Preparing standard solutions

1a Direct weighing method

REQUIREMENTS FOR PRIMARY STANDARD

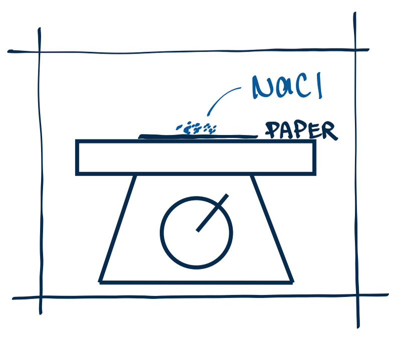
- Soluble in water
- X react w/ air
- X hygroscopic
- non-volatile
- non-toxic

cannot be performed for →

I_2 (s)	volatile → sublimes
$KMnO_4$ (s)	strong OA, reactive
NaOH(s)	neutralises by reacting w/ CO_2 hygroscopic

STEPS

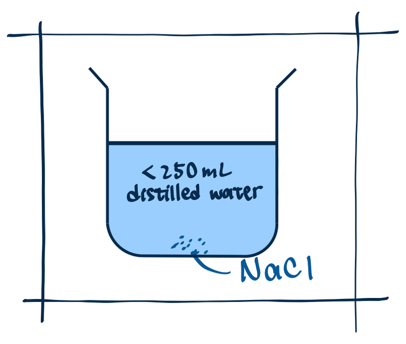
- Eg. prepare 0.1M NaCl solution



molarity · volume = mole $0.1 \cdot 0.25 = 0.025$ mol (volumetric flask capacity)

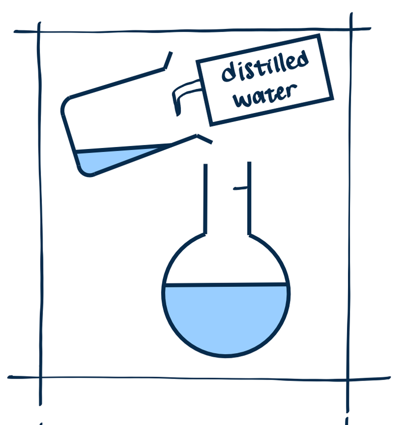
mole · Mr = mass $0.025 \times (23.1 + 35.5) = 1.465$ g (Na, Cl)

Weigh 1.465g of solid accurately w/ electronic balance



Dissolve NaCl(s) in water completely.
(如果溶不到用 stirrer / 加热)

为啥不直接倒进 volumetric flask 里?
- flask 的开口太小, NaCl 会粘在开口上
- 倒进 flask 以后很难让不是 very soluble 的物质溶在水里

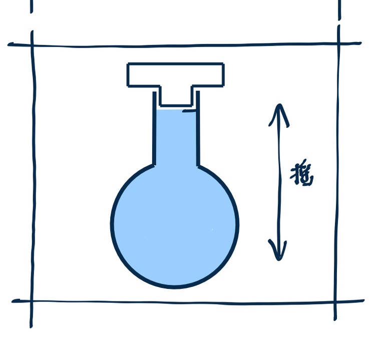


Pour solution in beaker to the volumetric flask.

Rinse the beaker w/ distilled water.

Transfer all the washings to the volumetric flask.

避免还有 NaCl 遗在了 beaker 里



Add distilled water to volumetric flask until it reaches 250 cm^3 graduation mark. Add a stopper then Shake well to dissolve.

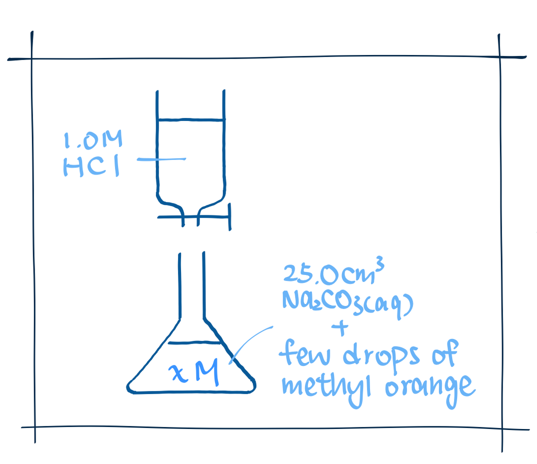
1b Double standardisation

OBJECTIVES & METHOD

- find actual concentration of std. sol^n
- eg. After weighing, some Na_2CO_3 reacts w/ CO_2.
  ↳ molarity of resultant sol^n will be smaller than original.
- find by titrating against other std. sol^n.

STEPS

- eg. prepared 1.0M Na_2CO_3 solution → titrate against standard 1.0M HCl



used avg. of 48.6 cm^3 1.0M HCl to change colour (red → orange) →

$$\begin{aligned} HCl &: Na_2CO_3 = 2 : 1 \\ 1.0 \times 0.0495 &: x \times 0.025 = 2 : 1 \\ x &= 0.972 \end{aligned}$$

2 Diluting method

STEPS

- dilute sol^n of known molarity to specific volume.
- 限制: 只可以使溶液变稀, 不可以变浓
- eg. prepare 100 cm^3 of 0.01M $Na_2CO_{3(aq)}$ w/ 250 cm^3 of 0.1M $Na_2CO_{3(aq)}$.
  1. Using a 10.0 cm^3 pipette, transfer 10 cm^3 of 0.1M $Na_2CO_{3(aq)}$ into 100.0 cm^3 volumetric flask.
  2. Add distilled water into the volumetric flask until it reaches graduation mark.
  3. Stopper the flask and invert it several times to mix the contents well.

PRACTICE

- 0.1M 250.0 cm^3 sol^n → 0.01M 250.0 cm^3 sol^n
  1. Using 25.0 cm^3 pipette, transfer 25 cm^3 of 0.1M sol^n into 250 cm^3 volumetric flask.
  2. Add distilled water into volumetric flask until graduation mark is reached.
  3. Stopper the flask, invert it several times to mix the content well.
- 0.1M 250.0 cm^3 sol^n → 0.02M 100.0 cm^3 sol^n
  1. Using 20.0 cm^3 pipette, transfer 20 cm^3 of 0.1M sol^n into 100 cm^3 volumetric flask.
  2. Add distilled water into volumetric flask until graduation mark is reached.
  3. Stopper the flask, invert it several times to mix the content well.

为什么不用两次 10.0 cm^3 pipette?
- random error ↑
  ↳ 人为错误 (vs systematic error 系统错误)
  ↳ burette reading having ±0.05 cm^3 max. error