

Chemical Equilibrium Worksheet Pt. 1

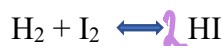
Determine whether each of the following statements are true or false:

1. As a system approaches equilibrium, only the forward reaction is occurring.
F
2. Once equilibrium is achieved, the amount of each reactant and product remains constant.
T
3. In a system in dynamic equilibrium, products are being made, but reactants are being made at the same rate.
T
4. You have to begin your reaction with reactants for equilibrium to be reached.
F

Balance the following reactions (if they are unbalanced) and then write the equilibrium constant expressions for the following reactions (note, all of the reactants and products are in a gaseous phase because solids and pure liquids do not appear in the equilibrium constant expression):



$$K_c = \frac{[\text{PCl}_3][\text{Cl}_2]}{[\text{PCl}_5]}$$



$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$



$$K_c = \frac{[\text{NO}]^4[\text{H}_2\text{O}]^6}{[\text{NH}_3]^4[\text{O}_2]^5}$$

Quick Properties of Solutions Review:

Calculate the molarity of the following solution:

2.3 moles of NaCl in 0.56 L of solution:

$$\frac{2.3 \text{ mol NaCl}}{0.56 \text{ L}} = \boxed{4.1 \text{ M NaCl}} \quad M = \text{mol/L}$$

Calculate the molality of a solution when 20.0 g of sodium hydroxide are dissolved in 500.0 mL of water:

$$\frac{20.0 \text{ g NaOH}}{40.0 \text{ g/mol}} = 0.500 \text{ mol NaOH} \quad m = \frac{\text{mol solute}}{\text{kg solvent}}$$

$$m = \frac{0.500 \text{ mol}}{0.500 \text{ kg}} \quad \boxed{m = 1.00 \text{ mol/kg}}$$

Quick Colligative Property Review:

Calculate the freezing point and boiling point of a solution prepared by mixing 6.00 g of $\text{C}_6\text{H}_{12}\text{O}_6$ with 35.0 g of H_2O (hint: calculate the molality first):

$K_f = 1.86 \text{ } ^\circ\text{C/m}$

$K_b = 0.51 \text{ } ^\circ\text{C/m}$

$$\text{molality} = \frac{\text{mol C}_6\text{H}_{12}\text{O}_6}{\text{kg H}_2\text{O}}$$
$$\frac{6.00 \text{ g C}_6\text{H}_{12}\text{O}_6}{180 \text{ g}} = 0.0333 \text{ mol C}_6\text{H}_{12}\text{O}_6$$

$$\frac{0.0333 \text{ mol C}_6\text{H}_{12}\text{O}_6}{0.035 \text{ kg H}_2\text{O}} = 0.952 \text{ m}$$

$$\Delta T_{bp} = K_b m$$

$$0.51 \text{ } ^\circ\text{C/m} (0.952 \text{ m}) = 0.486 \text{ } ^\circ\text{C}$$

$$100 \text{ } ^\circ\text{C} + 0.486 \text{ } ^\circ\text{C} = \boxed{100.486 \text{ } ^\circ\text{C}}$$

$$\Delta T_{fp} = K_f m$$

$$1.86 \text{ } ^\circ\text{C/m} (0.952 \text{ m}) = 1.77 \text{ } ^\circ\text{C}$$

$$0 - 1.77 \text{ } ^\circ\text{C} = \boxed{-1.77 \text{ } ^\circ\text{C}}$$