Kenya Certificate of Secondary Education
233/3
CHEMISTRY
PAPER 3

I) Procedure II

Table 1……. 3 marks

(a) – Complete table (C.T) ✓1 Mark

Conditions

(i) Complete table with 3 titrations – 1 Mark
(ii) Incomplete table with 2 titrations – ½ Mark
(iii) Incomplete table with 1 titration – zero mark

Penalties:- Penalise ½ mark each
(i) Wrong arithmetic
(ii) Inverted table
(iii) Burette reading beyond 50cm (unless explained)
(iv) Unrealistic titre values i.e. $1cm^3$ or 100

(b) **Use of decimals (** tied to 1st and 2nd rows only)

Conditions (½ mark)

(i) Accept 1 or 2 decimal points used consistently, if not penalise fully.
(ii) Where 2 decimal points used the 2nd decimal point should be "0" or "5" if not penalise fully.
(iii) Accept consistency in use of zero as initial burette reading i.e. 0, 0.0, 0.00

(c) Acuracy (Tied to correct titre value)…… (1 mark)

(i) Atleast one of candidate's values is within ± 0.1 of s.v (1mark)
(ii) If non of candidates' value is within ± 0.2 of s.v (0 mark)
(iii) If one of the candidates value is within ± 0.2 of the s.v (½ mark)

(d) Principles of Averaging …… 1 mark

Conditions

(i) - 3 consistent values averaged
- If 3 titrations done but only are consistent and averaged } 1 mark
- If 2 titrations done and are consistent and averaged

Penalties

- Wrong arithmetic error is outside ± 0.2 units in d.p. ½ mark
- No working shown but answer is given correctly ½ mark
- Wrong workings with correct answer 0 mark

(e) Final accuracy (Tied to correct average titre) (1 mark)

Compare candidate's average titre with the s.v
i) If the candidates value is in ± 0.1of the s.v. – (1 mark)
ii) If the candidate's value is in ± 0.2 of the s.v. – (½ mark)
iii) If the candidate's value is beyond ± 0.2 – (0 mark)
beyond ± 0.2 0 mark

(ii) number of moles of the acid used

n = $\frac{MV}{1000}$ = $\left\{0.15x \ \frac{Ans.in\ a\ (i)}{1000}\right\}$ = Ans _____ mole ½ mark

e.g. 0.15 x $\frac{20.35}{1000}$ = 0.003053 mole

(b) Equation

$2HA_{(aq)} + J_2CO_3.xH_2O \longrightarrow 2JA_{(aq)} + CO_{2(g)} + (x + 1)\ H_2O_{(l)}$ ✓ 1 Mark

Or $2HA_{(aq)} + J_2CO_3 \longrightarrow 2JA_{(aq)} + CO_{2(g)} + H_2O_{(l)}$ ✓

States wrong/missing ✓ ½ Mark, unbalanced 0 mk

(c) (i) No. of moles of metallic carbonate in 25cm^3 of Jd.

= (Answer in a (ii) above x $\frac{1}{2}$) ½ mk

= Answer _____ mole ✓ ½ Mark

e.g. 0.003053 x $\frac{1}{2}$ = 0.00153 mole

(ii) No. of moles of the metallic carbonate in 50.00 cm^3 of solution Jc ✓ 1 Mark

50cm^3 of Jc has same No. of moles of carbonate as 250cm^3 of Jd.

but 25cm^3 of Jd ⟶ Answer in c (i) above.

∴250cm3 of Jd has Ans. c (i) x $\frac{250cm^3}{25cm^3}$ ½ mk

= Ans. _____ mole ✓ ½ Mark

e.g. $\left(0.00153\ x\ \frac{250}{25}\right)$ = 0.0153 mole

(iii) Molar mass of the metallic carbonate

50cm^3 of Jc ⟶ Ans. c (ii)

80cm^3 of Jc ⟶ ?

∴Moles in 80cm^3 of Jc = $\left(Ans.\ c\ (ii)\ x\ \frac{80}{50}\right)$ moles

but 80cm^3 of Jc has 7.0g

$\Rightarrow \left\{Ans\ c\ (ii) x\ \frac{80}{50}\right\}$ mole = 7.0g

1 mole - ?

So molar mass = $\left\langle\frac{1\ x\ 70}{Ans\ c(ii) x\ \frac{80}{50}}\right\rangle$ ½ mk

= Ans _____ g ½ mark

e.g = $\frac{7.0\ x\ 1}{\left(0.0153\ x \frac{80}{50}\right)} = \frac{7.0}{0.02448}$ = 285.5477g

(iv) Value of x in $J_2CO_3.xH_2O$

Let molar mass = (23 x 12) + 12 + (16 x 3) + x (2 + 16)

= 106 + 18x

But molar mass = Ans. c (iii)

∴ 106 + 18x = Ans. c (iii)

x = $\left\{\frac{Ans.C\ (iii) - 106}{18}\right\}$ ✓ ½ mark

= Ans _____

e.g. 106 + 18x = 285.5477

x = $\frac{285.5477 - 106}{18}$

= 9.9749 ≈ 10 ½ mk

II) (a) Table ……✓3 ½ marks

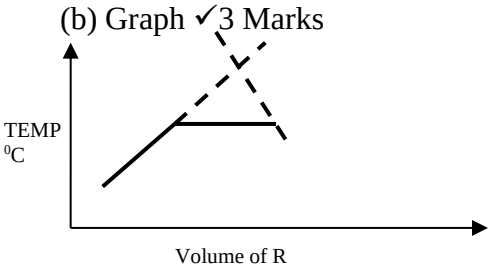
1. Complete table ✓1 Mark

Conditions

i. Complete table with 7 readings ✓1 Mark
   Incomplete table with 5 – 6 readings ✓ ½ Mark
   Incomplete table less than 5 readings 0 mark
ii. Treat initial value above 40^0C and below 10^0C as unrealistic and penalize ½ mark tied to t = 0
iii. Penalise ½ mark for each reading greater than 50^0C from t = 30 seconds to a maximum of ½ mark.
iv. Penalize fully if all readings are constant.

2. Use of decimals ✓1 Mark
   Accept whole numbers or readings with .0 or .5 used consistently, otherwise penalize fully.
3. Accuracy 1 mark
   Compare the candidate's initial temperature (at time = 0) with the school value: If within ± 2 award 1 mark otherwise
   penalize fully
4. Trend ✓1 Mark
   Award the first ½ mark for a continuous rise in temperature upto a maximum or constant values followed by a drop.

(b) Graph ✓3 Marks



Trend

(i) Labeling (both axis) ✓ ½ Mark
   Penalize fully for – inverted axes
   - wrong units
   Accept if units are omitted

(ii) Scale ½ mark
   Area covered by the plots should be at least ¾ of the plotting area: otherwise penalize fully.

(iii) Plotting ✓1 Mark
- Award ✓1 mark for at least 7 points correctly plotted
- Award ½ mark for 5 – 6 points correctly plotted otherwise award zero.
- Award fully for plots if the axes are inverted but the plotting is correct.

(iv) Shape 1 mark
- Award ½ mark for a straight line showing progressive increase in temperature.
- Award the other ½ mark for an extrapolated straight line showing a drop.

(c) (i) ½ mark - shown on the graph
   (ii) ½ mark - value

(d) Heat change 2 marks
   $\Delta H = McT$

e.g. $\frac{42.5}{1000}$ x 4.2 x 4.5 1mk = -0.8033kJ 1mk

- Penalize ½ mark for wrong or absence of units

(e) Moles of NaOH = $\frac{25\ x\ 0.6}{1000}$ = 0.015mol ✓ ½ Mark

Molar enthalpy

0.015 ⟶ -8033

1 mole ⟶ ?

= $\frac{1}{0.015}$ x .8033 = - 53.5533 kJ mol^{-1} ✓ ½ Mark

3a	pale blue flame ½ mk	Absence of = C = C = or -C ≡C- ½ mk
	miscible / uniformly mix ½ mk	polar organic cpd ½ mk
	pH = 1 / pH = 2 reject pH colour or range ½ mk	Strongly acidic reject: acidic substance or acid½ mk
	Pleasant smelling substance ½ mk	**RCOOH PRESENT ½ mk**
	Orange colour of $K_2Cr_2O_7$ persist ½ mk or Orange colour of $K_2Cr_2O_7$ do not change to green Reject: Orange colour forms / colour remains unchanged / no effect ON $K_2Cr_2O_7$	R - OH absent ½ mk . penalize fully for any contracting functional group.
	effervescence / bubbles of colourless gas/ fizzing ½ mk	RCOOH present ½ mk Accept H+ present
3b	**b) observation** - Droplets of colourless liquid on cooler part of test tube 1mk	**Inferences** Hydrated salt or contain water of crystallization 1mnk
	b) Observation Solid dissolves forming a colourless solution 1mk	**Inference** Cu^{2+}, Fe^{2+} or Fe^{3+} absent ½ mk Soluble salt ½ mk
	c) Observation White ppt ½ mk	**Inference** SO_4^{2-} ½ mk penalize fully for contradictory ion
	d) Observation White ppt formed ½ mk soluble in excess ½ mk	**Inference** Zn^{2+}, Al^{3+} present. @ ½ mk penalize ½ mk for each other ion
	e) Observation - White ppt formed ½ mk Insoluble ½ mk	**Inference** Al^{3+} present 1mk . Penalize fully for any contradictory ion