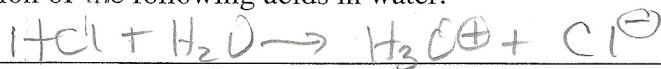


1. Write an equation for the ionization of the following acids in water:

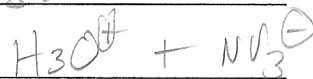
a. HCl, a strong acid



b. HF, a weak acid



c. HNO_3 , a strong acid



2. Write an equation for the ionization of the following bases in water:

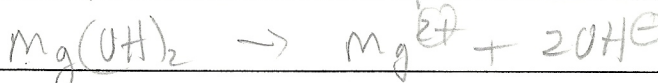
a. NaOH, a strong base



b. NH_4OH , a weak base



c. $\text{Mg}(\text{OH})_2$, a strong base



3. Write neutralization equations for the reaction between the following acids and bases:

a. hydrochloric acid and magnesium hydroxide



b. sulfuric acid and sodium hydroxide



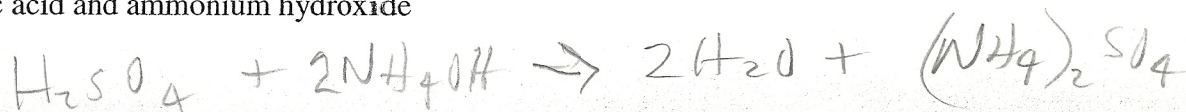
c. nitric acid and potassium hydroxide



d. phosphoric acid and sodium hydroxide



e. sulfuric acid and ammonium hydroxide



4. Calculate the $[\text{H}_3\text{O}^+]$ when the $[\text{OH}^-]$ has the following values:

a. $[\text{OH}^-] = 1 \times 10^{-10} \text{ M}$

$$[\text{H}^+] = 1 \times 10^{-4} \text{ M}$$

b. $[\text{OH}^-] = 1 \times 10^{-5} \text{ M}$

$$[\text{H}^+] = 1 \times 10^{-9} \text{ M}$$

c. $[\text{OH}^-] = 1 \times 10^{-7} \text{ M}$

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

d. $[\text{OH}^-] = 1.2 \times 10^{-4} \text{ M}$

$$8.3 \times 10^{-11} \text{ M}$$

e. $[\text{OH}^-] = 3.5 \times 10^{-8} \text{ M}$

$$2.9 \times 10^{-7} \text{ M}$$

5. Calculate the $[\text{OH}^-]$ when the $[\text{H}_3\text{O}^+]$ has the following values:

a. $[\text{H}_3\text{O}^+] = 1 \times 10^{-3} \text{ M}$

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

b. $[\text{H}_3\text{O}^+] = 1 \times 10^{-10} \text{ M}$

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

c. $[\text{H}_3\text{O}^+] = 1 \times 10^{-6} \text{ M}$

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

d. $[\text{H}_3\text{O}^+] = 2.8 \times 10^{-13} \text{ M}$

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

e. $[\text{H}_3\text{O}^+] = 8.6 \times 10^{-7} \text{ M}$

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

6. Complete the following table

$[\text{H}_3\text{O}^+]$	$[\text{OH}^-]$	pH	acidic, basic, or neutral
$1 \times 10^{-8} \text{ M}$	1×10^{-6}	8	BASIC
0.001	1×10^{-11}	3	ACIDIC
5×10^{-10}	2×10^{-5}	9.3	BASIC
1×10^{-2}	$1 \times 10^{-12} \text{ M}$	2	ACIDIC
1×10^{-10}	1×10^{-4}	10	BASIC
$5 \times 10^{-8} \text{ M}$	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.

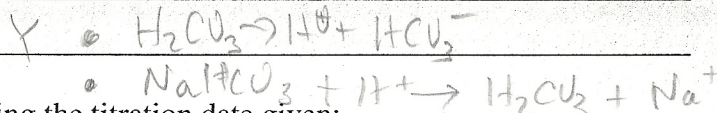
a. HCl and NaCl

N

b. H_2CO_3

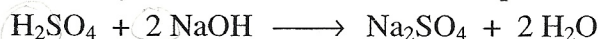
N

c. $\text{H}_2\text{CO}_3 + \text{NaHCO}_3$



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 ?



$$0.0085 \text{ L } \text{H}_2\text{SO}_4 \left(\frac{0.50 \text{ mmol } \text{H}_2\text{SO}_4}{1 \text{ L } \text{H}_2\text{SO}_4} \right) \left(\frac{2 \text{ NaOH}}{1 \text{ H}_2\text{SO}_4} \right) \left(\frac{1 \text{ L NaOH}}{0.20 \text{ mmol NaOH}} \right) = 0.042 \text{ L}$$

b. A 10.0 mL sample of H_3PO_4 is placed in a flask. Titration required 42.0 mL of 0.10 M NaOH.



$$0.042 \text{ L NaOH} \left(\frac{0.10 \text{ mmol NaOH}}{1 \text{ L NaOH}} \right) \left(\frac{1 \text{ H}_3\text{PO}_4}{3 \text{ NaOH}} \right) \left(\frac{1}{0.010 \text{ L } \text{H}_3\text{PO}_4} \right) = 0.14 \text{ M}$$