The Next Generation Science Standards (NGSS)

CHAPTER 4, LESSON 4: ENERGY LEVELS, ELECTRONS, AND COVALENT BONDING

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.

DISCIPLINARY CORE IDEAS

PS1.A Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)

- Each atom has a charged sub-structure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)

Students apply what they have learned about protons, electrons, and energy levels to learn about covalent bonding. Students see that two hydrogen atoms form hydrogen gas (H_2), two hydrogen atoms and one oxygen atom form water (H_2O), two oxygen atoms form oxygen gas (O_2), and that four hydrogen atoms and one carbon atom form methane (CH_4). The process of ionic bonding is covered in the next lesson.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

- Develop a model to predict and/or describe phenomena. (MS-PS1-1)

- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Students see a molecular model animation of atoms forming covalent bonds to form molecules and then draw and describe the process. Students see that mutual attraction between the protons and electrons of the atoms and available space in the outer energy levels of the atoms is necessary for forming covalent bonds.

CROSSCUTTING CONCEPTS

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-3)

Students use models of atoms to understand the attractions and conditions necessary for forming a covalent bond. Students use these models to predict whether two or more atoms are likely to form a covalent bond.