

Item 2



Step 1 (Concentration) of NaOH.
moles of HCl in 20 cm³

1000 cm³ contain 1 mole of HCl.

$$20 \text{ cm}^3 \text{ of solution contain } \frac{1}{1000} \times 20 = 0.02 \text{ moles.}$$

moles of NaOH in 20 cm³

1 mole of HCl react with 1 mole of NaOH.

$$\text{moles of NaOH} = 0.02 \text{ moles.}$$

Molarity of NaOH solution.

20 cm³ of solution contain 0.02 moles of NaOH.

$$1000 \text{ cm}^3 \text{ of solution contain } \frac{0.02}{20} \times 1000 = 1 \text{ M}$$

Therefore the molarity (concentration) of NaOH is 1 mol dm⁻³

Step 2

moles of HCl in 23 cm³

1000 cm³ of solution contain 1 mole of HCl

$$23 \text{ cm}^3 \text{ of solution } \frac{1}{1000} \times 23 = 0.023 \text{ moles}$$

moles of NaOH reacted with HCl (excess)

1 mole of HCl react with 1 mole of NaOH.

$$\text{moles of NaOH} = 0.023 \text{ moles}$$

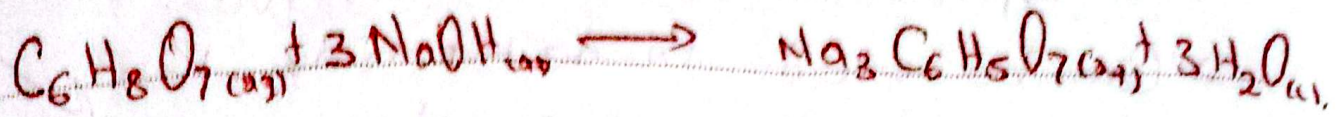
moles of NaOH in 100 cm³

1000 cm³ of solution contain 1 mole of NaOH

$$100 \text{ cm}^3 \text{ of } \frac{1}{1000} \times 100 = 0.1 \text{ moles.}$$

$$\text{moles of NaOH reacted with citric acid} = 0.1 - 0.023$$

$$= 0.077 \text{ moles}$$



moles of $C_6H_8O_7$ reacted with $NaOH$.

3 moles of $NaOH$ react with 1 mole of $C_6H_8O_7$.

$$0.077 \text{ moles of } \text{react with } \frac{1}{3} \times 0.077 = 0.02567 \text{ moles} \quad \checkmark \text{ Ha.}$$

mass of pure Citric acid

$$\text{RMM of } C_6H_8O_7 = 12 \times 6 + 1 \times 8 + 16 \times 7 = 192$$

$$\text{mass} = 0.02567 \times 192$$

$$= \underline{4.929 \text{ g}} \quad \checkmark \text{ Ha.}$$

$$\text{percentage purity} = \frac{4.929}{5.3} \times 100 = 93\% \quad \checkmark \text{ Ha.}$$

Therefore the percentage purity of Citric acid is 93%. $\checkmark$ Hi

⇒ The percentage purity of Citric acid is 93% which is between 85% and 100%. $\checkmark$ Hc

⇒ The available Citric acid can be $\checkmark$ R. used as an ingredient for food preservation since its purity is between 85 and 100%.

Other applications of this technique

- Can be used to determine the relative atomic mass of elements in a compound mostly insoluble ones
- ⇒ Analysing composition of salts to determine the quality of a given atom or group of atoms like Ammonium fertilisers
- ⇒ Can also be used to determine percentage impurity of given chemical samples.

Suitability of the technique

- ⇒ Some solids to be analysed like Citric acid in this case are insoluble in water and can easily dissolve in other substances.

Step 1

$$3H_a + H_i = 5 \text{ Scores}$$

$$3H_a = 3 \text{ Scores}$$

$$1 - 2H_a = 1 \text{ Score}$$

Step 2

$$7H_a + H_i + H_c = 10 \text{ Scores}$$

$$7H_a + H_i = 7 \text{ Scores}$$

$$17H_a = 5 \text{ Scores}$$

$$1 - 8H_a = 3 \text{ Scores}$$

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$$2A + R = 7 \text{ Scores}$$

$$2A = 5 \text{ Scores.}$$

$$Fe = 3 \text{ Scores.}$$

$$\text{Total} = 25 \text{ Scores.}$$