½mk for expressing solubility values to the same number of decimal points*

b) Graph marking points: scale (graph to cover >= ½ grid)√½

Labeling of axes√½

Plotting of points √1

Curve (smooth) √1

c) i) 11g/100gH_2O √1

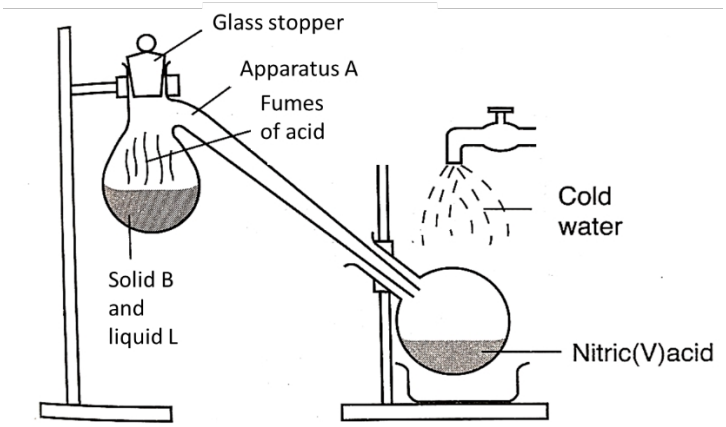
ii) 72^{0}C (+/- 0.5)√1

d) Solubility of $KClO_3$ increases with increase in temperature/more $KClO_3$dissolves as temperature rises√1

e) Extraction of soda ash(Sodium carbonate) from Trona√1

Extraction of common salt(sodium chloride). Etc.

5 (a)



(b) **B** – Sodium Nitrate/KNO_3✓**1**

L – Concentrated H_2SO_4✓**1**

(c) **A** – Retort Flask✓**1**

(d) $NaNO_{3(s)} + H_2SO_{4\,(l)} \rightarrow HNO_{3(aq)} + NaHSO_{4(aq)}$ ✓1

(e) HNO_3 is a powerful✓1 oxidizing agent. It oxides H_2 ✓1 to water.

(f) Semen storage for artificial insemination.✓1
- Manufacture of ammonia in the Haber process✓1

6. a) -Ammonia gas
-Limestone / calcium carbonate
-Brine / concentrated sodium chloride

b) Ammonia gas

c) Filtration

d)

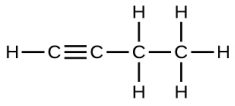
e) i)

ii) From equation: 2 moles $NaHCO_3$ produces 1 mole Na_2CO_3
R.F.M of $NaHCO_3$ is (1 x 23) + (1x1) + (1 x 12) + (3 x16) = 84
$(^{84g}/_{1000g}$ x 1) kg is 0.084 kg
2 mole $NaHCO_3$ is 0.084 x0.168 kg
R.F.M of Na_2CO_3 is (2 x 23) + (1x12) + (3 x16) = 106

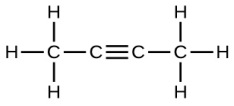
(106 g/ 1000g x 1 kg) is 0.106 kg
If, 0.168 kg $NaHCO_3$ produces 0.106 kg
98.128 produces $\frac{98.128 \times 0.106}{0.168}$

= 61.9109Kg Solid Z

7 (a)

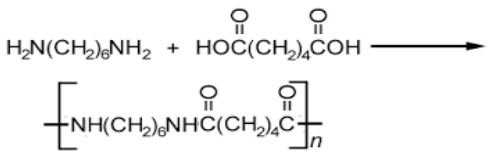


1-butyne



2-butyne

But – 1 – yne But – 2 – yne (structure ½mk, name ½mk total 2mks)

(b) Nylon 6,6. 1mk  1mk

(c) (i) Harmful rays from the sun reaches the earth's surface causing harm to humans 1mk

(ii) Contribute to global warming 1mk

(d) (i) I Oxidation (½mk)

II A: Propene B: Sodium propanoate C: Ethane (1½mk)

(ii) $2C_2H_6 + 7O_2$ $4CO_2 + 6H_2O$ (1mk)

(iii) Used in manufacture of polypropene used in making ropes, plastic crates, buckets, basins, plastic tables and chairs etc

Manufacture of other chemicals e.g. acetone, propan-1-ol etc

Used as an alternative to ethyne(acetylene) in welding flame

(e) Add sodium carbonate/ sodium hydrogen carbonate to separate samples of each 1mk. Propanoic acid produces bubbles of a gas/effervescence/fizzling while propan-1-ol does not 1mk