

Preparation of salt

1 Soluble salt

ACID - BASE → EXCESS INSOL. BASE + ACID

Required: prepare $\text{ZnSO}_4(\text{s})$

Excess when:

- 1) no colourless gas bubbles
- 2) no longer dissolves

Why is excess insol. base required?

- If $\text{ZnCO}_3(\text{s})$ is limited, the solⁿ contains $\text{H}_2\text{SO}_4(\text{aq})$.
- It is hard to separate H_2SO_4 from mixture, even by fractional distillation (ionized distillation cannot obtain pure H_2SO_4).
- Resulting crystal will contain impurities (H_2SO_4).

Crystallisation

1. Heat until saturated
2. Cool solⁿ (time is allowed for crystal to form)
3. Filter the solⁿ and obtain crystal as residue
4. Wash w/ small amt. of ice-cold distilled water
5. Dry crystal in filter paper

ACID - BASE → TITRATION OF SOL. BASE + ACID

Required: prepare $\text{NaCl}(\text{s})$

Why can't we use the above method?

- Na^+ 不管配什么 -ve ion, compound 也溶于水
- 没有 insol. base

1st titration (all reactants limited)

Crystallisation

1. Heat until saturated
2. Cool solⁿ (time is allowed for crystal to form)
3. Filter the solⁿ and obtain crystal as residue
4. Wash w/ small amt. of ice-cold distilled water
5. Dry crystal in filter paper

2 Insoluble salt

PRECIPITATION

Required: prepare $\text{PbSO}_4(\text{s})$

Mix equal volume & equal molarity of $\text{Pb}(\text{NO}_3)_2(\text{aq})$, $\text{Na}_2\text{SO}_4(\text{aq})$

depends on salt to prepare

- eg. $\text{PbCl}_2(\text{s})$
- $\text{Pb}(\text{NO}_3)_2 + 2\text{NaCl} \rightarrow \text{PbCl}_2 + 2\text{NaNO}_3$
- $\text{Pb}(\text{NO}_3)_2$ mol : NaCl mol = 1 : 2

Filtration

1. Filter mixture & collect $\text{PbSO}_4(\text{s})$ as residue
2. Wash w/ large amt. of distilled water
3. Dry w/ filter paper

SPECIAL CASE: prepare $\text{NaHSO}_4(\text{s})$

- H_2SO_4 的 ionization 其实有两个步骤:
 - a. $\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{HSO}_4^-$
 - b. $\text{HSO}_4^- \rightleftharpoons \text{H}^+ + \text{SO}_4^{2-}$
- 如何逼使 H_2SO_4 只 ionize 一次?
 - > 只提供 complete rx 所需 mole 一半的 $\text{H}_2\text{SO}_4(\text{aq})$.
 - > 本来: $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$, $\text{NaOH} : \text{H}_2\text{SO}_4 = 2 : 1$
 - > 如果变成: $\text{NaOH} : \text{H}_2\text{SO}_4 = 1 : 1 \Rightarrow \text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{H}_2\text{O}$
- 如何确保 $\text{NaOH} : \text{H}_2\text{SO}_4 = 1 : 1$? → Procedure
 - > Mix equal volume & equal molarity of $\text{NaOH}(\text{aq})$ and $\text{H}_2\text{SO}_4(\text{aq})$.
 - > Heat solⁿ until saturated then cool solⁿ.
 - > Time is allowed for crystal to form.
 - > Filter the solⁿ, obtain crystal as residue.
 - > Wash crystal w/ little amt. of ice-cold distilled water.
 - > Dry crystal in filter paper.
- Tip: 其他同类型的 salt 也能通过控制 mole ratio 而获得.
 - > $\text{H}_3\text{PO}_4 \rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_4^-$ ——— 1 $\text{NaOH} + 1 \text{H}_3\text{PO}_4 \rightarrow \text{NaH}_2\text{PO}_4 + \text{H}_2\text{O}$
 - $\text{H}_2\text{PO}_4^- \rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$ ——— 2 $\text{NaOH} + 1 \text{H}_3\text{PO}_4 \rightarrow \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{O}$
 - $\text{HPO}_4^{2-} \rightleftharpoons \text{H}^+ + \text{PO}_4^{3-}$ ——— 3 $\text{NaOH} + 1 \text{H}_3\text{PO}_4 \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$