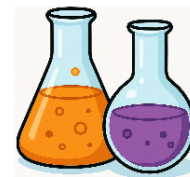
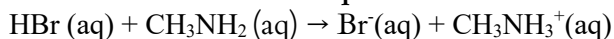
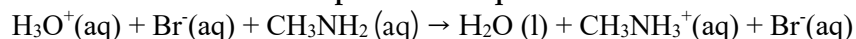
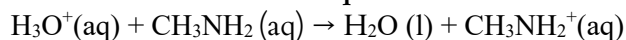
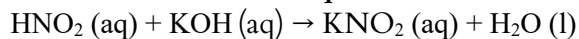
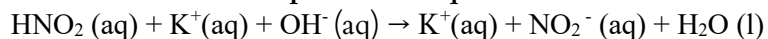
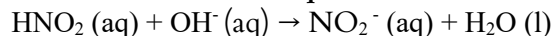
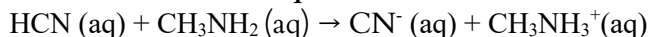


**Weak Acid or Base Neutralization Reactions**

Read from Lesson 4b: [Neutralization Reactions Involving a Weak Acid or Base](#) in the Chemistry Tutorial Section, Chapter 15 of The Physics Classroom

**Reaction Types & pH Outcomes**

| Acid Type          | Base Type                     | pH at Equivalence | Reason                                                   |
|--------------------|-------------------------------|-------------------|----------------------------------------------------------|
| Strong (e.g., HCl) | Strong (e.g., NaOH)           | 7.0               | Neutral salt + water                                     |
| Strong             | Weak (e.g., NH <sub>3</sub> ) | < 7.0             | NH <sub>4</sub> <sup>+</sup> is a weak conjugate acid    |
| Weak (e.g., HF)    | Strong                        | > 7.0             | F <sup>-</sup> is a weak conjugate base                  |
| Weak               | Weak                          | ~7.0 (varies)     | Depends on K <sub>a</sub> vs. K <sub>b</sub> of products |

**Examples: Reaction****Strong Acid + Weak Base****Molecular Equation:****Complete Ionic Equation:****Net Ionic Equation:****Weak Acid + Strong Base****Molecular Equation:****Complete Ionic Equation:****Net Ionic Equation:****Weak Acid + Weak Base****Equation:**

- Predicting the equivalence point pH requires comparing K<sub>a</sub> of the conjugate acid (CH<sub>3</sub>NH<sub>3</sub><sup>+</sup>) and K<sub>b</sub> of the conjugate base (CN<sup>-</sup>). The relationship holds: K<sub>a</sub> × K<sub>b</sub> = 1.0 × 10<sup>-14</sup> for conjugate pairs.

$$K_a \text{ of CH}_3\text{NH}_3^+ \text{ is } 2.3 \times 10^{-11}$$

$$K_b \text{ of CN}^- \text{ is } 1.6 \times 10^{-5}$$

\* CN<sup>-</sup> is a stronger base than CH<sub>3</sub>NH<sub>3</sub><sup>+</sup> is an acid; so, the equivalence pH is basic (> 7).

## Acids and Bases

### Questions



1. A 0.250 M solution of sulfurous acid reacts with a solution of lithium hydroxide.
  - a. Write the correct molecular equation for the neutralization reaction between these two reactants.
  - b. Write the correct net ionic equation for the neutralization reaction between these two reactants
  - c. What is the pH after the complete neutralization of sulfurous acid? Which product affects the pH of the solution? Support your answer with a reaction.
  - d. An Erlenmeyer flask contains 35.0 mL of the sulfurous acid solution. What volume of 0.375 M lithium hydroxide must be added to it for complete neutralization?
2. A 1.05 M solution of ammonia reacts with a solution of nitric acid.
  - a. Write the correct molecular equation for the neutralization reaction between these two reactants.
  - b. Write the correct net ionic equation for the neutralization reaction between these two reactants
  - c. What is the pH after the complete neutralization of ammonia? Which product affects the pH of the solution? Support your answer with a reaction.
  - d. An Erlenmeyer flask contains 98.0 mL of the ammonia solution. What volume of 0.169 M nitric acid must be added to it for complete neutralization?