

# The Next Generation Science Standards (NGSS)

## CHAPTER 4, LESSON 3: THE PERIODIC TABLE AND ENERGY LEVEL MODELS

**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*

- Each atom has a charged sub-structure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- 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. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)

*Students are introduced to the idea that the electrons surrounding the nucleus of an atom are on different levels and that each level can only hold a specific number of electrons. Students play a game to reinforce this concept. Students see that the periodic table is arranged in a way that atoms with the same number of electrons in their outermost level (valence electrons) are in columns. Students also see that atoms with the same number of valence electrons tend to react similarly.*

### SCIENCE AND ENGINEERING PRACTICES

#### *Developing and Using Models*

- Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4)
- Develop a model to describe unobservable mechanisms. (MS-PS3-2)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

*Students use energy level models to represent atoms in the periodic table. These energy level models can be used to determine the number of protons in the nucleus, the position of the element in the periodic table, and the likelihood that the element will react similarly to the element directly above or below it.*

## 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 see patterns in the way each additional electron is added to an energy level until that level cannot accommodate more electrons. Students see that the structure of the periodic table is determined by energy levels and the number of electrons in those levels.*