Chem 20 Ch.8 ACIDS and BASES Name: KEY

1. Write an equation for the ionization of the following acids in water:
   a. HCl, a strong acid $HCl + H_2O \rightarrow H_3O^+ + Cl^-$
   b. HF, a weak acid $HF + H_2O \rightleftharpoons H_3O^+ + F^-$
   c. HNO_3, a strong acid $H_3O^+ + NO_3^-$
2. Write an equation for the ionization of the following bases in water in water
   a. NaOH, a strong base $NaOH \rightarrow Na^+ + OH^-$
   b. NH_4OH, a weak base $NH_4OH \rightarrow NH_4^+ + OH^-$
   c. $Mg(OH)_2$, a strong base $Mg(OH)_2 \rightarrow Mg^{2+} + 2OH^-$
3. Write neutralization equations for the reaction between the following acids and bases:
   a. hydrochloric acid and magnesium hydroxide
   $2HCl + Mg(OH)_2 \rightarrow 2H_2O + MgCl_2$
   b. sulfuric acid and sodium hydroxide
   $H_2SO_4 + 2NaOH \rightarrow 2H_2O + Na_2SO_4$
   c. nitric acid and potassium hydroxide
   $HNO_3 + KOH \rightarrow H_2O + KNO_3$
   d. phosphoric acid and sodium hydroxide
   $H_3PO_4 + 3NaOH \rightarrow 3H_2O + Na_3PO_4$
   e. sulfuric acid and ammonium hydroxide
   $H_2SO_4 + 2NH_4OH \rightarrow 2H_2O + (NH_4)_2SO_4$
4. Calculate the $[H_3O^+]$ when the $[OH^-]$ has the following values:
   a. $[OH^-] = 1 \times 10^{-10}$ M $[H^+] = 1 \times 10^{-4}$ M
   b. $[OH^-] = 1 \times 10^{-5}$ M $[H^+] = 1 \times 10^{-9}$ M
   c. $[OH^-] = 1 \times 10^{-7}$ M $[H^+] = 1 \times 10^{-7}$ M
   d. $[OH^-] = 1.2 \times 10^{-4}$ M 8.3×10^{-11} M
   e. $[OH^-] = 3.5 \times 10^{-8}$ M 2.9×10^{-7} M

5. Calculate the $[OH^-]$ when the $[H_3O^+]$ has the following values:

a. $[H_3O^+] = 1 \times 10^{-3}$ M

$[OH^-] = 1 \times 10^{-11}$

b. $[H_3O^+] = 1 \times 10^{-10}$ M

$[OH^-] = 1 \times 10^{-4}$

c. $[H_3O^+] = 1 \times 10^{-6}$ M

$[OH^-] = 1 \times 10^{-8}$

d. $[H_3O^+] = 2.8 \times 10^{-13}$ M

$[OH^-] = 3.6 \times 10^{-2}$

e. $[H_3O^+] = 8.6 \times 10^{-7}$ M

$[OH^-] = 1.2 \times 10^{-8}$ M

6. Complete the following table

$[H_3O^+]$	$[OH^-]$	pH	acidic, basic, or neutral
1×10^{-8} M	1×10^{-6}	8	BASIC
0.001	1×10^{-11}	3	ACIDIC
5×10^{-10}	2×10^{-5}	9.3	BASIC
1×10^{-2}	1×10^{-12} M	2	ACIDIC
1×10^{-10}	1×10^{-4}	10	BASIC
5×10^{-8} M	2×10^{-7}	7.3	BASIC
1×10^{-7}	1×10^{-7}	7.0	neutral
1×10^{-1}	1×10^{-13}	1	ACIDIC

7. State whether each of the following represents a buffer system and why.

a. HCl and NaCl — N

b. H_2CO_3 — N

c. $H_2CO_3 + NaHCO_3$ — Y • $H_2CO_3 \rightarrow H^+ + HCO_3^-$ • $NaHCO_3 + H^+ \rightarrow H_2CO_3 + Na^+$

8. Solve the following problems using the titration date given:

a. How many mL of 0.20 M NaOH are required to neutralize completely 8.5 mL of 0.50 M H_2SO_4?

$H_2SO_4 + 2\ NaOH \longrightarrow Na_2SO_4 + 2\ H_2O$

$0.0085\ L\ H_2SO_4 \left(\frac{0.50\ mol\ H_2SO_4}{1\ L\ H_2SO_4}\right)\left(\frac{2\ NaOH}{1\ H_2SO_4}\right)\frac{1\ L\ NaOH}{0.20\ mol\ NaOH} = 0.042\ L$

b. A 10.0 mL sample of H_3PO_4 is placed ina flask. Titration required 42.0 mL of 0.10 M NaOH. What is the molarity of the H_3PO_4? $H_3PO_4 + 3\ NaOH \longrightarrow Na_3PO_4 + 3\ H_2O$

$0.042\ L\ NaOH \left(\frac{0.10\ mol\ NaOH}{1\ L\ NaOH}\right)\left(\frac{1\ H_3PO_4}{3\ NaOH}\right)\frac{1}{0.010\ L\ H_3PO_4} = 0.14\ M$