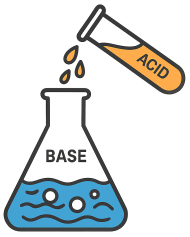
Acids and Bases **Name**_____

Acid-Base Neutralization Reactions

Read from **Lesson 4a: Reactions of a Strong Acid and a Strong Base** in the **Chemistry Tutorial Section, Chapter 15** of **The Physics Classroom:**

Acid-Base Neutralization Reactions



- **Neutralization** = Acid + Base → Salt + Water
- Occurs when **H^+ ions** from the acid react with **OH^- ions** from the base to form **H_2O**
- Final solution is **neutral** (pH = 7) when the reactants are a strong acid and a strong base.

Vocabulary:

- **Spectator ions** (e.g., Na^+, Cl^-) don't participate—just "watch" the reaction
- **Amphiprotic water** can act as acid or base, but in strong acid/base reactions, it's just the medium
- **Equivalence point** = when moles of H^+ (or H_3O^+) = moles of OH^-

Writing Molecular, Complete Ionic, and Net Ionic Equations for Neutralization Reactions
Three Equation Forms:

1. **Molecular Equation**: Shows full compounds: for example: HCl (aq) + NaOH (aq) → NaCl (aq) + H_2O (l)
2. **Complete Ionic Equation**: Shows all ions in solution: for example:
   H^+ (aq) + Cl^- (aq) + Na^+ (aq) + OH^- (aq) → Na^+ (aq) + Cl^- (aq) + H_2O (l)
3. **Net Ionic Equation:** Removes spectator ions: H^+ (aq) + OH^- (aq) → H_2O (l)

Stoichiometry Tips

- Use **mole ratios** from balanced equations
- Example: $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + 2\ H_2O$ (Requires **2 moles of NaOH** per **1 mole of H_2SO_4**)

Questions

1. True or False. If the statement is true, write "true." If the statement is false, then explain why it is false.
   a. The typical products of a strong acid reacting with a strong base are a salt and hydrogen gas.

   b. The correct molecular equation for the neutralization reaction between nitric acid and strontium hydroxide is: $HNO_3 + Sr(OH)_2 \rightarrow NO_2 + SrH_2$

   c. The mole ratio of HNO_3 to $Sr(OH)_2$ in the neutralization reaction is 2:1.

   d. The correct net ionic equation for the neutralization reaction between nitric acid and strontium hydroxide is $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

   e. The pH of the equivalence point for the neutralization reaction between nitric acid and strontium hydroxide is 3.5.

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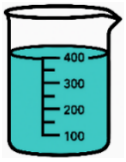
2. A beaker contains 16.9 grams of chloric acid dissolved in enough deionized water to make a 400.0 mL solution.



   a. What is the molarity of the chloric acid solution?

   b. What is the correct molecular equation for the neutralization reaction between chloric acid and calcium hydroxide?

   c. What volume of the chloric acid solution is required to completely neutralize 250.0 mL of a 0.100 M solution of calcium hydroxide?

3. A 33.5 mL sample of a strong monoprotic acid (HA) is titrated with 0.420 M lithium hydroxide. The equivalence point is reached after adding 55.6 mL of the base. Use this information to answer the following questions:

   a. What is the correct molecular equation for the neutralization reaction between the acid (HA) and lithium hydroxide?

   b. How many moles of acid are present in the solution?

   c. What is the molarity of the acid solution?

   d. If 3.00 g of the acid were used to make the solution, what is the molar mass of the acid?

   e. Based on the molar mass and the fact that the acid is strong and monoprotic, which acid could this be?

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