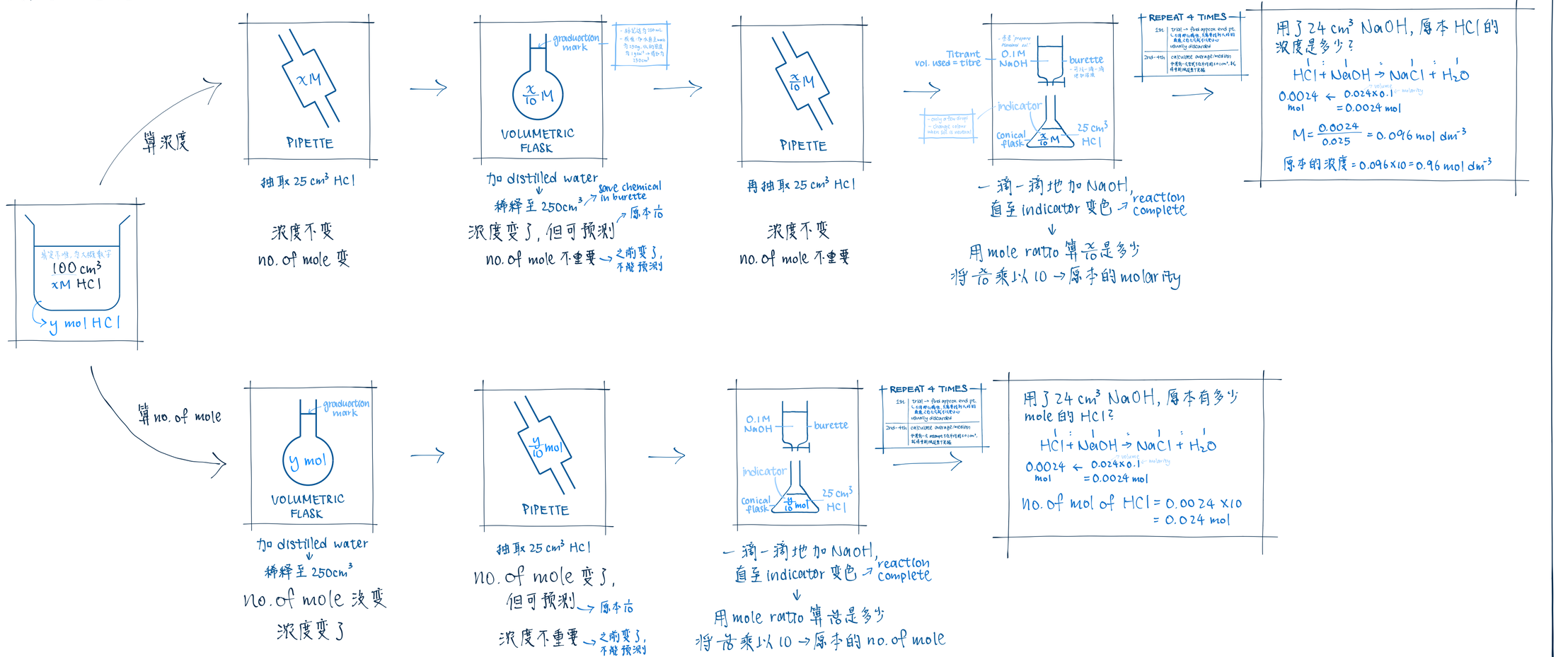
Titration

1 Steps and precautions

TITRATION STEPS



PREPARING PIPETTE

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

Pipette vol. 不变 (25 cm³) + 里面混了几滴水 (10 cm³) → acid vol. ↓ (20 cm³) → acid mole ↓ → 所需 alkali mole ↓ → acid mole ↓ + 以为 acid vol. 没变 (以为是 25 cm³) → acid 浓度 ↓

定际 / 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
  - > 会导致还有水遗在 burette 里，会稀释溶液

alkali M ↓ + alkali mole 不变 → 所需 alkali volume ↑ ($n = M \cdot V$，不变 ↑ 下降 ↓ 走势) → acid mole ↑ (以为 alkali molarity 不变 → 算出 alkali mole ↑) + acid volume 不变 → acid 浓度 ↑

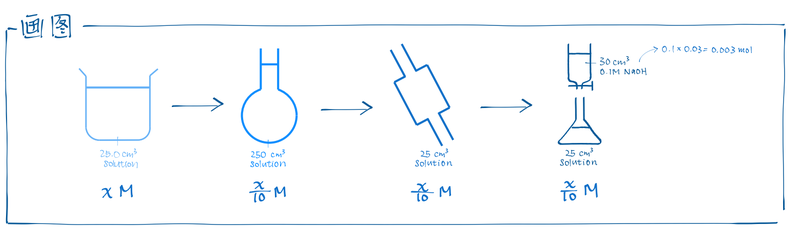
定际 / 算出来

2 Questions

LEVEL I

$25.0\ cm^3$ CH_3COOH is withdrawn to $250.0\ cm^3$ v-flask.
Sol. in v-flask is withdrawn by $25.0\ cm^3$ pipette to conical flask, and titrated against 0.1M NaOH. $30\ cm^3$ NaOH is needed for complete reaction.
Find stock CH_3COOH concentration.

画图



算数

$CH_3COOH\ n : NaOH\ n = 1:1 = n : 0.003$

$n = 0.003$ (CH_3COOH used in titration)

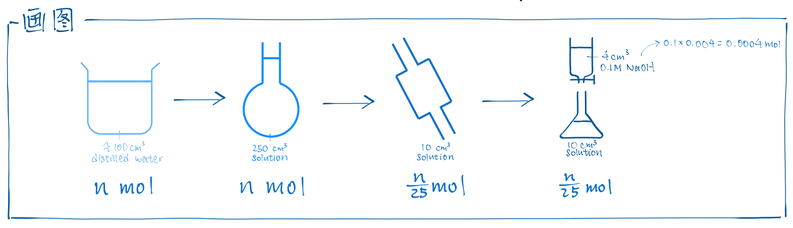
$\frac{x}{10} = \frac{0.003}{0.025}$

$x = 1.2\ mol\ dm^{-3}$

LEVEL II

0.6g monobasic acid is dissolved completely in a beaker w/ $100\ cm^3$ distilled water. The sol. in beaker is then poured into $250.0\ cm^3$ v-flask. Distilled water is added until the graduation mark is reached. $10.0\ cm^3$ of solution in v-flask is pipetted into conical flask. $4\ cm^3$ 0.1M NaOH is required for complete reaction. Find acid Mr.

画图



算数

acid n (monobasic) : NaOH n = 1 : 1 = $\frac{n}{25}$: 0.0004

$n = 0.01$

$\frac{0.6g}{Mr} = 0.01$

$Mr = 60.0\ g\ mol^{-1}$

LEVEL III

0.75g of solid mixture (KOH & K_2CO_3) is dissolved in distilled water completely. It requires 0.1M $120 cm^3$ HCl for complete reaction. Find KOH % by mass.

$KOH + HCl \rightarrow KCl + H_2O \Rightarrow KOH : HCl = 1:1$

$K_2CO_3 + 2HCl \rightarrow 2KCl_2 + CO_2 + H_2O \Rightarrow K_2CO_3 : HCl = 1:2$

Let x g be KOH mass, (0.75 - x) g be K_2CO_3 mass.

HCl in KOH rxn + HCl in K_2CO_3 rxn = 0.1 x 0.12

$$\frac{x}{39.1+16+1} + \frac{0.75-x}{39.1\cdot2+12+16\cdot3} \cdot 2 = 0.012$$

$$\frac{x}{56.1} + \frac{0.75-x}{69.1} = 0.012$$

$$\frac{69.1x + 42.075 - 56.1x}{3876.51} = 0.012$$

$$13x = 46.51812 - 42.075$$

$$x = 0.342$$

KOH % by mass = $\frac{0.342}{0.75} \cdot 100\% = 45.6\%$