Name: _____

1. Show an equilibrium expression for hydrochloric acid (HCl) and hydronium ion in aqueous solution.

2. Label the acid/base and conjugate acid/base below.

a) HNO_3 *(aq)* + $NaOH$ *(aq)* $\leftrightarrow$ $NaNO_3$ *(aq)* + H_2O *(l)*

b) H_3PO_4 *(aq)* + H_2O *(l)* $\leftrightarrow$ $H_2PO_4^-$ *(aq)* + H_3O^+ *(aq)*

c) NH_3 *(aq)* + H_2O *(l)* $\leftrightarrow$ NH_4^+ *(aq)* + OH^- *(aq)*

3. Use $K_w = 1.0 \times 10^{-14}$ to determine $[H^+]$ in water for:

a) $[OH^-] = 1 \times 10^{-14}$ M

b) $[OH^-] = 1 \times 10^{-2}$ M

c) $[OH^-] = 5 \times 10^{-6}$ M

d) $[OH^-] = 8 \times 10^{-6}$ M

e) $[OH^-] = 1 \times 10^{-7}$ M

4. Find the pH for:

a) $[H^+] = 1 \times 10^{-1}$ M

b) $[H^+] = 1 \times 10^{-6}$ M

c) $[H^+] = 1 \times 10^{-7}$ M

d) $[H^+] = 1 \times 10^{-8}$ M

e) $[H^+] = 1 \times 10^{-14}$ M

f) $[H^+] = 4.5 \times 10^{-9}$ M

g) $[H^+] = 4.0 \times 10^{-9}$ M

h) $[H^+] = 3.5 \times 10^{-9}$ M

5. Find the acid concentration $[H^+]$ for:

a) pH = 1

b) pH = 6

c) pH = 8.0

b) pH = 6.63

6. Use the Henderson-Hasselbalch equation to predict the pH of a buffer solution with 0.200 M HF and 0.240 M NaF. The pK_a for HF is 3.46.

pH = 3.54

7. Complete and balance the following gas evolution reactions

a) $HCl\ (aq) + CaCO_3\ (s) \rightarrow$

c) $HNO_3\ (aq) + CaCO_3\ (s) \rightarrow$

a) $H_2SO_4\ (aq) + CaCO_3\ (s) \rightarrow$

8. A 25.00 mL sample of HNO_3 of unknown concentration is titrated to an endpoint using 18.3 mL of 0.115 M NaOH. Find the acid molarity.

9. A 25.00 mL sample of HCl of unknown concentration is titrated to an endpoint using 11.7 mL of 0.088 M KOH. Find the acid molarity.

10. A 5.00 mL sample of NaOH of unknown concentration is titrated to an endpoint using 24.1 mL of 0.155 M HCl. Find the base molarity.

Name: _____

11. A 25.00 mL sample of H_2SO_4 of unknown concentration is titrated to an endpoint using 11.7 mL of 0.088 M NaOH. Find the acid molarity.

12. A 5.00 mL sample of $Mg(OH)_2$ of unknown concentration is titrated to an endpoint using 28.8 mL of 0.0055 M HNO_3. Find the acid molarity.