Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3

MARKING SCHEME

1. Table I (5 marks)
Distributed as follows:

A. Complete table 1 mark
(i) Complete table with 3 titration 1 mark
(ii) Incomplete table with 2 titration done ½ mark
(ii) Incomplete table with 1 titration done 0 mark

Penalties
(i) Wrong arithmetic / subtraction.
(ii) Inverted table.
(iii) Burette readings beyond $50cm^3$ unless explained.
(iv) Unrealistic titre values (below $1cm^3$ or above $100cm^3$).

NOTE: Penalise ½ mark each to a maximum of ½ mark

B. Use of decimals 1 mark
(Tied to 1st and 2nd rows of the table)

- Accept 1 or 2 decimal places used consistently otherwise penalize fully i.e. award 0 mark.
  - If 2 decimal places MUST have '0' or'5' otherwise penalize fully.
  - Accept inconsistency of the zeros as the initial burette readings e.g 0, 0.0, 0.00

C Accuracy 1 mark
Compare the candidates titre values with the school values and ticks (√) the value if it earn a mark.

Conditions
(i) If atleast one value is within ± 0.1 of school value 1 mark
(ii) If no value within 0.1 but one is within ± 0.2 of school value ½ mark
(iii) If no value is within 0.2 of school value award 0 mark

NB: If there was wrong arithmetic in the table, compare the school value with the correctly worked out value and award accordingly.

D. Principles of averaging 1 mark
(Values averaged MUST be within ± 0.2 from one another and MUST be shown)

Conditions:
- If 3 titrations are done and averaged 1 mark
- If 3 titrations are done but only 2 are consistent and averaged award 1 mark
- If 2 titrations are done and are averaged award 1 mark
- If 3 titrations are possible but only 2 are averaged award 0 mark
- If 1 titration is done award 0 mark

Penalties
(i) Penalise ½ mark for wrong arithmetic in the average titre if the error is outside ± 2 units in the 2nd dip.
(ii) Penalise ½ mark if no working is shown and the answer given is correct.
(iii) Penalise FULLY if no working is shown and answer given is wrong.
(iv) Accept rounding off of answer to 2 d.p otherwise penalize wrong rounding off.

NOTE: - Accept answers to 1 d.p or whole numbers if it works out correctly and credit fully.
- a(i) must be marked before awarding for principles of averaging.

E. Final accuracy 1 mark
(Tied to averaged titre)
Compare the correct average titre value with the school value and if:
(i) Within ± 0.1 of school value award 1 mark
(ii) If not within ± 0.1 but within ± 0.2 of school value award ½ mark
(iii) If not within ± 0.2 of school value award 0 mark

NOTE:
(i) If there are two possible pairs of titre values that can be averaged, use the pair that is closed to the school value.
(ii) If wrong values are averaged, pick the correct values (If any) following the principles of averaging, average and award accordingly.

Calculations
(a) (ii) Moles of NaOH in the average volume of solution R used

$$= \frac{\text{Average titre}}{1000} \times 0.3 \quad \surd \tfrac{1}{2} = \text{C.A.O} \surd \tfrac{1}{2}$$

(iii) Moles of HCl in $25cm^3$ of solution S
Mole ratio NaOH : HCl = 1 : 1 $\surd \tfrac{1}{2}$
Moles of HCl = ans a (ii) x $^1/_1$
= C.A.O $\surd \tfrac{1}{2}$

(iv) the molarity of HCl solution S

$$\text{Ans a(iii)} \surd \tfrac{1}{2} \times \frac{1000}{25}$$

= C.A.O $\surd \tfrac{1}{2}$

OR

Ans a (iii) x 40 √ ½
= C.A.O √ ½

2

$M_a v_a = mbvb$
$M_a V_a = 1$
$M_b V_b \ 1$
M_a = 0.3 x AV. Titre
25 = C.A.O

TABLE II 5 marks
(To be marked similar to table I)

Calculations

(b) (ii) Moles of hydrochloric acid in the average volume of solution S used
= Ans a (iv) ans b (i) √ ½
1000
= C.A.O √ ½

(iii) Moles of metal carbonate, solid Q in 25cm^3 of solution Q
Ratio acid : metal carbonate = 2 : 1 √ ½
Moles of metal carbonate = Ans b(ii) √1
2
= C.A.O √ ½

(iv) The solubility of metal carbonate, solid Q in water
Mass of solution = volume x density
= 25 x 1
= 25g
Mass of metal carbonate = mol x R.M.M
= Ans b (iii) x 74 √ ½
= C.A.O (A)
Mass of water (solvent) in 25cm^3 of solution
25 - ans (A) above √ ½
= C.A.O (B)
Solubility of M_2CO_3 (Solid Q) = Ans A x 100 √ ½
Ans B
= C.A.O √ ½

<u>Requirements</u>

1) Pipette + pipette filler
Burette
Conical flasks (2 pieces) 250ml
Filter paper
Filter funnel
Glass rod
Volumetric flask 250ml
200ml distilled water
Methyl orange water
Solid Q – Mixture 0.5g of Na_2CO_3 + 0.1g of $CaCO_3$
Solution P – Prepared by dissolving 172cm^3 of conc. HCl in distilled water and dilluting to 1 litre solution.

Solution C – prepared by dissolving 12g of NaOH pellets in 1 litre solution

2.

	Observation	Inferences
2 (a)	Colourless gas √ ½ which turn blue√ ½ litmus paper red √ ½ and red litmus remain red White residue √ ½	Acidic gas produced √1
B((i)	White ppt √1 Insoluble in acid √ ½	SO_4^{2-} present √1
(ii)	White ppt √1 Insoluble in excess √ ½	Al^{3+}, Pb^{2+} present √
(iii)	No yellow ppt √1	Al^{3+} present √1
3 (a)	Burns with a sooty / smoky flame	Organic compound with high C : H ratio Or or C C C C Present
(b)	Dissolves to form a colourless solution	F is polar
c) (i)	Yellow colour of bromine water remains	C C C C Absent
(ii)	Orange $K_2Cr_2O_7$ remains orange	R OH absent
(iii)	Effervescence / gas bubbles	H+ / H_3O^+ Present
(iv)	pH = 4 or 5 or 6	R – COOH present