233/3 – CHEMISTRY (PRACTICAL) PAPER 3 MARKING SCHEME

Procedure 1(a) - Table I

(a)   Complete table ----   (½mk)
- Final temperature must be lower than initial temperature otherwise penalize fully.
- For initial temperature values $\geq 40°$ or $\leq 10°$ are treated as unrealistic values 0°0 penalize (½mk).

(b)   Complete table ----   (½mk)
- Accept all readings in whole numbers or 1d.p. either '0' – '5' used consistently.
- Reject inconsistently.

(c)   Accuracy ----   (½mk)
- Compare students value (initial value) with S.V. and if within $\pm 2°C$ award (½mk) otherwise award zero.

(a) ΔT = Final temperature – initial temperature.
NB: (Insist on the correct answer as per the table).

(b)   (i) ΔH = $MC\Delta T$
                        = $40 \times 4.2 \times \Delta T$
                        = C.A.J

Conditions
- Accept an error of ± 2 units in the 3rd digit if answer is in J or 3rd d.p. if in KJ, otherwise penalize (½mk)
- Award 1mk for correct substitution and ignore the formular.
- Penalize (½mk) for wrong units shown, otherwise ignore units.
- Don't penalize if ΔH sign is missing or omitted.

(ii) $2g \to$ Ans c(i) above.
        $126g \to$?
        = $\dfrac{Ans(c(i) \times 126}{2}$
        = C.A. J/mol

Conditions
- If wrong units are given or omitted in final answer, penalize (½mk)
- Accept arithmetic error of ± 2 units in the 4th digits if in joules OR 2nd d.p if in KJ.
- Correct sign (+ve) must be shown for ΔH_1, otherwise penalize (½mk)
- Do not penalize of ΔH sign is missing or Not shown.

Procedure II(b) - Table II

NB: The marking of table II is done as that of table I except for complete table, the final temperature must be higher than the initial temperature.

Calculations

(a) ΔH =   Final temperature – initial temperature.
(b)   (i) ΔH = $80 \times 4.2 \times \Delta T$
                        =   C.A.J.

Conditions
Accept an error of ± 2 units in the 4th digit if answer if answer is in joules OR 3rd d.p if answer is in KJ. Other conditions remains as for b(i) in procedure (a).

(ii)   Moles reacting = $\dfrac{0.5 \times 40}{1000} = \underline{0.015 mol}$

$$\Delta H_2 = \frac{Ansb(i) \times 1}{0.015}$$

$$= \underline{C.A.J}$$

(c) ΔH_3 = ΔH_1 + ΔH_2
             = C.A.J

$H_2X_{(S)}$ NaOH

           ΔH_3 $NaX + H_2O_{(l)}$

ΔH_1 ΔH_2

        $H_2 X_{(aq)}$

Conditions.
- Negative (-ve) value must be shown on correct answer otherwise penalize. (½mk)
- Correct units must be used i.e. J/mol OR KJ/mol otherwise penalize. (½mk)
- Penalize (½mk) for wrong answer.
- For correct substitution without formula, you will credit (1½mks) at step II.
NB: Capital J and small K MUST be used.

Procedure II - Table III
(i)   **TITRATION**.
Consider the table below.

	I	II	III
Final burette reading	15.2	30.4	45.8
Initial burette reading	0.0	15.4	31.0
Titre volume (cm³)	15.2	15.0	14.8

Marks are awarded as follows.

A   **Complete table award 1 mark**
    (i)   Complete table with 3 titrations done award 1 mark
    (ii)   Incomplete table with two titrations done – award ½
    (iii)   Incomplete table with only one titration done – award 0 mark.
    Penalties.
    (i)   Wrong arithmetic
    (ii)   Inverted table.
    (iii)   Burette readings beyond 50.0cm³ unless explained.
    (iv)   Unrealistic titre values i.e. below 1.0cm³ or in hundreds.
    NOTE : Penalize ½ mark each to a maximum of ½ mark i.e. penalize ½ mark once.

B   **Decimal place award 1 mark**
    (i)   Accept only 1 or 2 d.p. used consistently, otherwise penalize FULLY i.e. award zero.
    (ii)   If 2 d.p. are used, the 2nd d.p. MUST be either "0" or "5" otherwise penalize fully.
    (iii)   Accept inconsistently in the use of zeros as initial burette e.g. 0.0, 0.00, 0.000 etc.
    NB: Decimal place is tied to 1st and 2nd rows ONLY of the table.

C   **Accuracy award 1 mark**
    Compare the candidates titre values with the school values (S.V) and tick the chosen
    value if it earns a mark.
    Conditions
    (i)   If at least is within ± 0.1 of the S.V award – 1 mark.
    (ii)   If no value is within ± 0.1 of the S.V but at least one value is within ± 0.2 of the
            S.V – award ½ mark.
    (iii)   Otherwise award zero marks.

NOTE: If there is arithmetic error in the table, compare the S.V with the correctly worked out titre value and award accordingly.

D   **Principles of averaging – 1 mark**

Values averaged must be shown and must be within ± 0.1 of each other.

Conditions

(i)   If 3 consistent titrations are done, are consistent and averaged – award 1 mark.

(ii)   If 3 titrations are done but only 2 are possible and are averaged – award 1 mark.

(iii)   If only 2 titrations are done, are consistent and averaged – award 1 mark.

(iv)   If 3 titrations are possible and only 2 are averaged – award 0.

(v)   If only 3 titrations are done, are inconsistent and are averaged – award 0 mark.

(vi)   If only 2 titrations are done, are inconsistent and are averaged – award 0 mark.

(vii) If only 1 titration done – award 0 mark.

Penalties

(i)   Penalize ½ mark for wrong arithmetic in average titre value if error is outside ± 2 units in the second decimal place.

(ii)   Penalize ½ mark if no working is shown but correct answer is given.

(iii)   Penalize fully if no working and if answer shown is wrong.

(iv)   Accept rounding off value (average titre value) to 2 d.p. otherwise penalize ½ mark for rounding off to 1 d.p. or whole number.

NOTE: (i)   Accept answer (average titre) to 1d.p. or whole number if it works out exactly and credit fully.

E   <u>Final answer – 1 mark</u>

(Tied to <u>correctly</u> averaged titre value)

Compare the candidates correct average titre value with S.V. and

(i)   If within ± 0.1 of S.V. – award 1 mark

(ii)   If within ± 0.2 of S.V. – award ½ mark

(iii)   If beyond ± 0.2 of S.V. – award 0

NOTE: (a)   Where there are two possible pairs of titres that can be averaged, use the pair that is closest to the S.V. and credit accordingly.

(b)   If wrong values are averaged pick the correct values if any following the principles of averaging, average and award accordingly.

(i)   **TITRATION**.

Consider the **below**.

	I	II	III
Final burette reading.	15.2	30.4	45.8
Initial burette reading.	0.0	15.4	31.0
Titre volume (cm³)	15.2	15.0	14.8

Marks are awarded as follows:

A   **Complete table award 1 mark**.

(i)   Complete table with 3 titrations done award 1 mark.

(ii)   Incomplete table with two titrations done – award ½ mark.

(iii)   Incomplete table with only one titration done – award 0 mark.

Penalties

(i)   Wrong arithmetic.

(ii)   Inverted table.

(iii)   Burette readings beyond 50.0cm³ unless explained.

(iv)   Unrealistic titre values i.e. below 1.0cm³ or in hundreds.

NOTE: Penalize ½ mark each to a maximum of ½ mark i.e. penalize ½ mark once.

B   **Decimal place – award 1 mark**.

      (i)   Accept only 1 or 2d.p used consistently, otherwise penalize FULLY i.e. award zero.

      (ii)   If 2d.p are used, the 2nd d.p MUST be either "0" or "5" otherwise penalize fully.

      (iv)   Accept inconsistently in the use of zeros as initial burette e.g. 0.0, 0.000, 0.000 etc.

      NB: Decimal place is tied to 1st and 2nd rows ONLY of the table.

C   **Accuracy – award 1 mark**.

      Compare the candidates titre values with the school values (S.V) and tick the chosen value if it earns a mark.

      (i)   If at least is within $\pm\,0.1$ of the S.V award – 1 mark.

      (ii)   If no value is within $\pm\,0.1$ of the S.V but at least one value is within $\pm\,0.2$ of the S.V – award ½ mark.

      (iii)   Otherwise award zero marks.

      NOTE: If there is arithmetic error in the table, compare the S.V with the correctly worked out titre value and award accordingly.

D   **Principles of averaging – 1 mark**.

      Values averaged must be shown and must be within $\pm\,0.1$ of each other.

      Conditions.

      (i)   If 3 consistent titrations are done, are consistent and averaged – award 1 mark.

      (ii)   If 3 titrations are done but only 2 are possible and are averaged – award 1 mark.

      (iii)   If only 2 titrations are done, are consistent and averaged – award 1 mark.

      (iv)   If 3 titrations are possible and only 2 are averaged – award 0.

      (v)   If only 3 titrations are done, are inconsistent and are averaged – award 0 mark.

      (vi)   If only 2 titrations are done, are inconsistent and are averaged – award 0 mark.

      (vii)   If only 1 titration done – award 0 mark.

      Penalties

      (i)   Penalize ½ mark for wrong arithmetic in average titre value if error is outside $\pm\,2$ units in the second decimal place.

      (ii)   Penalize ½ mark if no working is shown but correct answer is given.

      (iii)   Penalize fully if no working and if answer shown is wrong.

      (iv)   Accept rounding off value (average titre value) to 2d.p, otherwise penalize ½ mark for rounding off to 1d.p or whole number.

      NOTE: (i)   Accept answer (average titre) to 1d.p or whole number if it works out exactly and credit fully.

E   Final answer – 1 mark.

      (Tied to **correctly** averaged titre value).

      Compared the candidates correct average titre value with S.V and

      (i)   If within $\pm\,0.1$ of S.V – award 1 mark.

      (ii)   If within $\pm\,0.2$ of S.V – award ½ mark.

      (iii)   If beyond $\pm\,0.2$ of S.V – award 0.

      NOTE: (a)   Where there are two possible pairs of titres that can be averaged, use the pair that is closest to the S.V and credit accordingly.

(b)   If wrong values are averaged pick the correct values if any following the principles of averaging, average and award accordingly.

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Calculations

$$\frac{0.02 \times averagetitre}{1000}$$ ✓½   01

= C.A.   ✓½

Penalties
- For wrong transfer of average titre, penalize ½ mark.
- If an arithmetic error which is beyond ± 2 units in the 5ᵗʰ d.p. is omitted penalize ½ mark
- Accept rounding off to 4ᵗʰ or 5ᵗʰ d.p.
- If units are shown they must be correct, otherwise penalize ½ mark.

NB: Ignore if units are not shown.

(c)   Moles of B in 15cm³ = $\left(\frac{15}{1000} \times 0.5\right)$ ✓½

= 7.5×10^{-3}mol

250 cm³ → 7.5×10^{-3}mol

25cm³ → ?

= $\frac{7.5 \times^{-3} \times 25}{250}$ ✓½   2½

= 7.5×10^{-3}mol

(d) $\frac{Ans(c)}{Ans(b)}$ ✓½   1.2 = C.A. ✓½   1½

Conditions/Penalties.
- For wrong transfer if Ans(c) or (b) penalize (✓½mk)
- If strange values are used/is used award zero.
- The answer must be rounded off to a whole number, otherwise penalize fully.

2.	(a)	**Observations**	**Inferences**
		- White residue. - Colourless liquid formed at the cooler parts of test tube. - Blue litmus remains blue and red remains red. (1 mark)	- Presence of hydrated substance. - Presence of neutral fumes. (1 mark)

	(b)	**Observations**	**Inferences**
		- White residue. - Colourless filtrate. (1 mark)	- Presence of practically soluble substance. - Absence of Cu^{2+}, Fe^{2+}, Fe^{2+} (Tied to colourless filtrate) (1 mark)

	(i)	**Observations**	**Inferences**
		- Colour of phenolphthalein indicator turns pink. (Observation tied to colour of the indicator not solution) (½ mark)	- Presence of HCO_3^-, $HCO_3^- OH^-$ (1 mark)

(ii)	Observations	Inferences
	- No effervescene. - No white ppt. (1 mark)	- Absence of HCO_3^-, CO_3^{2-} ✓½ - Presence of OH⁻ ✓½ - Absence of Pb^{2+} (1 mark)

(iii)	Observations	Inferences
	- White ppt insoluble in excess (1 mark)	- Presence of Ca^{2+}, Mg^{2+} (1 mark)

(iv)	Observations	Inferences
	- Red flame (1 mark)	- Presence of Ca^{2+} (1 mark)

3.	(a)	Observations	Inferences
		- Burns with yellow sooty flame. (1 mark)	- Presence of $C=C$, $-C \equiv C-$ OR Long chained hydrocarbons. (1 mark)

(b)(i)	Observations	Inferences
	- PH 4 (1 mark)	- Presence of weak acid. (1 mark)

(ii)	Observations	Inferences
	- Purple colour of acidified KMnO₄ Turns colourless (1 mark)	$C=C$, $-C \equiv C-$ (1 mark)

(iii)	Observations	Inferences
	- Red/yellow colour of bromine water turns colourless. (1 mark)	- Presence of $C=C$, $-C \equiv C-$ - Absence of Pb^{2+} (1 mark)