Acids vs. Bases

Definitions

Acid: donates proton (H^+)

Examples: HCl, HNO_3, NH_4^+, $H_2PO_4^-$

Base: receives proton (H^+)

Examples: NH_3, CO_3^{2-}

Amphiprotic: can behave either as acid or base

Examples: H_2O, $H_2PO_4^-$

Conjugate acid-base pair: two species that differ by one H^+

Formulas

$pH = -\log [H^+]$

$[H^+] = 10^{-pH}$

$pOH = -\log [OH^-]$

$[OH^-] = 10^{-pOH}$

$pH + pOH = 14$

$Kw = 1.0 \times 10^{-14}$ at 25°C

$Kw = Ka \times Kb$

$Kw = [H^+] [OH^-]$

$pKw = -\log (Kw) = -\log (1.0 \times 10^{-14}) = 14$

$pKa = -\log (Ka)$

$pKb = -\log (Kb)$

Ka and Kb expressions = [products] / [reactants] (remember to exclude solids and liquids, like water)

Comparing Relative Strengths of Acids and Bases

The stronger the acid, the larger its Ka value, thus the smaller its pKa value

Stronger acids will have weaker conjugate bases with small Kb values

The stronger the base, the larger its Kb value, thus the smaller its pKb value

Stronger bases will have weaker conjugate acids with small Ka values

	pH	$[H^+]$	$[OH^-]$	pOH
Basic	14.00	1.0×10^{-14}		
			1.0×10^{-4}	
Neutral	7.00			
Acidic		1.0×10^{-4}	1.0×10^{-10}	
				14.00

Acid Base Equilibrium Basics (Chapter 15)

1. What are the 6 strong acids?

2. What are the 8 strong bases?

3. What is the formula for pH? pOH? How are they related?

4. What does the ionization of a strong acid look like when it is put in water according to Arrhenius? According to Bronsted Lowry?

5. What does the ionization of a weak acid look like when it is put in water according to Arrhenius? According to Bronsted Lowry?

6. Write the equilibrium constant expression, Ka, for the weak acid in #5.

7. What does the ionization of a strong base look like when it is put in water according to Arrhenius?

8. What does the ionization of a weak base look like when it is put in water according to Bronsted Lowry?

9. Write the equilibrium constant expression, Kb, for the weak base in #8.

10. What is Kw? How can we use Kw to find Ka or Kb?