Name:_____

Acids/Bases and Chemical Equilibrium
Pride Remediation Session Solutions

Acids, Bases & Conjugates

Identify the following compounds as acids, bases, conjugate acid or conjugate base

$CH_3^- + CH_3COOH \Rightarrow CH_4 + CH_3COO^-$
Base Acid CA CB

$CH_3OH + NH_2^- \Rightarrow CH_3O^- + NH_3$
Acid Base CB CA

$HF + H_2O \Rightarrow H_3O^+ + F^-$
Acid Base CA CB

LeChatelier's Principle

Use arrows to indicate how the indicated changes will effect the concentration of the following substances:

$$NH_3 \rightleftarrows N_2 + 3H_2 + \text{heat}$$

Change: increase $[N_2]$

$[NH_3] \Uparrow$

$[H_2] \Downarrow$

temperature $\Downarrow$

$$N_2 + O_2 + \text{heat} \rightleftarrows 2NO$$

Change: increase $[O_2]$

$[N_2] \Downarrow$

$[NO] \Uparrow$

temperature $\Downarrow$

$$2SO_3 + \text{heat} \rightleftarrows 2SO_2 + O_2$$

Change: decrease $[SO_2]$

$[SO_3] \Downarrow$

$[O_2] \Uparrow$

temperature $\Downarrow$

Reaction Rates and Collision Theory

Indicate if the following changes will increase or decrease the rate of the reaction and then explain why based on the collision theory of reaction rates. Use the terms frequency and magnitude of collisions.

Repeat an acid/base reaction with 2M HCl, rather than 1M HCl

Increasing the concentration will increase the rate of the reaction because the reactants will collide more frequently.

Decrease temperature

Decreasing temperature will decrease the rate of the reaction because the reactants will collide with less energy (magnitude) and less frequently.

Grind a crystalline reactant into a powder

Increasing the surface area of the reactant will increase the reaction rate because the reactants will collide more frequently.

Add water, making the reactants less concentrated

Decreasing the concentration will decrease the rate of the reaction because the reactants will collide less frequently.

Chemical Equilibrium

Below is the Haber Process, which has a Kc value of 9.60.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Write the K_c expression for the reaction

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

At equilibrium, it reachers the following concentrations: 0.025M N_2 and 0.050M H_2. Calculate the molarity of NH_3.

$$9.60 = \frac{[X]^2}{[0.025M][0.050M]^3}$$

$$x = 0.0055M$$

At equilibrium, does this reaction favor reactants or products? Explain your reasoning

At equilibrium, this reaction favors products. This conclusion is based on a K_c value greater than 1.