Experiment
Preparation and standardization of Sulphuric acid

Aim:- To Prepare and standardization of 0.5M Sulphuric acid solution.

Reference:-Indian Pharmacopoeia by Ministry of Health and Family Welfare, Gov. of India, Volume I 2007, P-313-316.
Practical book of Pharmaceutical Chemistry, Fourth edition edited by A.H Beckett, J.B Stenlake, CBS Publishers and Distributors, 2005 P-140.

Requirements:

- **Chemical Requirement:-** Concentrated sulfuric acid, Sodium carbonate (Na_2CO_3), Indicator: methyl orange (2–3 drops), Distilled water.
- **Glassware Requirement:-** Volumetric flask 1 L, beakers, 25–50 mL burette, pipettes, conical flasks (250–500 mL), analytical balance (±0.1 mg), graduated cylinder, glass rod, funnel, ice bath, fume hood.

Principle:

Concentrated H_2SO_4 is diluted to the required molarity and then its exact concentration is determined by titration with a primary standard (Na_2CO_3).

Reaction:

$$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2 \uparrow$$

Procedure

A. Preparation of approximate 0.5 M H_2SO_4

1. Place ~500 mL distilled water in a 1 L beaker in an ice bath (to control heat).
2. Take **27.2 mL** concentrated H_2SO_4 .
3. With stirring, **slowly add the acid to the water** dropwise at first. Allow temperature to fall between additions. Do not add water to acid.
4. After all acid is added and solution cooled to near room temp.
5. Make up to the 1 L mark with distilled water
6. Cool to room temperature; label: "~0.5 M H_2SO_4 — to be standardized", date and preparer.

B. Drying primary standard (Na_2CO_3)

1. If required, dry Na_2CO_3 at 110 °C for 1–2 h, cool in desiccator. (Record mass after drying.)

C. Standardization (titration)

1. Accurately weigh **~0.50–0.60 g** of dried Na_2CO_3.
2. Dissolve weighed Na_2CO_3 in ~250 mL distilled water in a 500 mL conical flask.
3. Add 2–3 drops methyl orange indicator.
4. Rinse and fill burette with prepared H_2SO_4 solution; note initial burette reading.
5. Titrate with H_2SO_4, swirling constantly, until colour changes from yellow → orange/red (methyl orange endpoint). Record final burette reading; compute titre V (mL). Perform **three concordant titrations** (within 0.10–0.20 mL). Use mean V.

Observations / Data table (example layout)

Trial	Mass Na_2CO_3 (g)	Initial burette (mL)	Final burette (mL)	Titre V (mL)
1	0.5500	0.00	32.10	32.10
2	0.5500	0.00	32.25	32.25
3	0.5500	0.00	32.05	32.05
Mean	—	—	—	**32.13**

Calculations (example using above data)

- Molar mass Na_2CO_3 = 105.99 $g \cdot mol^{-1}$.
- Moles $Na_2CO_3 = \frac{0.5500}{105.99} = 0.005188$ mol.
- From stoichiometry, moles H_2SO_4 = 0.005188 mol.
- Volume of H_2SO_4 used = mean titre $V = 32.13$ mL = 0.03213 L.
- Molarity $M = \frac{0.005188}{0.03213} = 0.1615$ M.

Result:- The molarity of prepared H_2SO_4 solution is …..…… M.

Viva-Voce Questions

1. Why do we prepare approximate H_2SO_4 solution and then standardize it?
2. Why do we use methyl orange indicator instead of phenolphthalein?
3. How will you calculate the molarity of H_2SO_4 from titration data?
4. What is the difference between molarity and normality?
5. Why should acid be added to water, and not water to acid?