The Next Generation Science Standards (NGSS)

CHAPTER 4, LESSON 5: ENERGY LEVELS, ELECTRONS, AND IONIC 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 ionic bonding. Students see that sodium and chlorine atoms form ions which com- bine to make sodium chloride (NaCl). Students also see that calcium and chlorine atoms form ions which combine to make calcium chloride ($CaCl_2$).

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 ions and then the formation of an ionic bond. Students then draw and describe the process in the animation. Students also use Styrofoam balls as ions to further model the formation of ionic bonds in a crystal of sodium chloride.

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 animations, drawings, and physical models of ions to understand the attractions and conditions necessary for forming an ionic bond. Students use these models to predict and better understand the cause of the cubic shape of an actual sodium chloride crystal.

