Experiment
Estimation of Calcium Gluconate

Aim:- To estimate the amount of **calcium gluconate** in the given sample solution by **complexometric titration** using **EDTA** as the titrant.

Reference:- Indian Pharmacopoeia by Ministry of Health and Family Welfare, Gov. of India, Volume I 2007.

Requirements:

Chemical Requirement:- 0.01 M Disodium EDTA solution (standard solution), Ammonia–ammonium chloride buffer solution (pH ≈ 10), Murexide indicator (for calcium determination), Distilled water.

Glassware Requirement:- Burette, pipette, conical flask, beaker, measuring cylinder, Analytical balance, Funnel, wash bottle

Principle:-

Calcium ions (Ca^{2+}) present in calcium gluconate react with ethylenediaminetetraacetic acid (EDTA) in a **1:1 molar ratio** to form a **stable, colorless calcium–EDTA complex**.

The reaction proceeds in an alkaline medium (pH ≈ 10) in the presence of an appropriate buffer. The endpoint is detected using a metallochromic indicator (such as **murexide** or **Eriochrome Black T**) which changes color when all calcium ions are complexed with EDTA.

$$Ca^{2+} + Na_2H_2Y \longrightarrow CaY^{2-} + 2Na+$$

Procedure:

1. Accurately weigh about **0.5 g** of calcium gluconate sample and dissolve it in distilled water.
2. Transfer the solution to a **100 mL volumetric flask** and make up to the mark with distilled water.
3. Pipette out **25 mL** of this solution into a **250 mL conical flask**.
4. Add **5 mL of ammonium buffer (pH 10)**.
5. Add a **small pinch of murexide indicator**. The solution becomes **pink in color**.
6. Titrate the solution with **0.01 M EDTA solution** until the color changes from **pink to purple** (endpoint).
7. Note the volume of EDTA used.
8. Repeat the titration to get concordant readings.

Observation Table

Sr. No.	Volume of sample (mL)	Burette reading (mL)	Volume of EDTA used (mL)
1.	25.0	12.3	12.3
2.	25.0	12.4	12.4
3.	25.0	12.3	12.3
Mean titre value			**12.33 mL**

Calculation

- Molarity of EDTA = 0.01 M
- Volume of EDTA used = 12.33 mL = 0.01233 L
- 1 mole of EDTA ≡ 1 mole of Ca^{2+}
- Atomic mass of Ca = 40.078 $g \cdot mol^{-1}$
- Molecular weight of calcium gluconate (monohydrate) = 430.37 $g \cdot mol^{-1}$

Step 1: Moles of Ca^{2+} in aliquot

= Molarity × Volume (L)

= 0.01 × 0.01233 = **1.233×10^{-4} mol**

Step 2: Mass of Ca in aliquot

= $1.233 \times 10^{-4} \times 40.078$ = **0.00494 g**

Step 3: Total Ca in 100 mL (since 25 mL aliquot taken)

= 0.00494 × (100 / 25) = **0.01976 g**

Step 4: % of calcium in sample

= (0.01976 / 0.5) × 100 = **3.95 % w/w**

Step 5: Equivalent % of calcium gluconate

= (3.95 × 430.37) / 40.078 = **42.5 % w/w**

Result:- The given sample of **Calcium Gluconate** contains **3.95% elemental calcium**, equivalent to **42.5% w/w of calcium gluconate** (monohydrate basis).

Viva-Voce Questions

1. What is the principle of the estimation of calcium gluconate?
2. What is the role of EDTA in this experiment?
3. Why is an ammonia buffer used?
4. Which indicator is used in this titration?
5. What is the advantage of EDTA titration over other methods?