

QUESTION 1

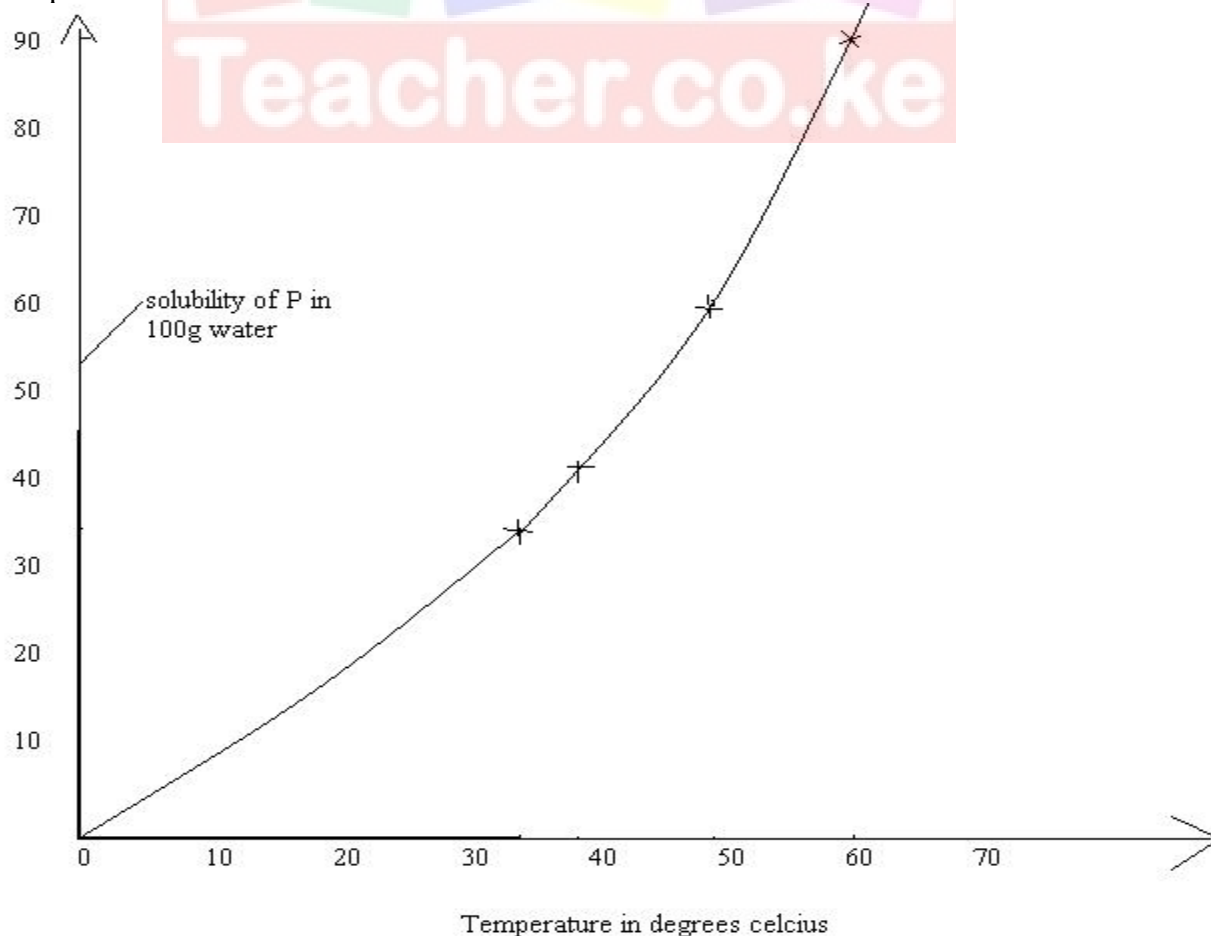
1. P is oxalic acid ($\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$)

Q1. i) Marking scheme

| Volume of distilled water | Crystallization temp. °c | Solubility of P in 100g H ₂ O |
|---------------------------|--------------------------|--|
| 4 | 60 | $\frac{3.6}{4} \times 100 = 90$ |
| 6 | 48 | $\frac{3.6}{6} \times 100 = 60$ |
| 8 | 38 | $\frac{3.6}{8} \times 100 = 45$ |
| 10 | 34 (½mk each) | $\frac{3.6}{3} \times 100 = 36$ |

School values ± 1

ii) Graph



Scale X – ½ mk

Y - ½ mk

Labeling X – ½ mk

Y – ½ mk

Plotting points - all 4 – 1mk
3 points – ½ mk
Less than 3 – 0

Smooth curve - 1mk

Total (4mks)

iii) Read the value from the student graph (1mk)

iv) 30g – 50g H₂O
? - 100g

= 60g (½mk) read temperature from the students graph at which solubility of P is 60g per 100g water. (½mk)

Question 2

Table 1- 5 marks

Marks distribution

- complete table ✓ 1mk

Penalize ½ mk for inverted table

Penalize ½ mk for wrong arithmetic

If only 2 titrations are done give ½ mk and penalize accordingly.

- Decimal points

- Consistently 1 decimal

- if 2 dp. Then the 2nd decimal should be 5 or 0

Else award '0' mks

- accuracy ✓ 1mk

± 0.1 of school value ✓ 1mk

± 0.2 of school value ✓ ½ mk

Else award '0' mks

(a) Average ✓ 1mk

Value averaged must be shown and consistent i.e within ± 0.2 from each other

Notes

-3 consistent values averaged ✓ 1mk

- inconsistency value average 0 mks

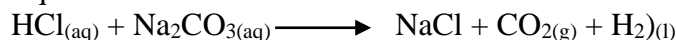
Final answer ✓ 1mk

- tied to correct average

- 3 dp

NB: CT – 1, DP – 1, A – 1, AU – 1, final ans 1

(ii) Equation



Balanced equation ✓ 1mk

State symbols ✓ 1mk

(b) (i) Molarity of Y

Conc g/l = molarity x RFM

RFM HCl = 36.5

$$\text{Molarity} = \frac{\text{g/l}}{\text{RFM}} = \frac{7.3}{36.5} = 0.2M \quad \checkmark \frac{1}{2} \quad \checkmark \frac{1}{2}$$

(ii) Molarity of Y₂

Moles of HCl = molarity x vol. in litres

$$\frac{0.2 \times 25}{1000} = 0.005 \text{ mol} \quad \checkmark \frac{1}{2} \text{ mk}$$

Mole ratio = 2: 1

∴ moles of Na₂CO₃ = $\frac{1}{2} \times 0.005 = 0.0025 \text{ mol}$ ✓ $\frac{1}{2}$

25cm³ = 0.0025mol

1000cm³ = ? ✓ $\frac{1}{2}$

$$\frac{1000 \times 0.0025}{25} = 0.1M \quad \checkmark \frac{1}{2} \text{ mk}$$

Or

$$\frac{1000 \times 0.0025}{1000} \quad \checkmark$$

answer a

Teacher.co.ke

3mks

(iii) Relative formula mass of salt Y₂

Conc = mol x RFM

$$\text{RFM} = \frac{\text{conc g/l}}{\text{molarity}} \quad \checkmark \frac{1}{2}$$

14.3 dissolved in 500cm³

? = $\frac{1000}{500}$

$$\frac{1000 \times 14.3}{500} \quad \checkmark \frac{1}{2} = 28.6 \text{ g/l}$$

(iv) Value of x in Y

$$\text{RFM} = \frac{28.6}{0.1} = 286 \quad \checkmark \frac{1}{2}$$

RFM Na₂CO₃ x H₂O = 286

106 + 18x = 286

18x = 180

X = 10 ✓ $\frac{1}{2}$

Question 3

Table III

| Solid | Colour of Flame |
|--------------------|----------------------|
| Sodium Chloride | Yellow ✓ |
| Potassium Chloride | Light T ✓ Light Blue |
| Calcium Chloride | Orange + Red ✓ |
| Barium Chloride | Pale Green ✓ |
| Solid G | Yellow ✓ |

½ Mark for each

What is the cation present in solid G? Na⁺ ✓ ½

b)

| Observation | Inferences |
|---|---|
| i) – Colourless gas ✓ - Gas with irritating smell ✓ - Gas turns blue litmus red ✓ - White residue ✓ (2mks for 4 correct observations) | Acidic gas ✓ 1 |
| ii) – Solid dissolves to form colourless solution ✓ 1 | Soluble solid ✓ 1 |
| iii) I No white precipitate formed | Ca ²⁺ , Mg ²⁺ , Pb ²⁺ , Al ³⁺ , Zn ²⁺ Absent ✓ 1 |
| II White precipitate formed ✓ ½ Soluble in dilute HCl acid ✓ ½ | SO ₃ ²⁻ ✓ CO ₃ ²⁻ ✓ 1 suspected |
| III Purple acidified KMnO ₄ Solution ✓ changes to colourless (decolourised) | SO ₃ ²⁻ confirmed ✓ 1 |