MARKING SCHEME
CHEMISTRY PAPER 3 233/3

1(a) Complete table ---------- (1mk)

Conditions

Complete table with 3 titration = 1mk.
Incomplete table with 2 titration = $\frac{1}{2}$mk.
Incomplete table with 1 titration = 0 mk.

Penalties

- wrong arithmetic / substraction
- Inverted tables
- Burette readings bayond 50.0cm^3 unless explained.
- Unrealistic titre values ie too low (below 1.0cm^3) or too high 100cm^3)
- Penalize $\frac{1}{2}$mk Each to a maximum penalty of $\frac{1}{2}$mk (penalize $\frac{1}{2}$mk only once)

b. Use of decimals (tied to rows 1 and 2 only) = ...1mk

Conditions

- Accept only 1 to 2 d.p. used consistently, otherwise Penalize fully.
- Accept 2dp only if the second dp is '0' or '5' otherwise penalize fully.
- Accept ~~2dp~~ inconsistency in use of zero's as initial volume ie 0, 0.0, 0.00,

C. Accuraney. (1 mark)

Only tick the correct value otherwise don't tick. Compare the candidates / students value ~~the~~ with the school value (SV) and tick(✓) the chosen value where it earns a mark.

Conditions

- If any value is within ±0.10cm^3 of S.V = (1mk)
- If No value is within ±0.10cm^3 but at least is with ±0.20 cm^3 of S.V ---------- ($\frac{1}{2}$ mk)
- If no value is within 0.20cm^3 of SV = (0 mk)
- If there is wrong arithmetic / substraction in the table

- Compare the S.V with the worked out correct value ll the titre and award accordingly

d. Principles of Averaging ---------- (1 mark)

- Values averaged must be shown and MUST be with ± 0·20 cm^3 of each other.

Conditions

- If three consecutive values are averanged --- (1 mk)
- If three titrations are done but only 2 are within 0·20 cm^3 of each other ---------- ($\frac{1}{2}$ mk)
- If only 2 titrations are done, consistent and averaged ---------- ($\frac{1}{2}$ mk)
- If 3 possible but only 2 are averaged ------- (0 mk)
- If 3 titrations are done, are inconsistent and yet all are averaged ---------- (0 mk)
- If only 2 titrations done, are inconsistent and yet averaged ---------- (0 mk)

Penalties

- Penalize ½ mk for wrong arithmetic error outside ± 2 units in the second decimal place.
- Penalize ½ mk if no working is shown but the answer is correct.
- If no working is shown and the answer is wrong Penalize FULLY.
- Accept rounding off the answer to 2 decimal places; otherwise Penalize ½ mk for wrong rounding off to 1 d.p. or to whole numbers

e. Final Accuracy ---------- (1 mk)

Compare the candidates correct average titre as reflected by his table with the S.V and award accordingly.

Conditions

- If the correct average is within $\pm 0.10 cm^3$ of S.V. ---------- award 1 mk
- If the correct average is not within $\pm 0.10 cm^3$ but within $\pm 0.20 cm^3$ ---------- award $\frac{1}{2}$ mk
- If the correct average is outside $\pm 0.20 cm^3$ of S.V. ---------- award 0 mk.

Penalties.

- Penalize $\frac{1}{2}$ mk for ~~wrong~~ rounding off to 2 d.p. or to whole numbers.
- Penalize fully for wrong rounding off to 1 d.p or to whole numbers.

Table I.

Complete table ---------- 1 mk
Use of decimals ---------- 1 mk
Accuracy ---------- 1 mk
Principles of averaging ---------- 1 mk
Final Accuracy ---------- 1 mk
05

Calculations.

(b) Concentration of the acid.

If $1000 cm^3 \equiv 0.2$ moles
$25 cm^3 \equiv \frac{25 \times 0.2}{1000} = 0.005$ moles ($\frac{1}{2}$, $\frac{1}{2}$)

Acid being dibasic mole ratio of acid : base = 1 : 2 ($\frac{1}{2}$)
Thus 2 moles NaOH reacts with 1 mole of acid
Then 0.005 moles reacts with $\frac{0.005 \times 1}{2} = 0.0025$ moles ($\frac{1}{2}$)

Average Titre value $\equiv 0.0025$ moles
Then $1000 cm^3 \equiv \frac{1000 \times 0.0025}{\text{Average titre value}}$

ie $\frac{1000 \times 0.0025}{S.V}$ ($\frac{1}{2}$) moles per litre (otherwise penalize wrong units)

3

3

($\frac{1}{2}$) Answer

(c) R.F.M. of acid.

Molarity = $\frac{\text{mass/litre (g/litre)}}{\text{RMM}}$ Thus RMM = $\frac{\text{g/litre}}{\text{molarity}}$

Mass Per litre

$500cm^3 \equiv 5.04g \Rightarrow \frac{1000 \times 5.04}{500} = 10.08g$. ½ ½

Thus R.F.M (RMM) = $\frac{10.08}{\text{Ans (b)}}$ (no units) ½

Answer ½

2

Conditions.

- Penalize ½mk for wrong transfer of moles and mass; Otherwise Penalize fully.
- Accept rounding off of answer to at least 3d.p. Otherwise Penalize ½mk
- Penalize ½mk for wrong transfer if the anthmetic error is outside ± 2 units in the 3.d.p.
- Penalize ½mk if units/wrong units given.

d. Value of X.

$H_2C_2O_4 X H_2O$ RMM = Ans in c above

$2(1)+2(12)+4(16)$ $\therefore 90 + 18x =$ Ans c above ½

$2+24+64 = 90$

$18x = \text{Ans c} - 90$ ½

$x = \frac{\text{Ans c} - 90}{18}$ ½ (no units)

Answer ½

2

Total = 12

2 (a) Table ..... (5mks)

1 Complete table ..... (2 mks)

Conditions

(i) Complete table with 12 readings ..... (2mks)
Incomplete table with 10–11 readings ..... (½ mk)
Incomplete table with 7–9 readings ..... (1 mk)
Incomplete table with Less than 6 readings ... (0mk)

(ii) Treat initial values of above 40°C and below 10°C as unrealistic and Penalize 1 mk tied to time ie t = 0)

(iii) Penalize ½ mk for each reading greater 50°C from t = 30 sec. to a maximum of 1 mk.

(iv) Penalize 1 mk if all values given in the table are constant-

2. Use of decimals ..... (1mk)
Accept whole numbers values or reading to .0 or .5 used consistently. Otherwise penalize fully.

3. Accuracy ..... (1mk)
Compare the candidates initial temparature reading ie. at time t = 0 with the school value: and if within ± 2°C award 1 mk, otherwise if Outside ± 2°C Penalize fully.

4. Trend ..... (1mk)
Award the first ½ mk for a continous rise in temparature up to a maximum, or constant values followed by a drop.

C.T	2
Use of decimals	1
Accuracy.	1
Trend	1
	5

b(i) Graph ---------- (3mks)

Marking

(i) Labelling (Both axis) ---------- ($\frac{1}{2}$ mk)

Penalties

Penalize fully for inversion of axis

Penalize fully for wrong units given, otherwise ignore units if units are omitted.

(ii) Scale ---------- ($\frac{1}{2}$ mk)

Conditions

- Area covered by the plots should be at least $\frac{3}{4}$ of the plotting otherwise penalize fully.
- Intervals must be consistent, otherwise penalize fully.

(iii) Plotting ---------- (1mk)

Conditions

- Award 1 mk if at least 9 points are correctly plotted.
- Award $\frac{1}{2}$ mk if 6-8 points are correctly plotted otherwise award 0.
- Accept plots even if the axis are inverted.

(iv) Shape ---------- (1mk)

- Award $\frac{1}{2}$ mk for a straight line showing progressive increase in temparature.
- Award the other $\frac{1}{2}$ mk for an extrapolated straight line showing a drop.

Labelling — $\frac{1}{2}$
Scale — $\frac{1}{2}$
Plotting — 1
Shape — 1
03

b(ii) ΔT shown on the extrapolated graph and correct award 1 mk.

If not shown but correct award $\frac{1}{2}$ mk.

C. Amount of heat

$\Delta H = MC\Delta T$

$= 50 \times 4.2 \times \Delta T$ 1

= Ans in Joules 1

2

3. You are provided with s[illegible] carry o[illegible] the followin[illegible] r observations and inferences in the tab[illegible] vided.

a) Put solid E in a boilin[illegible] Add distilled water to [illegible] mixture.

Observations (1mark)	[illegible] (1mark)
The solid dissolve to form a pale blue solution	Soluble compound Cu^{2+} present

2

b) i) To about 1cm³ of [illegible] formed, add sodium h[illegible] in excess.

Observations (1mark)	[illegible] (1mark)
Blue Precipitate formed insoluble in excess	Cu^{2+} present

2

ii) To about 1cm³ of [illegible] ution ab[illegible] add am[illegible] til in excess.

Observations 1mark)	(1mark)
Pale blue Precipitate formed, soluble in excess to form a deep blue solution.	Cu^{2+} present.

2

iii) To about 1cm³ o[illegible] ution abo[illegible] e, add un[illegible]

Observations 1/2mark)	[illegible] (1/2mark)
pH = 7	The solution is neutral

1

iv) To about 1cm³ o[illegible] tion [illegible] e, add 3 [illegible]

Observations 1mark)	[illegible] (1mark)
No effervescence, fizzing sound, bubbles Produced	CO_3^{2-}, SO_3^{2-}, HCO_3^- absent

2

v) To about 1cm³ o[illegible] tion [illegible] e, add Lea[illegible] nd boil the mixture

Observations (1mark)	(1mark)
White Precipitate formed insoluble on boiling.	SO_4^{2-} Present.

2

vi) To about 1cm³ of the solution, add barium chloride solution

Observations (1mark)	(1mark)
White Precipitate formed.	SO_4^{2-} Present.

2

4. You are provided with solid F. Carry out the tests below. Record your observations and inferences in the spaces provided.

i) Place half of Solid F in a boiling tube. Add about [illegible] of ethanol and shake.

Observations (1mark)	(1mark)
The Solid dissolves to form a colourless solution.	Non-Polar compound

ii) Place about 2cm³ of obtained in a test tube. [illegible] solution and test its PH.

Observations (1/2mark)	(1/2mark)
PH = 7	The solution is neutral.

iii) Place about 2cm³ of obtained in a test tube. [illegible] potassium dichromate (vi).

Observations (1/2mark)	(1/2mark)
Acidified Potassium dichromate(VI) turns from orange to green	R-OH Present

iv) Place about 2cm³ of [illegible] in a test tube and [illegible] sodium hydrogen carbonate provided.

Observations (1/2mark)	Inference (1/2mark)
No bubbles, No effervescence No fizzing sound. (½ for only one)	H^+, H_3O^+, $-COOH$ absent (½ for any of them)

v) Place the other half of [illegible] in a boiling tube. [illegible] water and shake.

a) Place about 2cm³ [illegible] obtained in a test tube [illegible] gen Carbonate that remained.

Observations (1/2mark)	Inference (1/2mark)
Effervescence occur / Bubbles formed / fizzing sound Produced (½ for any)	H^+, H_3O^+, $-COOH$ Present. (½ for any)

b) Place about 2cm³ of obtained in a test tube [illegible] water solution and test its PH.

Observations (1/2mark)	(1/2mark)
pH = 3 ½	F is strongly acidic ½