Preparing standard solutions

1a Direct weighing method

REQUIREMENTS FOR PRIMARY STANDARD

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

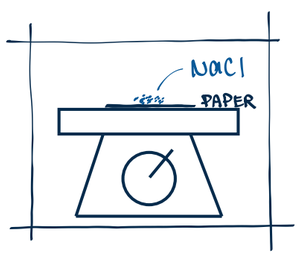
cannot be performed for →

$I_{2(s)}$	volatile → sublimes
$KMnO_{4(s)}$	strong OA, reactive
$NaOH_{(s)}$	neutralises by reacting w/ CO_2 hygroscopic

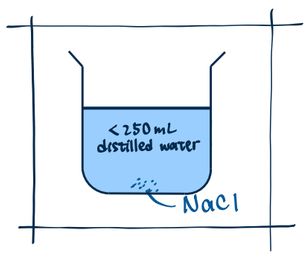
STEPS

- Eg. prepare 0.1M NaCl solution

molarity · volume = mole $0.1 \cdot 0.25 = 0.025$ mol (volume: volumetric flask capacity)
mole · Mr = mass $0.025 \times (23.1 + 35.5) = 1.465$ g (23.1: Na, 35.5: Cl)

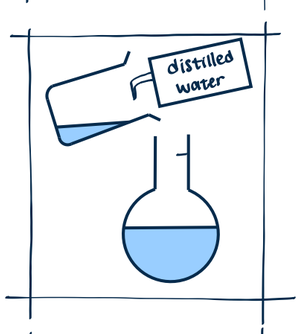


Weigh 1.465g of solid accurately w/ electronic balance



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 beaker 里

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

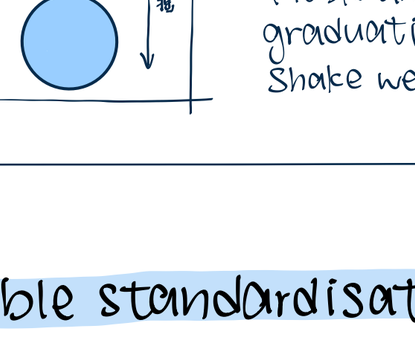
1b Double standardisation

OBJECTIVES & METHOD

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

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)

$HCl : Na_2CO_3 = 2 : 1$
$1.0 \times 0.0495 : x \times 0.025 = 2 : 1$
$x = 0.972$

2 Diluting method

STEPS

- dilute soln 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 soln → 0.01M 250.0 cm^3 soln
  1. Using 25.0 cm^3 pipette, transfer 25 cm^3 of 0.1M soln 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 soln → 0.02M 100.0 cm^3 soln
  1. Using 20.0 cm^3 pipette, transfer 20 cm^3 of 0.1M soln 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