

Note: when $\Delta n_{\text{gas}} = 0$, $K_p = K_c$

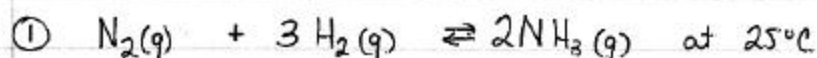
II K , the thermodynamic equilibrium constant

This is sometimes used in heterogeneous equilibria - equilibria involving species which are in different phases. When working with heterogeneous equilibria, the concentrations and partial pressures of pure solids and pure liquids are NOT included in the equilibrium constant expression since they are constants and included in the value of the equilibrium constant.

K is a "hybrid" version of K_c and K_p :

- (1) species in solution (aq) are expressed as concentration
- (2) gases are expressed as partial pressures.

Examples:

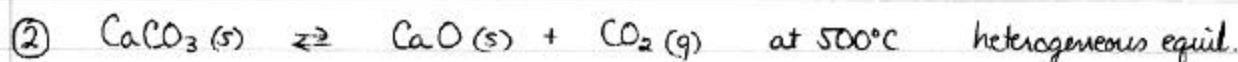


Note: $K = K_p$ when only gases are involved

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

$$K_p = \frac{(P_{\text{NH}_3})^2}{(P_{\text{N}_2})(P_{\text{H}_2})^3}$$

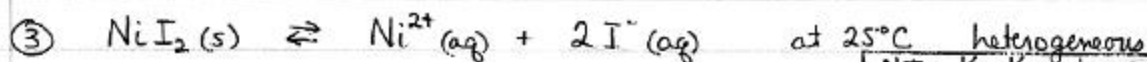
$$K = \frac{(P_{\text{NH}_3})^2}{(P_{\text{N}_2})(P_{\text{H}_2})^3}$$



$$K_c = [\text{CO}_2]$$

$$K_p = P_{\text{CO}_2}$$

$$K = P_{\text{CO}_2}$$

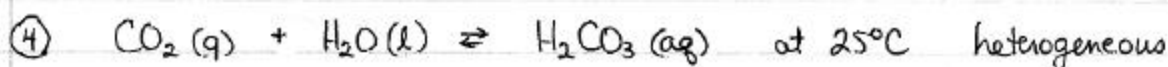


Note: $K = K_c$ when only solutions are involved

$$K_c = [\text{Ni}^{2+}][\text{I}^{-}]^2$$

$$K_p = \text{undefined}$$

$$K = [\text{Ni}^{2+}][\text{I}^{-}]^2$$



$$K_c = \frac{[\text{H}_2\text{CO}_3]}{[\text{CO}_2]}$$

$$K_p = \frac{1}{P_{\text{CO}_2}}$$

$$K = \frac{[\text{H}_2\text{CO}_3]}{P_{\text{CO}_2}}$$