**MARKING SCHEME**

**233/3**

**CHEMISTRY**

**TERM 2 2019**

## *Kenya Certificate of Secondary Education (K.C.S.E.)*

1. **Table 1**

**a)**

**Complete table** …… 1mark

**Conditions:**

i) Complete table with 3 titrations done ……. 1 mark
ii) Incomplete table with two titrations done….½ mark
iii) Incomplete table with only one titration done ….0 mark

**Penalties:**

i) Wrong arithmetic
ii) Inverted table
iii) Unrealistic values i.e less than 1 $cm^3$,or in 100s
iv) Burette readings >50 $cm^3$,unless explained

Penalize ½ mark each to a maximum of ½ mark, i.e, penalize ½ mark ONCE.

**Use of decimal places**…… 1 mark ( Tied to

$1^{st}$ and $2^{nd}$ row only)

i) Accept 1 or 2 decimal places used consistently, otherwise penalize FULLY.
ii) If two decimal places are used, the $2^{nd}$ must be a "0" or a "5", otherwise penalize FULLY.
iii) Accept the inconsistency in the use of zeros in the initial burette readings e.g 0.0,0.00, 00.0

**Accuracy**……. 1 mark

Compare candidate's correct titre value with school value (s.v) and tick (✓) if it earns a mark and award accordingly.

**Coditions:**

i) If at least one titre value is within ± 0.1 $cm^3$ of s.v award…… 1 mark

ii) If no value is within ± 0.1 $cm^3$ of s.v but there is at least one within ± 0.2 $cm^3$ award …… ½ mark

iii) If no titre value is within ± 0.2 $cm^3$ award…… 0 mark

**Principles of averaging**…… 1 mark

i) If three consistent values are averaged …… 1 mark

ii) If three titrations are done and only two are consistent and averaged…… (1 mark)

iii) If two titrations are done, are inconsistent and averaged … (0 mark)

**Final Accuacy** (tied to correct average titre)…….. (1 mark)

Compare the candidate's correct average titre with s.v;

i) If within ± 0.1 of s.v …….. 1 mark

ii) If not within ± 0.1 but within ± 0.2 of s.v ……½ mark

iii) If beyond ± 0.2 of s.v …… 0 mark

b) 250 $cm^3$ ⟶ 1.325g of $Na_2CO_3$

⟶ 1.325 x 4g of $N_{a2}CO_3$

= 5.3/ RFM

= $\underline{5.3}$ grams per litre

106

= 0.05M ✓

c) i) Moles of $Na_2CO_3$ reacted = $\frac{0.05 \times 25}{1000}$

= 0.00125 ✓

Reacting mole ratio of HA: $Na_2CO_3$ = 2:1

ii) 0.0025 moles of HA ⟶ average titre

? ⟵ $1000cm^3$

$= \frac{0.0025 \times 1000}{\text{Average titre}}$

= 0.12M ✓

**Table II: mark as in table I**

e) i) $1000cm^3$ ⟶ 0.12 mol.

Titre volume ⟶ $\frac{\text{average volume} \times 0.12}{1000}$ moles

= correct answer

ii) Reacting mole ratio of HA to $Na_2CO_3$ is 2 : 1
∴ Moles of $Na_2CO_3$ = ½ * answer above

=Correct answer

2. **Table 1**

**d)**

**Complete table** …… 1mark

**Conditions:**

iv) Complete table with 3 titrations done ……. 1 mark
v) Incomplete table with two titrations done….½ mark
vi) Incomplete table with only one titration done ….0 mark

**Penalties:**

v) Wrong arithmetic
vi) Inverted table

vii) Unrealistic values i.e less than 1 $cm^3$,or in 100s
viii) Burette readings >50 $cm^3$,unless explained
Penalize ½ mark each to a maximum of ½ mark, i.e, penalize ½ mark ONCE.

**Use of decimal places**…… 1 mark ( Tied to

1st and 2nd row only)

iv) Accept 1 or 2 decimal places used consistenly, otherwise penalize FULLY.
v) If two decimal places are, the 2nd must be a "0" or a "5", otherwise penalize FULLY.
vi) Accept the inconsistency in the use of zeros in the initial burette readings e.g 0.0,0.00, 00.0

**Accuracy**……. 1 mark

Compare candidate's correct titre value with school value (s.v) and tick (✓) if it earns a mark and award accordingly.

**Coditions:**

iv) If at least one titre value is within ± 0.1 $cm^3$ of s.v
award…… 1 mark
v) If no value is within ± 0.1 $cm^3$ of s.v but there is at least one within ± 0.3 $cm^3$ award …… ½ mark
vi) If no titre value is within ± 0.2 $cm^3$ award…… 0 mark

**Principles of averaging**…… 1 mark

iv) If three consistent values are averaged …… 1 mark
v) If three titrations are done and only two are consistent and averaged…… (1 mark)
vi) If two titrations are done, are inconsistent and averaged … (0 mark)

**Final Accuacy** (tied to correct average titre)…….. (1 mark)
Compare the candidate's correct average titre with s.v;
iv) If within ± 0.1 of s.v …….. 1 mark
v) If not within ± 0.1 but within ± 0.2 of s.v ……½ mark
vi) If beyond ± 0.2 of s.v ……. 0 mark

e) 250 $cm^3$ ⟶ 1.325g of $Na_2CO_3$
⟶ 1.325 x 4g of $N_{a2}CO_3$

= 5.3/ RFM

= 5.3 grams per litre

106

= 0.05M ✓

f) i) Moles of $Na_2CO_3$ reacted = $\frac{0.05 \times 25}{1000}$

= 0.00125 ✓

Reacting mole ratio of HA: $Na_2CO_3$ = 2:1

ii) 0.0025 moles of HA ⟶ average titre

? ⟵ $1000cm^3$

= $\frac{0.0025 \times 1000}{\text{Average titre}}$

= 0.12M ✓

**Table II: mark as in table I**

e) i) $1000cm^3$ ⟶ 0.12 mol.

Titre volume ⟶ $\frac{\text{average volume} \times 0.12}{1000}$ moles

= correct answer

iii) Reacting mole ratio of HA to $Na_2CO_3$ is 2 : 1

$\therefore$ Moles of $Na_2CO_3$ = ½ * answer above

=Correct answer

iv) $25cm^3$ ⟶ answer( ii)
$75\ cm^3$ answer (ii) x $\frac{75}{25}$ = correct answer

v) Original solution c: 75 x answer (iii) = correct answer

vi)

vii) 0.00375 – answer (iV) = correct answer

viii) Reacting mole ratio is 1 : 1 $\therefore$ moles of $M(OH)_2.8H_2O$=
= answer (v)

f) i) answer b(vi) are in 25 $cm^3$ of $M(OH)_2.8H_2O$

x $\frac{1000}{25}\ cm^3$

x = $\frac{\text{answer x } 1000}{25}$ ✓

= correct answer (moles per litre) ✓

ii) 15.75 g ⟶ answer (i)

?? ⟵ 1mol.

x = $\frac{18.3 \text{ x } 1}{\text{answer (i)}}$ ✓

= correct answer ✓ (accept rounded off to ma whole number)

iii) M + 178 = answer (ii)
M = Answer (ii) - 178 ✓

$\therefore$ R.A.M of M = correct answer ✓

ix) answer( ii)
75 $cm^3$ answer (ii) x $\frac{75}{25}$ = correct answer

x) Original solution c: 75 x answer (iii) = correct answer

xi) 0.00375 – answer (iV) = correct answer

xii) Reacting mole ratio is 1 : 1 $\therefore$ moles of $M(OH)_2.8H_2O$=
= answer (v)

f) i) answer b(vi) are in 25 $cm^3$ of $M(OH)_2.8H_2O$

x $\frac{1000}{25}$ $cm^3$

x = $\frac{\text{answer x } 1000}{25}$ ✓

= correct answer (moles per litre) ✓

ii) 15.75 g ⟶ answer (i)

?? ⟵ 1mol.

x = $\frac{18.3 \text{ x } 1}{\text{answer (i)}}$ ✓

= correct answer ✓ (accept rounded off to a whole number)

iv) M + 178 = answer (ii)
M = Answer (ii) - 178 ✓

$\therefore$ R.A.M of M = correct answer ✓

**Question 2**

**Table**

(i) Complete table…..2 readings recorded…. 1 mk

Penalty:

penalize fully for any space not filled.

(ii) Use of decimal…… 1 mk

Accept temperature readings for 1 mk if consistently given either as whole numbers of 1 d.p. of .0 or .5

(iii) Accuracy…… 1 mk

Compare candidate's initial temperature reading to school value. Award 1 mk for value within $\pm$ 2$^{o}$C of SV otherwise penalize fully.

Questions

(a) $\Delta T$ = Final-Initial = Correct ans 1 mk

Penalties

- Penalise ½ mark for wrong units or omission of unit on the answer.

(b) (i)Accept correct transfer of $\Delta T$, even if rejected in (a) above.

Heat change= m.c. $\Delta T$

= 30 x 4.2 x $\Delta T$ 1 mk

= correct ans 1 mk

ii) Number of moles= $\frac{2.0}{126}$ = 0.01587 1 mk

- Penalise ½ mk for wrong units used otherwise ignore if omitted.

iii) Molar heat of solution.

$\Delta H = \frac{\text{ans b(i)}}{ans\ b(ii)}$ ½ mk

= correct ans ½ mk

Penalties

- Penalise ½ mk for transfer of either b(i) or b(ii), otherwise penalize fully for strange values.

3 i)

| Observation | Inference |
|---|---|
| No white precipitate formed ✓½ | $Na^+$, $K^+$, $NH_4^+$ ✓½ |

(ii)

| Observation | Inference |
|---|---|
| Burns with a golden-yellow flame ✓1 | $Na^+$ present ✓½ |

(iii)

| Observation | Inference |
|---|---|
| White precipitate ✓½ dissolves on addition of HCl acid ✓½ | $SO_3^{2-}, CO_3^{2-}$ *present* ✓ |

(iv)

| Observation | Inference |
|---|---|

| | |
|---|---|
| Colour changes from <u>orange</u> to <u>green</u> ✓½ | $SO_3^{2-}$ *present* ✓½ |

b) You are provided with solid F. Carry out the tests below and record your observations and inferences in the spaces provide

(i) Using a metallic spatula, heat half of solid F in a non-luminous burnsen burner flame for some time then remove when it ignites

| Observations | Inferences |
|---|---|
| Melts burns with a sooty/smoky/luminous yellow flame√½ (accept melts on its own for ½ mk) | C= C or -C = C- present √1 Organic compound with high C:H ratio long chain organic compound ( ½ mk) |

ii) Put a half spatula endful of solid F into a boiling tube. Add about 10cm3 of distilled water and shake vigorously

| Observations | Inferences |
|---|---|
| Dissolves into a colourless solution ½ mk | Soluble compound /salt/polar substance ½ mk |

iii)Divide the resulting solution into two portions

a) To the first portion,add 2-3 drops of universal indicator and dertermine its PH

| Observations | Inferences |
|---|---|
| pH 2.0√ ½ | Strongly acidic $H^+$/-COOH √ ½ ( ½ mk |

b) To the second portion, add two drops of acidified potassium manganate (VII) solution and shake vigorously

| Observations | Inferences |
|---|---|
| $H^+/KMnO_4$ decoclourises √1 ( ½ mk) | C=C or –C= C- present √ ½ Or R-OH present √ ½ |