**Concentration Formula Sheet:**

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| **Mass Percent:**$$mass \%= \frac{mass of solute}{mass of solution} x 100\%$$ | **Volume Percent:**$$Volume \%= \frac{Volume of solute}{Volume of solution} x 100\%$$ |
| **Solutions:**$$Solute \left(NaCl\right)+Solvent \left(H2O\right)=Solution$$ | **Dilution:**$$M\_{1}V\_{1}=M\_{2}V\_{2}$$ |
| **Mole Fraction:**$$X\_{A}= \frac{n\_{A}}{n\_{T}} n\_{T}=n\_{A}+n\_{B}+n\_{C} + ...$$ | **Density:** $$d=\frac{mass}{Volume} d=\frac{m}{V}$$ |
| **Molarity:**$$M=\frac{moles of solute}{Liters of Solution} M=\frac{n}{V}$$ | **molality:**$$molality=\frac{moles of solute}{Kg of Solvent}$$ |
| **Normality:**$$N=\frac{\# of gram equivalent weight of solute}{Liters of Solution}$$**# of Gram Equivalent Weight:**$$\# of gram EW=\frac{mass of solute}{Equivalent Weight}$$**Equivalent Weight:**$$EW=\frac{Molar mass}{n}$$ | **Normality:**$$N=M×n$$**Normality – Simplified Formula:**$$N= \frac{m\*n}{V\*M\_{w}}$$$$m\rightarrow mass (g)$$$$V\rightarrow Volume (Liters of Solution)$$$$M\_{w}\rightarrow Molecular Weight or Molar mass$$$$n\rightarrow number of H^{+} or OH^{-} ions per formula unit$$**Acid Base Neutralization Reactions:**$$N\_{1}V\_{1}=N\_{2}V\_{2}$$ |

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| **Parts Per Million:** (ppm)$$ppm \left({m}/{m}\right) = \frac{mass of solute}{mass of solution} x 10^{6}$$$$ppm \left({V}/{V}\right) = \frac{Volume of solute}{Volume of Solution} x 10^{6}$$$$ppm \left({m}/{V}\right) = \frac{mass of solute (g)}{Volume of Solution (mL)} x 10^{6}$$$$ppm \left({m}/{V}\right) = \frac{mass of solute (mg)}{Volume of Solution (L)}$$**Note:** $1 ppm=1 {mg}/{L} 1 ppb=1 {ug}/{L}$ | **Parts Per Billion:** (ppb)$$ppb \left({m}/{m}\right) = \frac{mass of solute}{mass of solution} x 10^{9}$$$$ppb \left({V}/{V}\right) = \frac{Volume of solute}{Volume of Solution} x 10^{9}$$$$ppb \left({m}/{V}\right) = \frac{mass of solute (g)}{Volume of Solution (mL)} x 10^{9}$$$$ppb \left({m}/{V}\right)= \frac{mass of solute (ug)}{Volume of Solution (L)}$$**Note:** $1 ppm=1000 ppb$ |
| **Concentration Vs Solubility:**Unsaturated Solution: $C<S$ (Dissolution)Saturated Solution: $C=S$ (Equilibrium)Supersaturated Solution: $C>S$ (Precipitation) | **Henry’s Law:**$$\frac{P\_{2}}{P\_{1}}= \frac{S\_{2}}{S\_{1}} S=kP \frac{S\_{1}}{P\_{1}}=\frac{S\_{2}}{P\_{2}}$$**Note:** $k\rightarrow Solubility gas constant \left(\frac{mol}{L\*atm}\right)$ |
| **Enthalpy of Solution:**$$∆H\_{Solution}=∆H\_{Hydration}- ∆H\_{Lattice Energy}$$$$∆H^{o}\_{solution}=\sum\_{}^{}nH^{o}\_{f}\left(products\right)-\sum\_{}^{}nH^{o}\_{f}(reactants)$$ |