SERIES 17 EXAMS

233/3
CHEMISTRY
PAPER 3

1. 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 mk)
(i) Atleast one of candidate's values is within ± 0.1 of s.v (1mk)
(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
$2HA_{(aq)} + M_2CO_3.xH_2O \longrightarrow 2MA_{(aq)} + CO_{2(g)} + (x + 1)\ H_2O_{(l)}$ ✓ 1 Mark
States wrong/missing or letters joined ✓ ½ Mark

(c) (i) No. of moles of metallic carbonate in $25cm^3$ of Md.
= (Answer in a (ii) above x $\frac{1}{2}$)

= 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 Mc ✓ 1 Mark

50cm^3 of Mc has same No. of moles of carbonate as 250cm^3 of Md.

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

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

= 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 Mc ⟶ Ans. c (ii)

80cm^3 of Mc ⟶ ?

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

but 80cm^3 of Mc has 7.0g

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

1 mole - ?

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

= 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 $M_2CO_3.xH_2O$

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 _____ ½ mark

e.g. 106 + 18x = 285.5477

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

= 9.9749 ≈ 10

2. (a) Table ……✓3 ½ marks

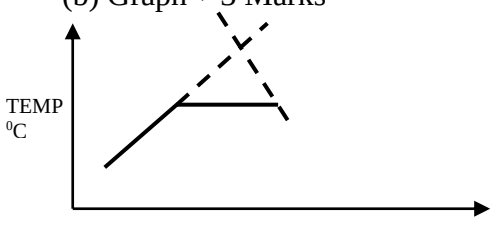
1. Complete table ✓1 Mark

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 ½ mark
   Compare the candidate's initial temperature (at time = 0) with the school value: If within ± 0.2 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



Volume of R

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 1 ½ marks

$\Delta H = Mc\Delta T$

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

- Penalize ½ mark for wrong or absence of units
- Penalize ½ mark for the absence of the –ve sign on the answer

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

Molar enthalpy

0.015 ⟶ -8033

1 mole ⟶ ?

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

2. (II)

1. (a) Complete table ✓5 Marks

(i) Complete table with 10 readings 2 ½ marks

- Penalize ½ mark for each space not filled
- Penalize ½ mark for any time reading less than or greater than 220 seconds.
- If the candidate enters some readings in fractions and others in decimals award accordingly (each value is worth ½ mark)

(ii) Use of decimals ½ mark

Accept whole numbers or 1dpl – 2dpl used consistently throughout: otherwise penalize fully.

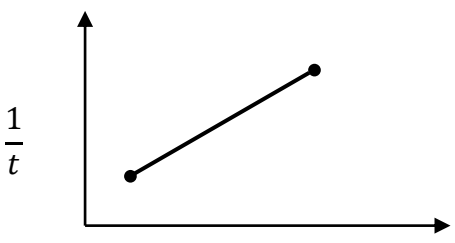
(iii) Accuracy ½ mark

Compare the candidate's first reading and the school value. If within ±2 seconds award ½ mark: otherwise penalize fully.

(iv) Trend ½ mark

Award ½ mark if time increasing throughout: otherwise penalize fully.

(b) The graph



(i) Scale ½ mark

Area covered to be ¾ of the space provided. Scale should accommodate 4 plots, otherwise penalize fully.

(ii) Labeling of axes ½ mark
- Penalize fully for wrong units of volume
- Penalize fully for inverted axes
- Accept if no units are shown on labelling

(iii) Plotting ✓ 1 mark
Accept 4 -5 correctly plotted otherwise penalize fully if 3 plots are correctly plotted award ½ mark if less than 2 plots are correctly plotted award 0 mark. Accept rounding off if consistently used.

(c) Time taken 1cm long magnesium ribbon to react with $5cm^3$ of solution S.
Showing on the graph – ½ mark
Stating correct reading ½ mark

Conditions
- ✓ Penalize fully if not shown on the graph.
- ✓ Award 1 mark if shown on the graph but not stated
- ✓ Accept the answer to at least 1 dpl unless it works out exactly to a whole number. Otherwise penalize fully.
- ✓ Award zero if not shown on the graph and the stated value is wrong.
- ✓ If value shown of the graph is stated wrongly penalize fully.

3. (a)

(i)

Observations	Inferences
– Brown fumes ✓ ½ mark – Colour of moist blue litmus turns red ✓ ½ mark – Colour of moist red litmus remains red.	NO^3 present ✓ ½ mark
Colour of white solid becomes orange (when hot) ✓ ½ mark but yellow when cold ✓ 1 mark	PbO formed ✓ ½ mark

(ii)

I	Observations	Inferences
	White ppt formed insoluble in excess ✓ ½ mark	Pb^{2+}, Al^{3+} present ✓ 1 mark Accept Zn^{2+} absent ✓ 1 mark
II	Yellow ppt formed ✓ ½ mark	Pb^{2+} present ✓ ½ mark

(iii)

I	Observations	Inferences
	No effervescence of colourless gas ✓ ½ mark	SO_4^{2-} likely present or CO_3^{2-} and SO_3^{2-} ✓ ½ mark
II	No white ppt formed ✓ ½ mark	Cl^-, SO_4^{2-} absent Accept NO_3^- likely to be present ✓ ½ mark

(b)

(i)	Observations	Inferences
	- Melts into a colourless liquid ✓ ½ mark - Burns with a sooty / smocky/ luminous / yellow flame ✓ ½ mark	C = C or –C ≡ C - ✓ present 1 mark Accept:- organic cpd in high C:H ratio - Long chain organic cpd - Aromatic cpd - Unsaturated organic cpd - Carbon – carbon double of triple bonds (in words) Rej: C ≡ C or C = C - Alkene, alkyne - Long chain hydrocarbon ✓ 1 mark
(ii)	Partially dissolves ✓ ½ mark to form colourless solution ✓ ½ mark	

I	Observations	Inferences
	Slow effervescence✓ 1 mark/ fizzing formation of bubbles of colourless gas Accept: Slow production of colourless gas Rej: "hissing" ½ mark	- H^+/H_30^+/-COOH/R – OH ✓ 1 mark - Carboxylic group in words - Solution is acidic Rej: Solution is an acid ½ mark
II	- Orange colour of $H^+/K_2Cr_2O_7$ persists/is retained Rej:Colour of $H^+/K_2Cr_2O_7$ retained ½ mark	Absence of R – OH ½ mark
III	Red/orange/yellow bromine water decolourised ✓ 1 mark Rej: Bromine water turns colourless /dicoloured ✓ ½ mark	$\diagdown\!\diagup C = C \diagdown\!\diagup$ or –C ≡ C - ✓ 1 mark Accept: Unsaturated organic compound Penalise fully for any contradictory functional group ✓ ½ mark
IV	Method - Place $1cm^3$ of solution T in a test tube - Add 1 – 3 drops of universal indicator solution - Match the colour obtained with the pH chart pH value 4 Rej: pH range of 4 – 5 ✓ ½ mark	Solution is weakly acidic Rej: Weak acid ✓ ½ mark