SERIES 4 EXAMS

Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3

MARKING SCHEME

1.

Titration	I	II	III
Final burette reading (cm^3)	30.1	30.1	30.1
Initial burette reading (cm^3)	0.0	0.0	0.0
Volume of solution C1 used (cm^3)	30.1	30.1	30.1

CT – 1
D – 1
A – 1
AV -1
FA – 1
05

(a) - Complete table 1 mark
- Consistent use of decimal 1 mark
- Penalise fully for mixed decimal
- Accuracy
  If ± 0.1 SV 1 mark
  ± 0.2 SV ½ mark
- Principles of averaging

$$\frac{30.1 + 30.1 + 30.1}{3} \surd \text{½ mark} = 30.1\ cm^3 \surd \text{½}$$

- Final answer 1 mark
  Rounded to atleast 2 dp
  Penalise fully if rounded to less than 2 dp
- If average titre within ± 0.1 of S.V 1 mark

(b) Number of moles of the acid, C_1 that reacted

Moles of NaOH reacting
If $1000cm^3$ 0.2 moles
$25cm^3$? √ ½ mark

$$= \frac{25}{1000} \times 0.2 \surd \text{½ mark}$$

$= 0.005$ moles

- Since the acid is dibasic, mole ratio of acid : base is 1 : 2 i.e $H_2C_2O_4.XH_2O$: NaOH
  1 : 2 √ ½ mark

Thus 2 moles of NaOH react with one mole of acid

2 moles of NaOH 1 mole of acid √ ½ mark

0.005 moles ?

$= \frac{0.005 \times 1}{2}$ √ ½ mark

= 0.0025 moles √ ½ mark

(c) Concentration of the acid

If 30.1cm^3 0.0025 moles

1000cm^3 √ ½ mark

$= \frac{1000}{30.1} \times 0.0025$ √1 mark

=0.0831 moles / litre √ ½ mark

(d) RMM of acid

Molarity = $\frac{\text{g/litre}}{\text{RMM}}$

RMM = $\frac{\text{g/litre}}{\text{Molarity}}$

g/litre

500cm^3 contain 5.04g √ ½ mark

1000cm^3 ?

$= \frac{1000}{500} \times 5.04$ √ 1 mark

= 10.08g √ ½

Thus RMM = $\frac{10.08}{0.0831}$ √ ½ mark

=121.3 √ ½ mark

= 121

(d) Value of X

$H_2C_2O_4.XH_2O$ = 121 √ ½ mark

90 + 18x = 121

18x = 121 – 90 √ 1 mark

x = 1.7

x = 2 √ ½ mark

2. (a)

Total volume of water added to 5g of solid K (cm^3)	10	15	20	25	30	35
Temperature at which crystals appear (^0C)	86	67	57	48.5	42	39
Solubility of K in g/100g of water	50	33.3	25	20	16.7	14.3

2

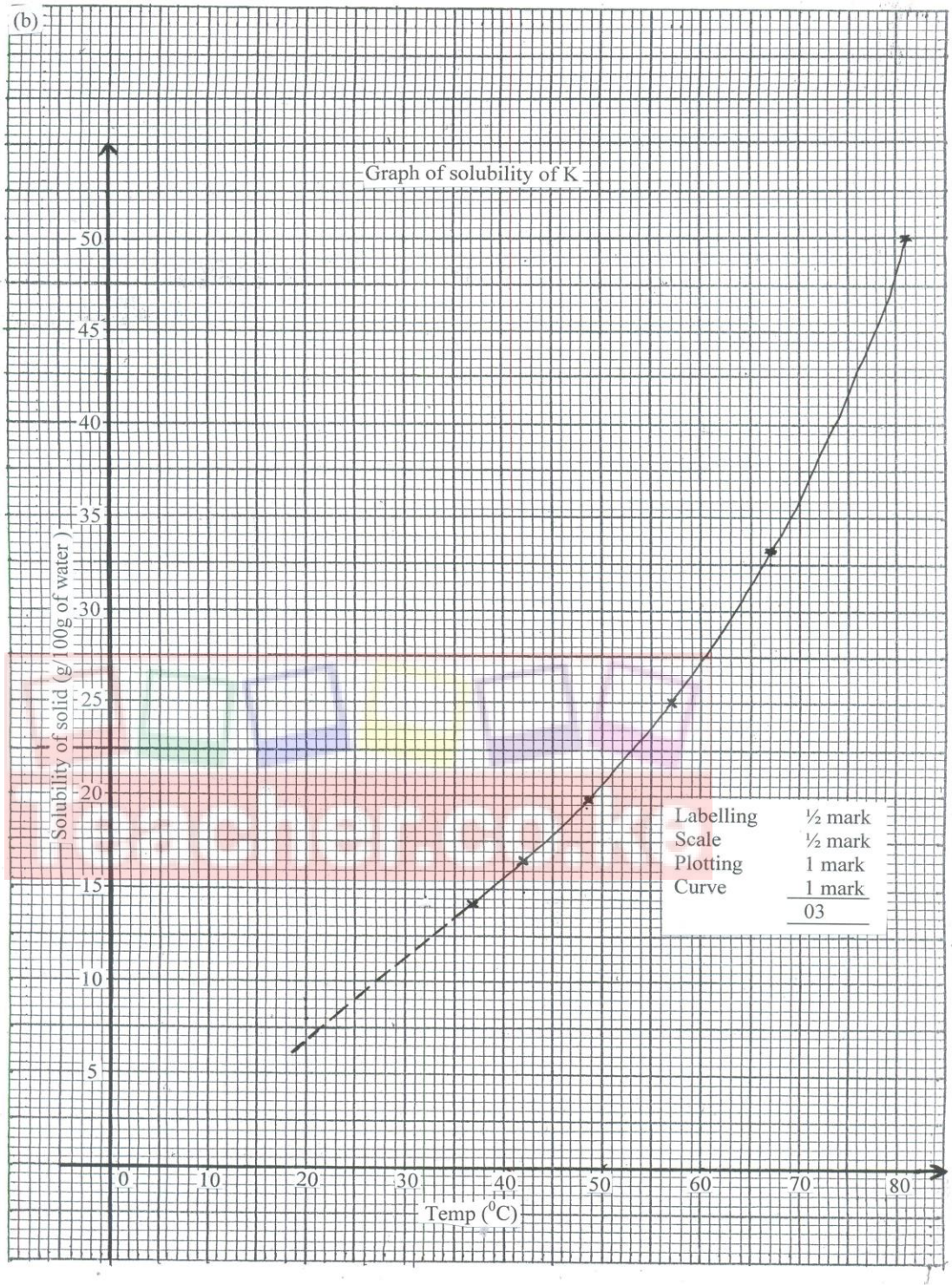
(i) Complete table (column I) 2 marks
Incomplete table with 5 readings 2 marks
Incomplete table with 4 readings 1 mark
3 and below readings 0 mark

(ii) Use of decimals 1 mark
Whole numbers or 1dp (applies to column I)

(iii) Accuracy ½ mark
± 2.0 of S.V ½ mark
If otherwise 0 mark

(iv) Trend ½ mark
½ mark for continuous drop in temperature readings in column I, otherwise penalize fully.
Column II 2 marks
- ½ mark for each value of solubility correctly calculated

(b)



Labelling	½ mark
Scale	½ mark
Plotting	1 mark
Curve	1 mark
	03

(c) (i) Solubility at 25^0C 1 mark
(Shown in graph) Penalise ½ mark for wrong units
- From extrapolated graph = 8.5g / 100g pf H_2O

(ii) Temperature when solution will contain 22g
- Penalise ½ mark for wrong units.

(d) Mass of solid K (1 mark
At 52^0C = 21.5 g/100g of H_2O
At 37^0C = 14.0 g/100g of H_2O
21.5 – 14.0 = 7.5g

3.

	OBSERVATIONS	INFERENCES
(a)	Blue green flame √ ½	Cu^{2+} present √ ½
b) (i)	White ppt √ ½ soluble in excess √ ½	Zn^{2+}, Pb^{2+}, Al^{3+} present All 3 mentioned 1 mark 2 mentioned - ½ mark Only one – 0 mark
(ii)	White ppt formed √ ½ soluble in excess √ ½	Zn^{2+} present √ ½
(iii)	White ppt formed √ ½ Insoluble on warming √ ½	SO_4^{2-} present √ ½
(iv)	White ppt formed √ ½ insoluble on adding HCl	SO_4^{2-} present √ ½
c)	Effervescence / bubbles formed √ ½	CO^{2-}_3 present √ ½ (HCO_3^-, SO_3^{2-} present
d) (i)	Burns with a yellow sooty flame √ ½	- C = C - , - C C - present √ ½
(ii) I)	Effervescence of a colourless gas √ ½	Acidic substance √ ½ Accept H^+ / H_3O^+ present / RCOOH present
II)	Sweet fruity smell √ ½	R – COOH present √ ½
III)	Purple colour of $KMnO_4$ turns colourless √1	C = C , - C C - , R – OH present √1 Named 3 – 1 mark Named 2 – ½ mark But no mark if R – OH only

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Requirements for candidates.
In addition to the fittings and apparatus that are commonly in a chemistry laboratory, each candidate requires:

1. 50ml burette.
2. 25 ml pipette.
3. 2 conical flasks.
4. Solution C_1 – about $100cm^3$.
5. Solution C_2 – about $100cm^3$.
6. White tile.
7. Stand and clamp.
8. Solid K – 5g exactly.
9. 10ml measuring cylinder.
10. One 250 ml glass beaker.
11. 2 boiling tubes.
12. Thermometer.
13. Means of heating.
14. Distilled water in a wash bottle.
15. Solid F – About 3g.
16. Solid P – about 3g
17. Metallic spatula.
18. Filter paper.
19. Filter funnel.
20. Stirring rod.
21. 6 test tubes.
22. About 1g sodium hydrogen carbonate.
23. Test tube holder.

ACCESS TO:

- 2M NaOH
- 2M NH_4OH
- 0.25M Pb $(NO_3)_2$
- 0.25M $BaCl_2$
- 2M HCl
- Phenolphthalein indicator.

All supplied with droppers

- Access to conc. H_2SO_4
- Access to acidified $KMnO_4$.
- Access to ethanol

PREPARATION OF SOLUTIONS / SOLIDS

- Solid K
- Solid K – Potassium chlorate (V).
- Solution C_1 is prepared by dissolving 10.08g of oxalic acid in about 500cm^3 and making to one litre.
- Solution C_2 is prepared by dissolving 8g of NaOH pellets in about 500cm^3 of distilled water and making to 1 litre of solution.
- Solid F is a mixture of $CuCO_3$ and $ZnSO_4$ in the ratio 4 : 3 by mass respectively
- Solid P is oxalic acid.