

Acids and Bases

1. Write balanced equations that describe the following reactions:

- the dissociation of perchloric acid in water.
- the dissociation of propanoic acid ($\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$) in water.
- the dissociation of ammonium ion in water.

2. For each of the following aqueous reactions, identify the acid, the base, the conjugate base, and the conjugate acid.

- $\text{Al}(\text{H}_2\text{O})_6^{3+} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{HCO}_3^-$
- $\text{C}_5\text{H}_5\text{NH}^+ + \text{H}_2\text{O} \rightleftharpoons \text{C}_5\text{H}_5\text{N} + \text{H}_3\text{O}^+$
- $\text{HCO}_3^- + \text{C}_5\text{H}_5\text{NH}^+ \rightleftharpoons \text{H}_2\text{CO}_3 + \text{C}_5\text{H}_5\text{N}$

3. Calculate $[\text{H}^+]$ and $[\text{OH}^-]$ for each solution at 25°C . Identify each solution as neutral, acid, or basic.

- $\text{pH} = 7.40$ (the normal pH of blood)
- $\text{pH} = 15.3$
- $\text{pH} = -1.0$
- $\text{pH} = 3.20$
- $\text{pOH} = 5.0$
- $\text{pOH} = 9.60$

4. Calculate the pH of each of the following:

- A solution containing 0.10 M HCl and 0.10 M HOCl .
- A solution containing $0.05\text{ M HC}_2\text{H}_3\text{O}_2$ and 0.05 M HNO_3 .

5. A 0.15 M solution of a weak acid is 3.0% dissociated. Calculate K_a .

6. Calculate the pH of a $0.20\text{ M C}_2\text{H}_5\text{NH}_2$ solution ($K_b = 5.6 \times 10^{-4}$).

7. Calculate the pH of a $0.050\text{ M Al}(\text{NO}_3)_3$ solution. The K_a for $\text{Al}(\text{H}_2\text{O})_6^{3+}$ is 1.4×10^{-5} .