

Acid/Base Chemistry

- Identify the Brønsted-Lowry acid and Brønsted-Lowry base in each of the following neutralization reactions.
 - $\text{NaCN}(\text{aq}) + \text{HI}(\text{aq}) \rightarrow \text{NaI}(\text{aq}) + \text{HCN}(\text{aq})$
B-L base B-L acid
 - $\text{NH}_3(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
B-L base B-L acid
- Identify the Arrhenius acid and Arrhenius base in each of the following neutralization reactions.
 - $\text{H}_2\text{C}_2\text{O}_4(\text{aq}) + 2 \text{LiOH}(\text{aq}) \rightarrow \text{Li}_2\text{C}_2\text{O}_4(\text{aq}) + 2 \text{H}_2\text{O}(\text{l})$
A acid A base
 - $\text{H}_2\text{SO}_4(\text{aq}) + \text{Mg}(\text{OH})_2(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + 2 \text{H}_2\text{O}(\text{l})$
A acid A base
 - $\text{HNO}_3(\text{aq}) + \text{KOH}(\text{aq}) \rightarrow \text{KNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
A acid A base
- Given the following balanced neutralization reaction, please circle all that are correct:
 $\text{HBr}(\text{aq}) + \text{H}_2\text{PO}_4^-(\text{aq}) \rightarrow \text{H}_3\text{PO}_4(\text{aq}) + \text{Br}^-(\text{aq})$
 - HBr (aq) is an Arrhenius acid and a Brønsted-Lowry acid.
 - HBr (aq) is an Arrhenius base and a Brønsted-Lowry base.
 - HBr (aq) is an Arrhenius acid but not a Brønsted-Lowry acid.
 - HBr (aq) is a Brønsted-Lowry base but not an Arrhenius base.
 - $\text{H}_2\text{PO}_4^-(\text{aq})$ is an Arrhenius acid and a Brønsted-Lowry acid.
 - $\text{H}_2\text{PO}_4^-(\text{aq})$ is an Arrhenius base and a Brønsted-Lowry base.
 - $\text{H}_2\text{PO}_4^-(\text{aq})$ is an Arrhenius acid but not a Brønsted-Lowry acid.
 - $\text{H}_2\text{PO}_4^-(\text{aq})$ is a Brønsted-Lowry base but not an Arrhenius base.
- Indicate whether the following solutions are strongly or weakly acidic or basic:
 - egg white, pH = 7.9 weakly basic
 - champagne, pH = 3.7 weakly acidic
 - lime juice, pH = 1.8 strongly acidic
 - tomato juice, pH = 4.1 weakly acidic
 - drain cleaner, pH = 13 strongly basic
 - stomach acid, pH = 1 strongly acidic
 - seawater, pH = 8.2 weakly basic
- Determine the pH for the following:
 - $[\text{H}^+] = 0.00001$ pH = 5
 - $[\text{H}^+] = 0.001$ pH = 3
 - $[\text{H}^+] = 0.00000001$ pH = 8
 - $[\text{OH}^-] = 0.00001$ pOH = 5 so pH = 14 - 5 = 9
 - $[\text{OH}^-] = 0.001$ pOH = 3 so pH = 14 - 3 = 11
 - $[\text{OH}^-] = 0.00000001$ pOH = 8 so pH = 14 - 8 = 6

6. Calculate the pH of eggs if the pOH is 6.2. $\text{pH} = 14 - 6.2 = 7.8$
7. Calculate the pOH of peas if the pH is 7.6. $\text{pH} = 14 - 7.6 = 6.4$
8. Calculate the pH of carrots if the pOH is 8.9. $\text{pH} = 14 - 8.9 = 5.1$
9. Use your solubility rules to determine if the following compounds is a strong or weak electrolyte:

a. NH_4Cl	strong electrolyte	weak electrolyte
b. $\text{Zn}(\text{OH})_2$	strong electrolyte	weak electrolyte
c. BaCO_3	strong electrolyte	weak electrolyte
d. K_2S	strong electrolyte	weak electrolyte
e. SrSO_4	strong electrolyte	weak electrolyte

10. If the titration of a 25.00 mL sample of hydrochloric acid requires 22.15 mL of 0.155 M sodium hydroxide, what is the molarity of the acid?

$$\text{Titration Problem: } \frac{22.15 \text{ mL} (1 \text{ L}) (0.155 \text{ mol NaOH}) (1 \text{ mol HCl})}{(1000 \text{ mL}) (1 \text{ L}) (1 \text{ mol NaOH})} = 0.00343 \text{ mol HCl}$$

$$\text{Molarity} = \frac{\text{mol}}{\text{L}} = \frac{0.00343 \text{ mol HCl}}{0.02500 \text{ L}} = 0.137 \text{ M HCl}$$

11. If the titration of a 35.75 mL sample of sulfuric acid requires 50.55 mL of 0.225 M potassium hydroxide, what is the molarity of the acid?

$$\text{Titration Problem: } \frac{50.55 \text{ mL} (1 \text{ L}) (0.225 \text{ mol KOH}) (2 \text{ mol H}_2\text{SO}_4)}{(1000 \text{ mL}) (1 \text{ L}) (1 \text{ mol KOH})} = 0.0227 \text{ mol H}_2\text{SO}_4$$

$$\text{Molarity} = \frac{\text{mol}}{\text{L}} = \frac{0.0227 \text{ mol H}_2\text{SO}_4}{0.03575 \text{ L}} = 0.636 \text{ M H}_2\text{SO}_4$$