ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

112

MARKING SCHEME

NOVEMBER 2012

ST Johns

ST ANNCELL → 6

DAKGURU

Maphosa - 15

CHEMISTRY

9189/5

1 (a) (i) **Mass of FA1 used**

correct subtraction

Give 1 mark for a ~~final mass of FA1 reading to 2 d.p~~ [1]

Give one mark for a recorded mass of FA1 in the range 0.5 g to 0.60 g of solid **FA1** ~~inclusive~~. exclude limits 0.5 & 0.6 [1]

Deduct one of these marks if the readings are not recorded in the correct spaces in the table or the table is incomplete.

Deduct a second mark if the subtraction is incorrect

(b) **Titration Table**

ticking precise titres + calculation of $\bar{v}$ + burette readings to 2 dp

One mark for a ~~final burette reading to 2 d.p~~ [1]

One mark for correct subtraction provided no more than 1 zero start / [1]

One mark for sufficient titres any 2 difference of 0.2 ≥ (~~2 or more titres~~) [1]

Accuracy

Calculate the ratio $\dfrac{\text{mass in Table 1.1}}{\text{volume of } \mathbf{FA3}}$ and assign

Accuracy marks by comparing this ratio with that obtained for the Supervisor. Work to 4 decimal places. × 100

The spread penalty may have to be applied using the table below.

accuracy marks		spread penalty	
Mark	Difference from Supervisor	Range used/ cm^3	Deduction
		Less than 0.20	0
12	Up to 0.0100	0.20+ to 0.25	1
11	0.0100+ to 0.0150	0.25+ to 0.30	2
10	0.0150+ to 0.0200	0.30+ to 0.35	3
9	0.0200+ to 0.0250	0.35+ to 0.40	4
8	0.0250+ to 0.0300	0.40+ to 0.50	5
7	0.0300+ to 0.0350	0.50+ to 0.60	6
6	0.0350+ to 0.0400	0.60+ to 0.70	7
5	0.0400+ to 0.0500	0.70+ to 0.80	8
4	~~0.0500+ to 0.0600~~ 0.05+ to 0.10	0.80+ to 1.00	9
3	~~0.0600+ to 0.0800~~ 0.10+ to 0.2	1.00+ to 1.50	10
2	~~0.080+ to 0.100~~ 0.2+ to 0.3	1.50+ to 2.00	11
1	~~0.100+ to 0.200~~ 0.3+ to 0.4	Greater than 2.00	12
0	~~Greater than 0.2000~~ >0.4		

[12]

(c) $2S_2O_3^{2-}{}_{(aq)} + I_2 \rightarrow S_4O_6^{2-}{}_{(aq)} + 2I^-{}_{(aq)}$

one mark for balanced equation with / without state symbols 12 / 9 — 3 [1]

(d) Number of moles $Na_2S_2O_3$ = conc. of $Na_2S_2O_3 \times \frac{\text{titre in summary}}{\cancel{0.01} \times 1\,000}$ Substituting

= $0.01 \times \frac{\text{titre in smmary}}{1\,000}$ ~~Calculation~~ [1]

ans in std form

(e) Number of moles of I_2 in 250 cm^3 = $\frac{\text{answer to (d)}}{2}$ [1]

or $\frac{\text{mole } Na_2S_2O_3}{2}$ Substituting

(f) Moles of lead(IV) in 250 cm^3 = Moles of I_2 produced = answer in (e) evaluation std or 4SF [1]

(g) Mol PbO_2 in 250 cm^3 volumetric flask = $\frac{250}{25} \times$ Mol PbO_2 in 25 cm^3 [1] (A) AW

Mass of PbO_2 in 250 cm^3 volumetric flask = mol $PbO_2 \times M_r$ (PbO_2) [1]

in 25 cm^3

Mr [1]

% purity PbO_2 = $\frac{\text{Mass of } PbO_2 \text{ in } 250\ cm^3}{\text{mass of impure sample of } PbO_2} \times 100\%$ [1]

or = $\frac{\text{Mass of } PbO_2 \text{ in } 250\ cm^3}{\text{mass of FA1 used}} \times 100\%$

× 100 [1]

evaluation at most 2 d.p.

(h) acid increases the solubility of PbO_2 [1]

[Total : 25]

Designing an experiment to prepare 500 cm^3 of 1 $moldm^{-3}$ NaOH.

STEP I: Calc. n(NaOH) in 50 cm^3 of 4.5 $moldm^{-3}$ NaOH. [1]
as $\frac{50 \times 4.5}{1\,000}$ = [1]

STEP II: Calc. n(NaOH) in 60 cm^3 of 3.5 $moldm^{-3}$ NaOH. [1]
as $60 \times 3.5 \times 10^{-3}$ = [1]

STEP III: Calc. n(NaOH) in 45 cm^3 of 2.5 $moldm^{-3}$ [1]
as $45 \times 2.5 \times 10^{-3}$ = [1]

STEP IV: Calc. sum of moles in three solutions worked answer [1]

STEP V: Mix the three solutions thoroughly. [1]

Zivic e/f
50 cm^3 of 4.5 M
50 cm^3 of 3.5 M
110 cm^3 of 2.5 M

$n = CV$

STEP VI: Calc. the conc. of the resultant solution as: [1]

substitution + answer [1]

$$\left(\frac{1\ 000}{50+60+45}\right)\left(\frac{50\times4.5}{1\ 000}+\frac{60\times3.5}{1\ 000}+\frac{4.5\times2.5}{1\ 000}\right)$$ [1]

$V_1 = $ [illegible] $V_2 = 500$ $C_2 = 1M$.

$C_1V_1 = C_2V_2$

STEPVII: Divide the conc. into 5 00 cm³ and get the volume to be diluted (V). [1]

STEP VIII: Measure using a measuring cylinder the volume V of the solution [1]

STEP IX: Place V into the 500 cm³ volumetric flask. [1]

STEP X: Dilute to the mark using distilled water by adding smaller volumes/portions with thorough shaking/mixing [1] [1]

[Max 15]

OR.

Alternative Design

Step 1. Calculate max vol of 1M NaOH that can be prepared from each of the given solns as follows [illegible] measure the volumes [illegible] measuring cylinder [1]

Step 2: 50 cm³ × 4.5 M = 22.5 cm³ of 1 M NaOH [1]

Calculation of dilution vol = 225 − 50 = 175 cm³ distilled [1]

[illegible] for the others 60 × 3.5 = 210 cm³ [1]

210 − 60 = 150 cm³ [1]

45 cm³ × 2.5 = 112.5 cm³ [1]

112.5 − 45 = 67.5 cm³ [1]

Dilute the 3 solns with the respective distilled H₂O calculated [1] [1] added smaller portions of distilled water with the shaking/mixing

[illegible] [1] soln in a 500 cm³ then top with [1] [3]

Mix [illegible] [1] the others [illegible] all 3 distilled [1]

Calculation of vols any 2 [illegible] [1] [illegible] 60 [1]

Alt. 2

RMM mass	Titre	[illegible]