

# Preparing standard solutions

## 1a Direct weighing method

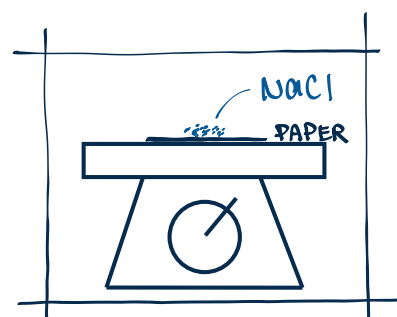
### REQUIREMENTS FOR PRIMARY STANDARD

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

cannot be performed for	$I_2(s)$	volatile $\rightarrow$ sublimates
	$KMnO_4(s)$	Strong OA, reactive
	$NaOH(s)$	neutralises by reacting w/ $CO_2$ hygroscopic

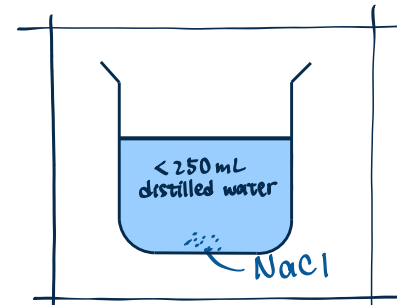
### STEPS

- Eg. prepare 0.1M NaCl solution



Weigh 1.465g of solid accurately w/ electronic balance

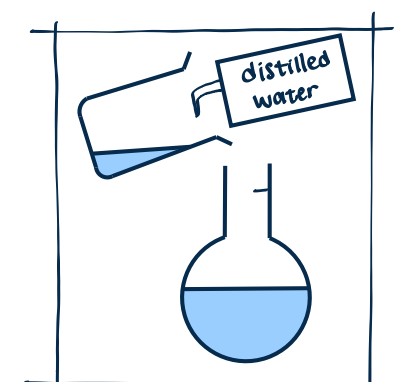
molarity  $\cdot$  volume = mole  $0.1 \cdot 0.25 = 0.025 \text{ mol}$   $\rightarrow$  volumetric flask capacity  
mole  $\cdot$  Mr = mass  $0.025 \times (23.1 + 35.5) = 1.465 \text{ g}$   
 $\swarrow$  Na  $\searrow$  Cl



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 的物质落在水里

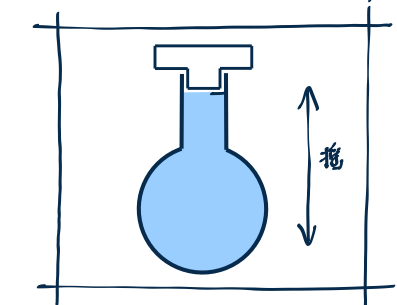


Pour solution in beaker to the volumetric flask.

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  $250 \text{ cm}^3$  graduation mark. Add a stopper then Shake well to dissolve.

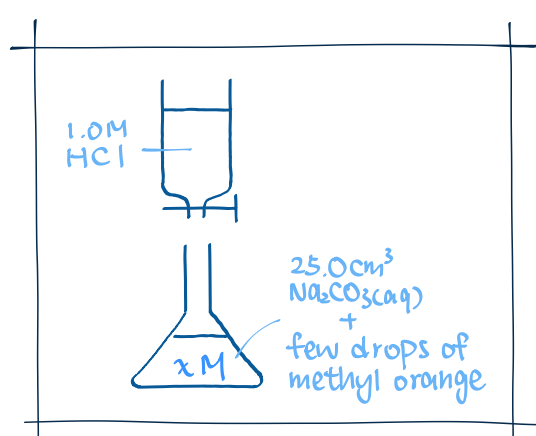
## 1b Double standardisation

### OBJECTIVES & METHOD

- find actual concentration of std. sol<sup>n</sup>
- eg. After weighing, some  $Na_2CO_3$  reacts w/  $CO_2$ .  
 $\hookrightarrow$  molarity of resultant sol<sup>n</sup> will be smaller than original.
- find by titrating against other std. sol<sup>n</sup>.

### STEPS

- eg. prepared 1.0M  $Na_2CO_3$  solution  $\rightarrow$  titrate against standard 1.0M HCl



used avg. of  $48.6 \text{ cm}^3$  1.0M HCl to change colour (red  $\rightarrow$  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 sol<sup>n</sup> of known molarity to specific volume.
- 限制: 只可以使溶液变稀, 不可以变浓
- eg. prepare  $100 \text{ cm}^3$  of 0.01M  $Na_2CO_3(aq)$  w/  $250 \text{ cm}^3$  of 0.1M  $Na_2CO_3(aq)$ .
  1. Using a  $10.0 \text{ cm}^3$  pipette, transfer  $10 \text{ cm}^3$  of 0.1M  $Na_2CO_3(aq)$  into  $100.0 \text{ cm}^3$  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  $250.0 \text{ cm}^3$  sol<sup>n</sup>  $\rightarrow$  0.01M  $250.0 \text{ cm}^3$  sol<sup>n</sup>
  1. Using  $25.0 \text{ cm}^3$  pipette, transfer  $25 \text{ cm}^3$  of 0.1M sol<sup>n</sup> into  $250 \text{ cm}^3$  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  $250.0 \text{ cm}^3$  sol<sup>n</sup>  $\rightarrow$  0.02M  $100.0 \text{ cm}^3$  sol<sup>n</sup>
  1. Using  $20.0 \text{ cm}^3$  pipette, transfer  $20 \text{ cm}^3$  of 0.1M sol<sup>n</sup> into  $100 \text{ cm}^3$  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.

为啥不用两次  $10.0 \text{ cm}^3$  pipette?  
- random error  $\uparrow$   
 $\hookrightarrow$  人为误差 (vs systematic error 系统误差)  
 $\hookrightarrow$  burette reading having  $\pm 0.05 \text{ cm}^3$  max. error