02 Chemical Bonding

Content Area: **Science**
Course(s): **Chemistry A**
Time Period: **Semester 1**
Length: **10 weeks**
Status: **Published**

Standards

SCI.HS.PS1.A	Structure and Properties of Matter
SCI.HS.PS1.B	Chemical Reactions
SCI.HS.PS2.B	Types of Interactions
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
SCI.HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
SCI.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
SCI.HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
	Developing and Using Models
	Patterns
	Structure and Function
	Obtaining, Evaluating, and Communicating Information
	Constructing Explanations and Designing Solutions
	Planning and Carrying Out Investigations

Enduring Understandings

1. Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.

2. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

3. The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.

4. Stable forms of matter are those in which the electric and magnetic field energy is minimized. A stable molecule has less energy, by an amount known as the binding energy, than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.

5. Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in total binding energy (i.e., the sum of all bond energies in the set of molecules)

that are matched by changes in kinetic energy.

6. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.

7. The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.

8. Chemical processes and properties of materials underlie many important biological and geophysical phenomena.

9. Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.

10. The strong and weak nuclear interactions are important inside atomic nuclei—for example, they determine the patterns of which nuclear isotopes are stable and what kind of decays occur for unstable ones.

Essential Questions

1. How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?

2. How do particles combine to form the variety of matter one observes?

3. What factors dictate whether a reaction will occur or not?

4. How does the periodic table of elements reflect the regular patterns of chemical behavior exhibited by the elements?

5. How do the chemical names and formulas of compounds relate to their physical and chemical properties?

6. Why is it important to be able to predict the outcome of a reaction?

7. What underlying forces explain the variety of interactions observed?

8. How does the strength of electrical forces between particles affect the measurable properties of a substance?

Knowledge and Skills

Knowledge:

1. Students will know that each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (DCI PS1.A Structure and Properties of Matter)

2. Students will know that the periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (PS1.A Structure and Properties of Matter)

3. Students will know the fact that atoms are conserved, together with knowledge of the chemical properties of the element involved, can be used to describe, and predict chemical reactions. (PS1.B Chemical Reactions)

4. Students will know that the structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (DCI PS1.A Structure and Properties of Matter)

5. Students will know that the attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (PS2.B Type of Interactions)

Skills:

1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

3. Identify bulk properties of a substance that would allow inferences to be made about the strength of electrical forces between particles.

4. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

5. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing