# **Atoms and Molecules Discussion Guide (for use during or after reading)**

1. How would you explain the scientific concept of matter to someone who has not studied it before? (Introduction, p. 4-7)
   1. Students’ answers will vary but are likely to include information about matter making up everything in the world around us. Students will likely use examples like those found in the text to provide more context for describing such a broad concept as matter.
2. Define and describe the parts of an atom, including protons, neutrons, electrons, and shells. (Parts of an Atom, p. 10-11)
   1. Atoms are tiny little particles that make up all matter. All atoms are made up of even tinier particles. Atoms contain a nucleus at their center which consists of protons (positive charge) and neutrons (no charge). Electrons are negatively charged and move freely around the nucleus in special regions called shells.
3. How are electrons organized into electron shells? (Electron Shells, p. 14-15)
   1. Electrons are held in shells around the nucleus of an atom. Each shell holds a specific number of electrons. Electrons close to the nucleus are considered stuck because they are so attracted to the protons. Those in the outermost shell have the greatest amount of energy and the ability to escape to form bonds with other atoms.
4. How are ionic and covalent bonds similar? How are they different? (Chemical Bonds, p. 16-17)
   1. Ions are atoms that have either gained an electron to become negatively charged or lost an electron to become positively charged. Ions are attracted to other ions with opposite charges and form ionic bonds. Covalent bonds, on the other hand, form when atoms share electrons rather than giving or taking them.

1. What are positive valence and negative valence? How do they impact molecules’ ability to bond? (Valence, p. 18-19)
   1. An atom’s valence refers to the number of electrons it has available for chemical bonding. Atoms that tend to lose electrons have positive valence and those that tend to gain electrons have negative valence. Atoms with opposite valences tend to bond more easily.
2. Compare compounds and elements. (Molecules, 20-23)
   1. Compounds and elements are both types of molecules. Elements are molecules that consist solely of one type of atom. For example, ozone is an element made from three oxygen atoms. Compounds are different than elements because they are molecules that consist of two or more types of atoms combined.
3. According to the text, the structure of a molecule determines its properties. How does the example on pages 26 and 27 illustrate this? (The Structure of Molecules, p. 24-27)
   1. Molecules come in many shapes and sizes, and their structure determines the properties they have. The example on pages 26 and 27 shows this by comparing two substances with the exact same chemical makeup but quite different structures. Graphite contains carbon atoms linked together in flat, sheetlike layers, making it soft, slippery, and the perfect material for a pencil. Diamonds are also made solely of carbon but are among the hardest elements on Earth because their atoms are linked together in a pyramid-like structure.
4. What does it mean if a substance is chemically stable? (Chemical Properties, p. 28-29)
   1. A substance is considered chemically stable if it does not join easily with other atoms to react and form new substances.
5. Why is photosynthesis considered an example of a chemical reaction? (Chemical Reactions, p. 30-33)
   1. Photosynthesis is the process plants use to turn light energy from the sun into chemical energy. This is considered an example of a chemical reaction because plants use the light energy from the sun to chemically break apart the bonds of water molecules, so they react with other molecules to create glucose molecules, or chemical energy.
6. What fun fact stood out to you and why? (Can You Believe It?!, p. 38-39)
   1. Students’ answers will vary.