



Honors Chemistry - Unit 6 - Atomic Structure, Electron Configuration and Periodic Relationships

Unit Focus

Students will describe the quantum mechanical model of the atom and explore the scientific evidence that led to the development of this model. By evaluating electron configuration and orbital diagrams, students will explain the Periodic Law. Building on this, students will apply their understanding of periodic relationships among elements to interpret and predict properties of elements including ionization energy, electronegativity, and atomic radius, are related to the valence electrons of each element.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p>Next Generation Science Standards (DCI) <i>Science: 10</i></p> <ul style="list-style-type: none"> The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. <i>PS1.9.A2</i> 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. <i>PS1.9.A3</i> The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. <i>PS4.9.A1</i> Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. <i>PS4.9.B1</i> When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. <i>PS4.9.B3</i> <p><i>Science: 11</i></p>	<p>T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.</p> <p>T2 Evaluate scientific claims and analyze issues to verify the credibility of the source, data, and/or approach.</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
<p>U1 The organization of elements in the periodic table based on atomic structure facilitates predictions about their characteristics.</p> <p>U2 Energy can be described on a microscopic level which describes the motion/behavior of the particles.</p> <p>U3 Atoms are comprised of subatomic particles held together by fundamental forces and their quantity and arrangement determines the atom's properties, identity, and behavior.</p> <p>U4 The structure and interactions of matter are determined by electrical forces within and between atoms.</p> <p>U5 Wavelength, frequency, and amplitude are properties of a wave that determine its characteristics such as color and energy and are used in everyday scientific application.</p> <p>U6 Electrons are arranged in energy levels, sublevels, and orbitals. The arrangement of the outermost electrons determines the properties and chemical behaviors of the element.</p>	<p>Q1 How does structure relate to function?</p> <p>Q2 How can we use models to represent structure of matter?</p> <p>Q3 Explain the evidence that supports the current model (quantum mechanical model) of the atom?</p> <p>Q4 How does understanding the organization of the periodic table allow scientists to make predictions?</p>	

Stage 1: Desired Results - Key Understandings

	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
<ul style="list-style-type: none"> Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. <i>PS1.9.A1</i> <p>NGSS/NSTA Science & Engineering Practices <i>NGSS Science & Engineering Practices: 9-12</i></p> <ul style="list-style-type: none"> Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria. <i>SE.9-12.2.1</i> Design a test of a model to ascertain its reliability. <i>SE.9-12.2.2</i> Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. <i>SE.9-12.2.3</i> Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems. <i>SE.9-12.2.6</i> <p>Madison Public Schools Profile of a Graduate <i>Critical Thinking</i></p> <ul style="list-style-type: none"> Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) <p><i>Collaboration/Communication</i></p> <ul style="list-style-type: none"> Product Creation: Effectively use a medium to communicate important information. (POG.3.2) 	<p>K1 That models are directly related to how the Periodic Table is displayed.</p> <p>K2 Electrons can display energy changes as movements between energy levels.</p> <p>K3 Electron configurations describe how electrons spaces themselves apart from one another and from the nucleus of an atom.</p> <p>K4 Electron configurations explain the properties of elements.</p> <p>K5 Vocabulary: wave, wavelength, frequency, photon, quantum, atomic emission spectrum, electron configuration, principal energy level, sublevel, orbital, periods, groups, valence electrons, ionization energy, atomic radius, and electronegativity.</p>	<p>S1 Draw a model of a given atom.</p> <p>S2 Describe and calculate wavelength, frequency, and energy of a photon.</p> <p>S3 Describe the energy change that happens during an absorption spectrum.</p> <p>S4 Identify electron configuration of a given element, from its position on the periodic table.</p> <p>S5 Perform calculations of wavelength, frequency, or energy, given any one of the three variables.</p>