

Introduction to Natural Science, Spring 2007
Chemistry Workshop – Week 5

- What species are present when the following substances dissolve in water?
 - HCl
 - CH₃COOH
 - NH₃
 - NaOH
 - H₃PO₄
- Write a dissociation reaction and the expressions for K_a or K_b for the following in water.
 - [Co(H₂O)₆]³⁺
 - CH₃NH₂
- Identify the Bronsted acid, base and their corresponding conjugate acid and base for the following.
 - HF (aq) + H₂O (l) ↔ H₃O⁺ (aq) + F⁻ (aq)
 - HSO₄⁻ (aq) + H₂O (l) ↔ SO₄²⁻ (aq) + H₃O⁺ (aq)
 - C₆H₅NH₂ (aq) + HOCl (aq) ↔ C₆H₅NH₃⁺ (aq) + OCl⁻ (aq)
- Calculate the pH and pOH for the following solutions. Determine if the solutions are acidic or basic.
 - 0.250 M HNO₃
 - M CH₃CH₂COOH
 - 2.0 M hydrazine (H₂NNH₂), K_b = 3.0 × 10⁻⁶
- A solution is prepared by mixing 90.0 mL of 5.00 M HCl and 30.0 mL of 8.00 M HNO₃. Water is then added to make the final volume to 500.0 mL. Calculate the pH, [H⁺] and [OH⁻] of this solution. Write balanced reactions to show the presence of all the ions in the above solutions.
- Consider this reaction $\text{NO}_{(g)} + \text{CO}_{(g)} \rightleftharpoons \frac{1}{2}\text{N}_{2(g)} + \text{CO}_{2(g)}$ $\Delta H = -374 \text{ kJ}$ The conditions of temperature and pressure that favor the formation of CO₂ are
(A) high *T* and high *P*. (B) high *T* and low *P*. (C) low *T* and high *P*. (D) low *T* and low *P*
- The value of the equilibrium constant *K* for a reaction at equilibrium is altered by
(A) changing the effective concentration of reactants. (B) changing the effective concentration of products. (C) changing the temperature. (D) adding a catalyst. (E) adding water.
- Into an empty vessel COCl_{2(g)} is introduced at 1.0 atm pressure whereupon it dissociates until equilibrium is established:
 $2\text{COCl}_{2(g)} \rightleftharpoons \text{C}_{(graphite)} + \text{CO}_{2(g)} + 2\text{Cl}_{2(g)}$

If *x* represents the partial pressure of CO_{2(g)} at equilibrium, what is the value of the equilibrium constant, K_p?

- (A) $\frac{x \cdot 2x^2}{(1.0 - 2x)^2}$ (B) $\frac{x \cdot x \cdot 2x^2}{(1.0 - 2x^2)}$ (C) $\frac{x \cdot (2x)^2}{(1.0 - 2x)^2}$ (D) $\frac{x \cdot (2x)^2}{(1.0 - x)^2}$