Name ______________________

Strengths Of Acids & Bases

I. Strengths Of Acids

1. Differentiate between the terms strong acid and weak acid.

Strong Acid : acids that ionize completely (good conductors)

Weak Acid : produce fewer ions (ionizes partially)

2. List five examples of strong and weak acids and their ionization equations.

Strong Acid	Weak Acid
Hydrochloric: ($HCl \rightarrow H^+ + Cl^-$)	Hydrofluoric: ($HF \rightleftharpoons H^+ + F^-$)
Hydroiodic: ($HI \rightarrow H^+ + I^-$)	Acetic : ($HC_2H_3O_2 \rightleftharpoons H^+ + C_2H_3O_2^-$)
Perchloric: ($HClO_4 \rightarrow H^+ + ClO_4^-$)	Hydrosulfuric: ($H_2S \rightleftharpoons H^+ + HS^-$)
Nitric : ($HNO_3 \rightarrow H^+ + NO_3^-$)	Carbonic : ($H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$)
Sulfuric: ($H_2SO_4 \rightarrow H^+ + HSO_4^-$)	Hypochlorous: ($HClO \rightleftharpoons H^+ + ClO^-$)

3. Strong acid reactions tend to react until completion, whereas weak acid reactions tend to reach chemical equilibrium.

Circle One : [✓ True] False

4. What is the generic equation for an acid ionization constant (K_a)? (Acid) (Base)

$$K_a = \frac{[\text{Conjugate Acid}][\text{Conjugate Base}]}{[\text{Acid}][\text{Base}]} = \frac{[H_3O^+][X^-]}{[HX][H_2O]} = \frac{[H_3O^+][Y^-]}{[HY][H_2O]}$$

5. The weakest acids tend to have the smallest **K_a values.**

(lowest concentration of ions and highest concentration of un-ionized acid molecules)

II. Strengths Of Bases

1. Differentiate between the terms strong base and weak base.

Strong Base : base that dissociates entirely into metal ions + hydroxide ions

Weak Base : ionizes only partially in dilute aqueous solutions

2. List five examples of strong bases and their dissociation equations.

Sodium Hydroxide	$NaOH \rightarrow Na^+ + OH^-$
Potassium Hydroxide	$KOH \rightarrow K^+ + OH^-$
Rubidium Hydroxide	$RbOH \rightarrow Rb^+ + OH^-$
Cesium Hydroxide	$CsOH \rightarrow Cs^+ + OH^-$
Calcium Hydroxide	$Ca(OH)_2 \rightarrow Ca^{+2} + 2OH^-$

3. What is the generic equation for a base ionization constant (K_b)?

$$K_b = \frac{[\text{Conjugate Acid}][\text{Conjugate Base}]}{[\text{Acid}][\text{Base}]}$$

4. The weakest bases tend to have the smallest **K_b values.**

Name ____________________

III. Ion Product Constant For Water

1. **Water self-ionizes into equal concentrations of H^+ and OH^- ions.**

   Circle One : [✓ True] False

2. **Write the equation for the self-ionization of water molecules.**

   $$H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$$

   (Simplified: $H_2O \rightleftharpoons H^+ + OH^-$)

3. **Determine the ion product constant for water at 298 K with H^+ and OH^- ions equal to 1.0×10^{-7} M.**

   $$K_w = [H^+][OH^-] = (1.0\times10^{-7})(1.0\times10^{-7}) = \boxed{1.0\times10^{-14}}$$

   (Le Chatelier's Principle - system reacts to relieve stress)

IV. pH and pOH

1. **Chemists use the** pH **Scale to assess the acidity of solutions (H^+ ions) and** pOH **Scale to assess the alkalinity (basicity) of solutions (OH^- ions).**

2. **The pH Scale and pOH Scale are based on common logarithms and therefore have a** tenfold **change in ion concentration.**

3. **Indicate the type of solution present using the pH and pOH Scales.** (@ 278 K)

	pH Scale	pOH Scale
Below 7.0	Strong Acid	Basic
7.0	Neutral	Neutral
Above 7.0	Strong Base	Acidic

4. **List familiar substances associated with their pH values.**

0.0 - 0.9 : Hydrochloric Acid (HCl)
1.0 - 1.9 : Stomach Acid
2.0 - 2.9 : Lemon Juice
3.0 - 3.9 : Soft Drinks
4.0 - 4.9 : Tomatoes
5.0 - 5.9 : Coffee
6.0 - 6.9 : Milk
7.0 : Pure Water

7.0 - 7.9 : Human Blood, Tears
8.0 - 8.9 : Baking Soda ($NaHCO_3$)
9.0 - 9.9 : Toothpaste
10.0 - 10.9 : Milk of Magnesia
11.0 - 11.9 : Ammonia (NH_3)
12.0 - 12.9 : Lime ($Ca(OH)_2$)
13.0 - 3.9 : Oven Cleaner
14.0 : Drain Cleaner (NaOH)