Exam 2 Equations

Molality of solute \((m)\) = \(\text{mol solute} \over \text{kg solvent}\)

Mole fraction of A \((X_A)\) = \(n_A \over n_A + n_B + n_C + \ldots\)

Weight % A = \(\text{mass of A} \over \text{mass of A} + \text{mass of B} + \text{mass of C} + \ldots\)

Henry’s Law
\(S_g = k_H P_g\)
where \(S_g\) is the solubility of the gas, \(k_H\) is a constant, and \(P_g\) is the partial pressure of the gaseous solute

Raoult’s Law
\(P_{\text{solute}} = X_{\text{solute}} P^\circ_{\text{solvent}}\)
where \(P^\circ_{\text{solvent}}\) is the vapor pressure of the pure solvent

Mole fraction of solvent \((X_{\text{solvent}})\) = \(n_{\text{solvent}} \over n_{\text{solvent}} + (n_{\text{solute}} x i)\)

Elevation in boiling point \(\Delta T_{BP} = T_F - T_I = m_{\text{solute}} x k_{BP} x i\)

Freezing point depression \(\Delta T_{FP} = T_F - T_I = m_{\text{solute}} x k_{FP} x i\)
Osmotic pressure

\[ \Pi = c \times R \times T \times i \]
where \( c \) is solute concentration in \( \text{mol/L} \), \( R \) is the gas constant \( 0.0821 \text{ L} \cdot \text{atm/K} \cdot \text{mol} \), and \( T \) is temperature in kelvins

Rate_{RXN} = k[A]^x[B]^y
where \( aA + bB \rightarrow cC \), \( x \) is the order of the reaction with respect to \( A \), and \( y \) is the order of the reaction with respect to \( B \)

Concentration at half-life
\[ [R]_{\frac{1}{2}} = \frac{1}{2} [R]_0 \]

Half-life for 0th order reaction
\[ t_{1/2} = \frac{[R]_0}{2k} \]

Half-life for a first order reaction
\[ t_{1/2} = 0.693/k \]

Decimal % remaining for first order reactions
\[ \text{Decimal } \% = 0.5^x \]
where \( x \) is the number of half-lives that have passed

Half-life for second order reaction
\[ t_{1/2} = \frac{[R]_0}{k} \]
Molecular Orbital Diagram