



Unit 4: Properties of Solutions
Introduction to Acids and Bases

This worksheet will introduce the foundational concepts of acids and bases. According to the Arrhenius theory, acids release hydrogen ions (H^+) and bases produce hydroxide ions (OH^-), further classified as strong or weak based on their degree of dissociation in water. The chemical neutralization reactions, illustrated by the ionic equation "Acid + Base \rightarrow Salt + Water," will be explored.

1. Explain the Arrhenius theory of acids and bases. Provide an example of each.
2. According to the Arrhenius theory, classify each as either Arrhenius acid or base?
 - a. Hydrochloric acid (HCl)
 - b. Sodium hydroxide (NaOH)
 - c. Nitric acid (HNO_3)
 - d. Sulfuric acid (H_2SO_4)
3. Explain the concept of a neutralization reaction and its significance in chemistry. Provide a real-life example where neutralization reactions play a crucial role.
4. In a neutralization reaction between hydrochloric acid (HCl) and sodium hydroxide (NaOH), what are the products formed?

ANSWER KEY:

1. Explain the Arrhenius theory of acids and bases. Provide an example of each.

The Arrhenius theory defines acids as substances that release hydrogen ions (H^+) in water and bases as substances that release hydroxide ions (OH^-) in water. For example, hydrochloric acid (HCl) is an Arrhenius acid because it dissociates in water to produce H^+ ions. Sodium hydroxide (NaOH) is an Arrhenius base as it dissociates to yield OH^- ions in water.

2. According to the Arrhenius theory, classify each as either Arrhenius acid or base?

- a. Hydrochloric acid (HCl)
- b. Sodium hydroxide (NaOH)
- c. Nitric acid (HNO_3)
- d. Sulfuric acid (H_2SO_4)

- a. Hydrochloric acid (HCl) - HCl is an Arrhenius acid since it releases H^+ ions in water
- b. Sodium hydroxide (NaOH) - NaOH is an Arrhenius base since it releases OH^- ions in water
- c. Nitric acid (HNO_3) - HNO_3 is an Arrhenius acid since it releases H^+ ions in water
- d. Sulfuric acid (H_2SO_4) - H_2SO_4 is an Arrhenius acid since it releases H^+ ions in water

Note: Arrhenius theory is just one theory of defining what an acid and base are. This theory only works to define compounds that can dissociate into water, in which the components have either H^+ or OH^- . It would not be able to be used to characterize compounds such as, ammonia, NH_3 , since this does not dissociate (in fact, later on in other units, you will learn that ammonia is a base).

3. Explain the concept of a neutralization reaction and its significance in chemistry. Provide a real-life example where neutralization reactions play a crucial role.

A neutralization reaction occurs when an acid and a base react to form a salt and water. This reaction is significant as it helps neutralize acidic or basic solutions, making them less acidic or basic. An example is the use of antacids (containing bases) to neutralize excess stomach acid (an acid), providing relief from heartburn.

4. In a neutralization reaction between hydrochloric acid (HCl) and sodium hydroxide (NaOH), what are the products formed?

In a neutralization reaction, an acid and a base react to form a salt and water, which is represented by the equation: $Acid + Base \rightarrow Salt + Water$. So, the products formed in this case would be NaCl (a salt) and H_2O (water).

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