# **Acids, Bases, and Salts Discussion Guide (for use during or after reading)**

1. What is an ion and how is it different from a typical atom? (Ions, p. 7-10)
   1. Ions are like special versions of atoms. Ions are atoms that have gained or lost an electron. Anions have a negative charge because they have gained an electron and cations have a positive charge because they have lost an electron.
2. What is an acid and how does it relate to what we know about ions? (What Are Acids?, p. 11-14)
   1. Acids are substances that produce hydrogen cations (H+) when dissolved in water. Acids ionize in water, which means their atoms split into positively or negatively charged ions.
3. Explain how hydrogen chloride reacts with water to produce hydrochloric acid. (What Are Acids?, p. 11-14)
   1. When hydrogen chloride (HCl) is exposed to water, it ionizes. This means it separates into ions. Because chlorine is more attracted to the electrons than hydrogen, the chlorine becomes the negatively charged anion and the hydrogen becomes the positively charged cation, forming hydrochloric acid.

1. What is a base? What is produced when a base is dissolved in water? (What Are Bases?, p. 15-16)
   1. A base is a substance that produces hydroxide anions (OH-) when dissolved in water. Hydroxide anions (OH-) are quite reactive and have an extra electron they are trying to lose. Hydroxide anions can form new bonds with substances exposed to the base.
2. Explain how sodium hydroxide reacts with water to produce a sodium cation and a hydroxide anion. (What Are Bases?, p. 15-16)
   1. Sodium hydroxide is a base made of one sodium atom, one oxygen atom, and one hydrogen atom. Its chemical formula is NaOH. When NaOH crystals dissolve in water, the sodium gives one of its electrons to the hydrogen and oxygen molecule. This results in a sodium cation and a hydroxide anion.
3. Describe the pH scale. How can one determine the pH of a given substance and use it to classify that substance as an acid or a base? (pH Scale and Strength of Acids and Bases, p. 17-23)
   1. The pH scale is a tool chemists use to measure the strength of acids and bases. Because the pH scale uses a negative logarithmic scale, each consecutive rating represents a tenfold drop in acidity, with 1 being the most acidic and 14 being the most basic. In order to find the pH of something, scientists use special substances called indicators. Indicators, like litmus paper or red cabbage juice, are compounds that change color when exposed to acids or bases.
4. According to the text, what are two ways in which acids are used? What are two ways in which bases are used? (Uses of Acids, Uses of Bases, p. 24-27)
   1. Students’ answers about current uses for acids may vary. Responses may include information about acids in our stomachs used to break down food, to flavor food, to preserve food, as components of fertilizer to help crops grow, and in the batteries of cars and other vehicles.
   2. Students’ answers about current uses of bases may vary. Responses may include information about bases in industrial cleaners, weak bases in everyday soaps, bases used to make the dark and chewy crust on pretzels, and bases used as medicines for upset stomachs or as laxatives.
5. What happens when acids and bases react? Why do some people consider acids and bases to be a perfect pair? (Acids and Bases Coming Together, p. 28-29)
   1. When acids and bases react, they produce salt! They are considered the perfect pair because, when combined in water, they produce a hydrogen cation (H+) and a hydroxide anion (OH-), which bond easily to form an ordinary water molecule (H2O).
6. Review the example detailed on page 29. Explain how combining the base sodium hydroxide (NaOH), the acid hydrogen chloride (HCl), and water, and then boiling out the water, produces sodium chloride (NaCl), or salt. (Acids and Bases Coming Together, p. 28-29)
   1. When the base sodium hydroxide (NaOH), the acid hydrogen chloride (HCl), and water are combined, they ionize and create hydrogen cations (H+) as well as hydroxide anions (OH-), which bond easily to form water (H2O). Combining acids and bases also releases heat. If we continue to add heat, the water will evaporate. This leaves us with sodium chloride (NaCl), or salt!
7. What properties do most salts contain? (Salts, p. 30-35)
   1. All salts have similar properties. For example, they are brittle solids at room temperature and most dissolve in water. It is important to note that salts can come in many colors, including red, orange, yellow, green, and blue!