SOLUBILITY RULES

1. Salts of ammonium ($\text{NH}_4^+$) and Group IA are always soluble

2. 
   a. All chlorides (Cl$^-$) are soluble except AgCl, Hg$_2$Cl$_2$, and PbCl$_2$ which are insoluble
   b. All bromides (Br$^-$) are soluble except AgBr, Hg$_2$Br$_2$, HgBr$_2$ and PbBr$_2$ which are insoluble
   c. All iodides (I$^-$) are soluble except AgI, Hg$_2$I$_2$, HgI$_2$ and PbI$_2$ which are insoluble

3. Chlorates (ClO$_3^-$), Nitrates (NO$_3^-$) and Acetates (CH$_3$COO$^-$) are soluble.

4. Sulfates (SO$_4^{2-}$) are soluble except CaSO$_4$, SrSO$_4$, BaSO$_4$, Hg$_2$SO$_4$, HgSO$_4$, PbSO$_4$, and Ag$_2$SO$_4$ which are insoluble

5. Phosphates (PO$_4^{3-}$), and carbonates (CO$_3^{2-}$) are insoluble except NH$_4^+$ and Group IA compounds.

6. All metallic oxides (O$^2-$) are insoluble expect NH$_4^+$ and Group IA compounds.

7. All metallic hydroxides (OH$^-$) are insoluble except NH$_4^-$ and Group IA and Group IIA from calcium down.

8. All sulfides (S$^2-$) are insoluble except NH$_4^+$ and Groups IA and IIA.
**Constants:**

Avogadro's number = $6.022 \times 10^{23}$

$R = 0.08206 \text{ L atm/mol K}$

$0^\circ\text{C} = 273.15\text{K}$

$1 \text{ atm} = 760 \text{ Torr}$

$S_{\text{water}} = 4.18 \text{ J/g } ^\circ\text{C}$

$K_w = 1.0 \times 10^{-14}$

**Equations:**

\[ d = \frac{m}{V} \quad q = m \Delta t \quad \Delta E = q + w \]

\[ PV = nRT \quad q = C \Delta t \quad M_{\text{initial}}V_{\text{initial}} = M_{\text{Final}}V_{\text{Final}} \]

\[ PM = dRT \quad \text{molarity} = \text{moles solute/liters solution} \]

\[ P_1V_1/T_1 = P_2V_2/T_2 \quad \text{molality} = \text{moles solute/kilograms solvent} \]

\[ P_T = P_1 + P_2 + P_3 + \ldots \quad \text{mole fraction} = \text{moles component/total moles solution} \]

\[ P_i = X_i P_T \quad \Delta H^\circ_{\text{rxn}} = \Sigma n \Delta H^\circ_f(\text{products}) - \Sigma m \Delta H^\circ_f(\text{reactants}) \]

\[ \text{pH} = -\log_{10}[H^+] \quad \Delta S^\circ_{\text{rxn}} = \Sigma n \Delta S^\circ_f(\text{products}) - \Sigma m \Delta S^\circ_f(\text{reactants}) \]

\[ \text{pOH} = -\log_{10}[OH^-] \quad \Delta G = \Delta H - T \Delta S \]

\[ \text{pH} + \text{pOH} = 14 \]