Group A ions are insoluble as chloride (Ag⁺, Pb²⁺, Hg₂²⁺).

**A⁺** becomes soluble with Cl⁻ present because it forms a complex.

HCl neutralizes NH₃ so A⁺ complex is destroyed.

H₂C₂O₄ is more soluble in hot H₂O than AgCl.

**B** ions are insoluble in slightly basic conditions.

- **B₁**: B⁺⁺⁺, Zr⁺⁺⁺, Nb⁺⁺⁺, Fe⁺⁺⁺
  - **B₂**: Al⁺⁺⁺, Cr⁺⁺⁺, H₂C₂O₄

Blue dichromate ion gets reduced to make MnO₄⁻ (purple).

Redox to make black ppt.

Red-brown ppt.

Prussian Blue (light blue ppt).
- C
- $C_2O_4^{2-}$
- $\text{Ppt}$
- $\text{H}_2O, \text{HNO}_3$
- $\text{HCl}$
- Ba$^{2+}$, Ca$^{2+}$, Sr$^{2+}$, Co$^{2+}$
- KNO$_2$
- $\text{Ppt}$
- $\text{Co}^{2+}$
- $\text{SnT}$
- $\text{CO}_3^{2-}$
- $\text{Ppt}$
- $\text{Ba}^{2+}$, Ca$^{2+}$, Sr$^{2+}$
- $\text{SnT}$
- $\text{CO}_3^{2-}$
- $\text{Ba}^{2+}$
- $\text{S}_{4}O_6^{2-}$
- $\text{Ppt}$
- $\text{Ca}^{2+}$

Group Cations are insoluble as oxalates.

Yellow ppt: Co(NO$_2$)$_2$.

Precipitate and redissolve to ensure only are present.

CoSO$_4$ less soluble than CaSO$_4$.
Colligative properties:

- Review: electronegativity + VSEPR → IMF
- Phase changes: KE vs. IMF
- Concentration: molarity, molality, mass %, ppm
- Electrolytes: extent of dissociation (i)
- Freezing point depression + Boiling point elevation: \( \Delta T = k \cdot m \cdot i \)
- Vapor pressure: cause (molecular energy distribution) - relationship to BP
- Heat of sol’n - molecular solids (solute vs solvent) - ionic solids (hydrations vs lattice)
- Dissolve vs dissociate
- Solubility: relationship to \( \Delta G \) vs \( \Delta H \)
- Osmotic pressure

Equilibrium: rate forward = rate reverse

\[ \Delta G = \text{change in } [\text{Reactants}] = \text{change in } [\text{Products}] \]

\( \Delta E = 0 \) (not \([\text{Reactants}] > [\text{Products}]\))

\[ \Delta G^\circ > 0 \]

Ksp - conversion between g/mL + Ksp

Qsp vs Ksp

selective precipitation
Buffers - what is a buffer? range? capacity?

ICE - when can simplifications be made?
(C when concentrations change very little as equilibrium is reestablished)

Henderson-Hasselbalch \( \Rightarrow \) \( \text{pH} = pK_a + \log_{10} \frac{[A^-]}{[HA]} \)

Calculate pH of a buffer

Calculate quantity of acid or its conjugate

Calculate change in pH due to neutralization

Titirations -

Draw titration curve - buffer range mono-, di-, polyprotonic

Y2 equivalence point indicators

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Electrochemistry

Oxidation state vs formal charge

Balancing redox runs

Standard electrode potential

Voltaic cell

Standard reduction potential

Half runs

Identifying stronger oxidizing or reducing agent

Nernst equation

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Transition metal complexes

Crystal field theory - d-orbital splitting

Stereochemistry + complex geometry

Ligands - mono vs bi vs polydentate

Strong vs weak field ligands

Transition metals + electron configuration