Acid-Base Equilibrium

1. Define the following terms:

a) Arrhenius Acid

proton donor (H^+ donor)

b) Arrhenius Base

hydroxide ion donor (OH^- donor)

c) Bronsted-Lowry Acid

proton donor (H^+ donor)

d) Bronsted-Lowry Base

proton acceptor (H^+ acceptor)

2. Label the acid, base, and their conjugates in the following reactions:

$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

base acid con. acid con. base

$CN^- + H_2O \rightarrow HCN + OH^-$

base acid con. acid con. base

$CH_3NH_2 + H_3BO_3 \rightarrow CH_3NH_3 + H_2BO_3^-$

base acid con. acid con. base

$HNO_3 + HCO_3^- \rightarrow NO_3 + H_2O$

acid base con. base con. acid

3. What is the formula for pH?

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

4. What is the formula for pOH? How do we find pH from it?

$pOH = -\log[OH^-]$ $\quad pH = 14 - pOH$

5. Calculate the pH of the following solutions:

a) 1.0×10^{-3} M HCl

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

$= -\log(1.0 \times 10^{-3})$

$pH = 3.00$

b) 0.0234 M KOH

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

$pOH = -\log(0.0234)$

$pOH = 1.63$

$pH = 14 - 1.63$

$pH = 12.369$

c) 6.2×10^{-5} M NaOH

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

$pOH = -\log(6.2 \times 10^{-5})$

$pOH = 4.21$

$pH = 14 - 9.21$

$pH = 9.79$

6. Calculate the pH and pOH of a 7.80×10^{-6} M solution of $Ca(OH)_2$. Determine if the solution is acidic, basic, or neutral.

$2(7.80 \times 10^{-6}) = 1.56 \times 10^{-5}$

$-\log(1.56 \times 10^{-5}) = 4.807$

$pOH = 4.807$

$pH = 9.193$

7. What is a polyprotic acid?

an acid with more than 1 acidic proton

8. List the 7 strong acids:

HCl, HI, HBr, HNO_3, H_2SO_4, $HClO_3$, $HClO_4$

9. To be considered strong, an acid or base has to:

dissociate completely