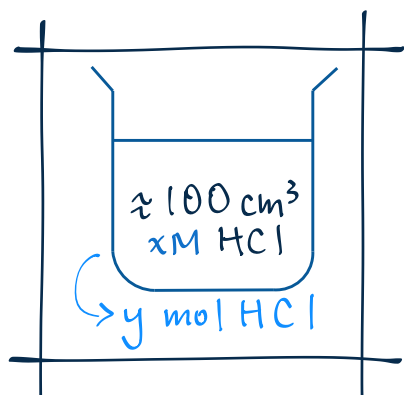


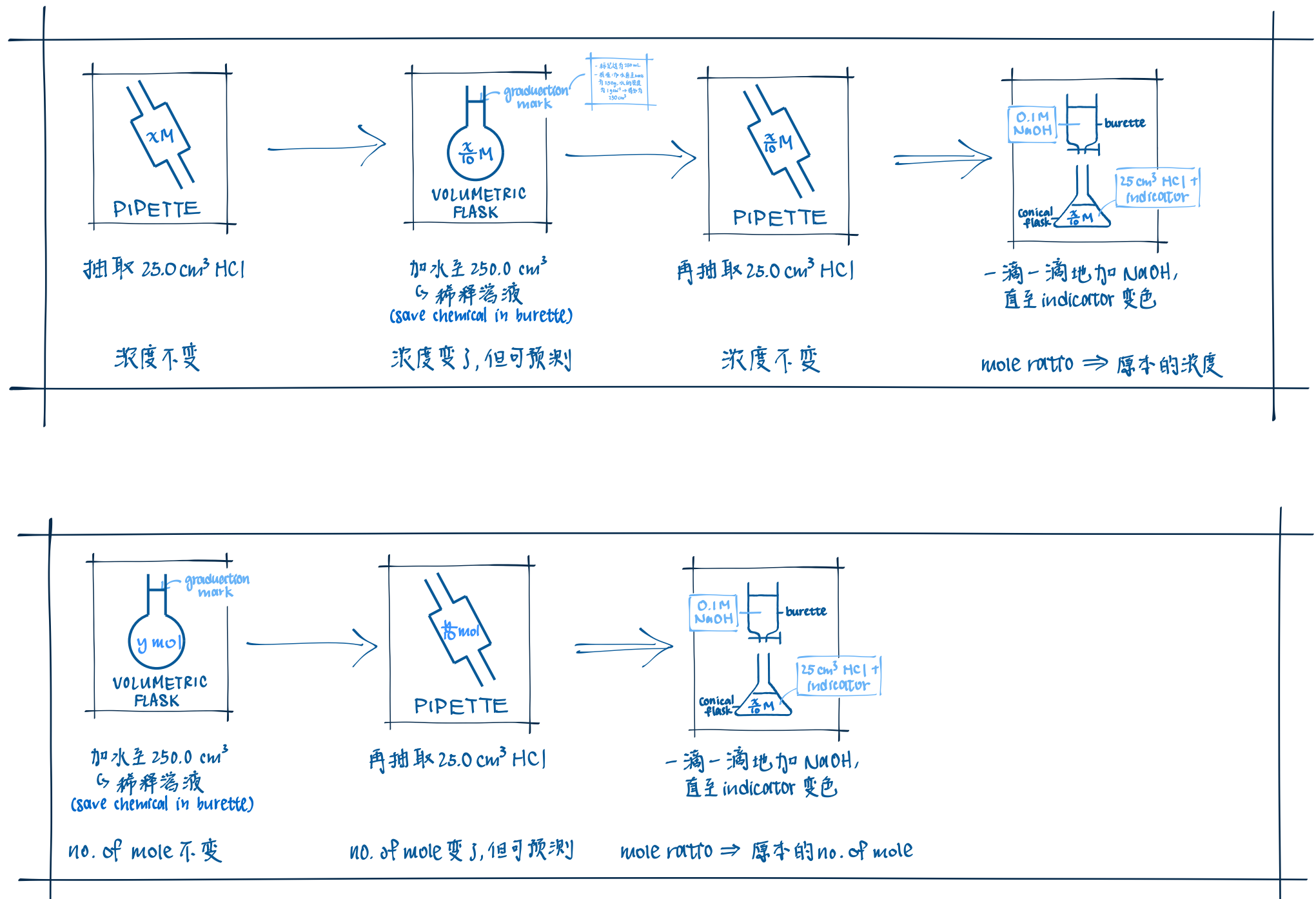
# Titration (experiment)

## 1 Steps

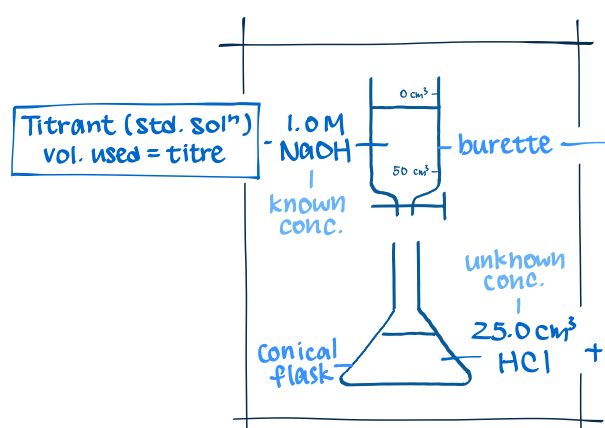
算浓度



算 no. of mole



## 2 Set-up



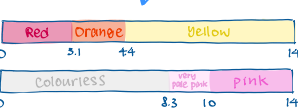
Unknown conc. of HCl is titrated against 0.1M NaOH.

- $\checkmark$  = 滴 = 滴地加 solution
- 精度 0.1 cm³  $\rightarrow$  max. error = 0.05 cm³
- 结果记录 2dp, 百分位是 0.05
- 50 cm³ 以下还能放溶液, 但没刻度
- 在每次 attempt 前确保里面有足够溶液

加 NaOH 时会短暂地变成黄色 (若用 methyl orange)

- NaOH 与 酸 反应  $\rightarrow$  黄色  $\rightarrow$  与 HCl 反应  $\rightarrow$  变回红色
- 所需时间越长越好!
- At the beginning of experiment
- $\rightarrow$  highest [H<sup>+</sup>]  $\rightarrow$  highest rx rate
- $\rightarrow$  fastest disappearance of yellow colour
- After rx. proceeds for a long time
- $\rightarrow$  [H<sup>+</sup>]  $\downarrow$   $\rightarrow$  rx rate  $\downarrow$
- $\rightarrow$  yellow colour persists for long time

Even if completely reacted resulting soln is not neutral



强酸弱碱甲基橙 methyl orange  
弱酸强碱是酚酞 phenolphthalein  
强酸强碱 either one  
弱酸弱碱 neither

## 3 Result processing

Initial burette reading (cm³)	5.00	21.05	2.05	20.15
Final burette reading (cm³)	21.05	39.15	20.15	38.30

15.10 cm³ 18.10 cm³ 18.10 cm³ 18.15 cm³

第一次通常不算

- 原因
- 不用理 0.1M 浓度, 因为 0.1M 浓度是 0.1M
- 之后 0.1M 浓度是 0.1M 浓度, 但没刻度
- 0.1M 浓度是 0.1M 浓度
- 0.1M 浓度是 0.1M 浓度

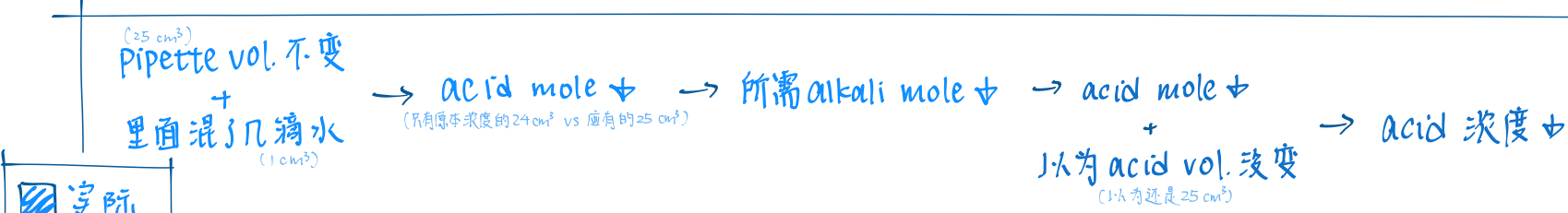
- 大约用 18 cm³
- 今天已经 39 cm³, 再放 0.1M NaOH 量不到
- $\rightarrow$  0.1M NaOH
- 为什么两个不一样?

- 最少做 3 次
- $\Rightarrow$  ① 把相差别太大 ( $> \pm 0.1$  cm³) 的 attempt 舍弃
- ② 算剩下 attempt 的 mean  $\rightarrow$  reasonable volume of titrant (NaOH)
- ③ 用 mole ratio 算 HCl 的 no. of mole ( $\Rightarrow$  molarity)  $\rightarrow$  see Titration (questions)

## 4 Precautions

### PREPARING PIPETTE

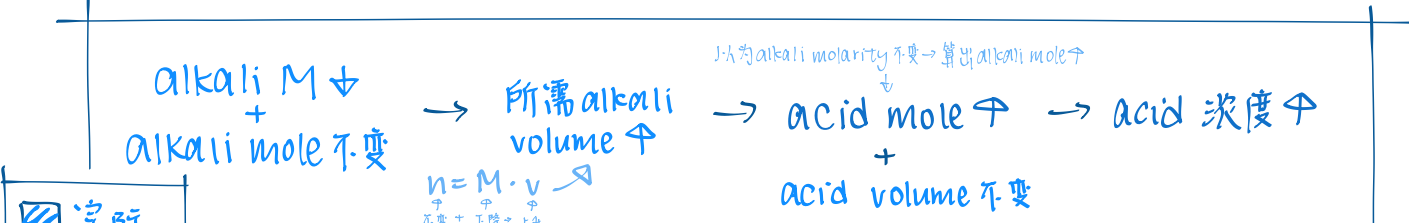
- rinse by distilled water for several times, followed by the solution
- 只用水洗  $\rightarrow$  导致还有水遗在 pipette 里, 抽溶液的时候会稀释溶液



实际  
算出来

### PREPARING BURETTE

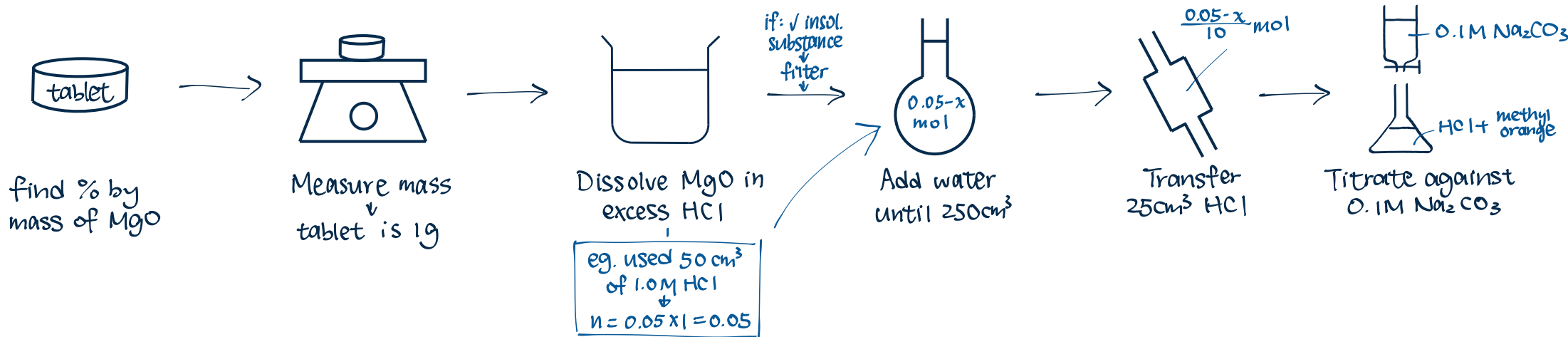
- rinse by distilled water for several times, followed by the solution (alkali)
- open the knob to allow sol. to fill up burette w/ no bubbles trapped inside
- 只用水洗  $\rightarrow$  导致还有水遗在 burette 里, 会稀释溶液



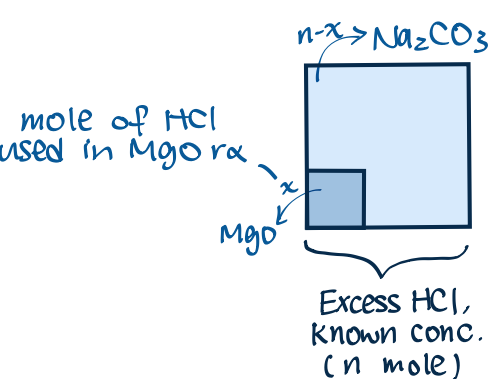
实际  
算出来

## 5 Back titration

### STEPS



An average of 10 cm³ 0.1M Na₂CO₃ is used. Find MgO % by mass.



$$\begin{aligned} \text{HCl} : \text{Na}_2\text{CO}_3 &= \frac{0.05 - x}{10} : 0.1 \times 0.01 \\ 2 : 1 &= \frac{0.05 - x}{10} : 0.1 \times 0.01 \\ x &= 0.03 \text{ mol} \end{aligned}$$

$$\begin{aligned} \text{HCl} : \text{MgO} &= 0.03 : \text{MgO} \\ 2 : 1 &= 0.03 : \text{MgO} \\ \text{MgO} &= 0.015 \text{ mol} \\ &= 0.6045 \text{ g} \end{aligned}$$

$$\begin{aligned} \% \text{ mass} &= \frac{0.6045}{1} \times 100\% \\ &= 60.5\% \end{aligned}$$