

Chapter 16 Summary

Main Concepts (Big Ideas):

Types of Acids and Bases: *Arrhenius acid-a substance that transfers a hydrogen ion to water.*
Arrhenius base-a substance that transfers a hydroxide ion to water.

Brønsted-Lowry acid-a substance that transfers a hydrogen ion to another substance.
Does not have to be water.

Brønsted-Lowry base-a substance that accepts a hydrogen ion from another substance.

Lewis acid-a substance that accepts an electron pair from another substance forming a covalent bond.

Lewis base-a substance that donates an electron pair to another substance forming a covalent bond.

Conjugate acid: *The resulting substance after it has accepted a proton from a stronger acid.*

Conjugate base: *The resulting substance after a relatively strong acid has donated a proton.*

Strong acid: *a substance that completely donates its proton to another substance. Ex.: HCl, HBr, HI, H₂SO₄, HNO₃, HClO₃, HClO₄*

Weak acid: *a substance that only partially donates protons to a solution, establishing some level of equilibrium.*

pH scale: *a logarithmic approach to expressing the concentration of H⁺ in an aqueous solution.*

Effect of a salt on pH: *cations and anions have the ability to react with water, removing a hydrogen or hydroxide and thus increase the concentration of the other in solution. We will cover in more detail in class.*

Some important Formulas:

pH = -log [H⁺] *definition of pH.*

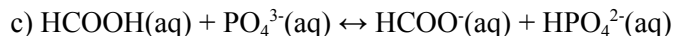
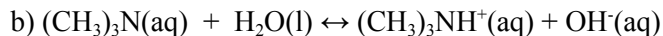
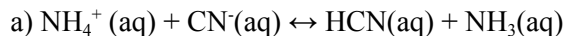
$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$ *equation of the dissociation of a weak acid.*

Percent ionization = $\frac{[\text{H}^+]_{\text{equilibrium}}}{[\text{HA}]_{\text{initial}}} \times 100\%$ *Equation to determine percent of an acid that dissociates.*

$K_a \times K_b = K_w$ *the product of the equilibrium constants of the acid and base equals 1.0×10^{-14}*

Practice Problems:

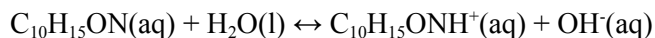
#17 Designate the Brønsted -Lowry acid and the Brønsted -Lowry base on the left side of each of the following equations, and also designate the conjugate acid and conjugate base of each on the right side:



#39 The average pH of normal arterial blood is 7.4. At normal body temperature (37°C), $K_w = 2.4 \times 10^{-14}$. Calculate $[\text{H}^+]$, $[\text{OH}^-]$, and pOH for blood at this temperature.

#53 A 0.100M solution of chloroacetic acid (ClCH_2COOH) is 11.0 % ionized. Using this information, calculate $[\text{ClCH}_2\text{COOH}^-]$, $[\text{H}^+]$, $[\text{ClCH}_2\text{COOH}]$, and K_a for chloroacetic acid.

#75 Ephedrine, a central nervous system stimulant, is used in nasal sprays as a decongestant. This compound is a weak organic base:



A 0.035M solution of ephedrine has a pH of 11.33.

a) What are the equilibrium concentrations of $\text{C}_{10}\text{H}_{15}\text{ON}$, $\text{C}_{10}\text{H}_{15}\text{ONH}^+$, and OH^-

b) Calculate K_b for ephedrine.

#89 Explain the following observations:

a) HNO_3 is a stronger acid than HNO_2

b) H_2S is stronger acid than H_2O

c) H_2SO_4 is a stronger acid than HSO_4^-

d) H_2SO_4 is a stronger acid than H_2SeO_4

e) CCl_3COOH is a stronger acid than CH_3COOH .