# Unit 03: Electronic Structure and Periodicity

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **2-3 Weeks**
Status: **Published**

## Brief Summary of Unit

Students will learn the experimental evidence upon which electron structures are based. The relative energies of different electrons and their spatial locations will be introduced and the relationship of the periodic table to electron configurations will be explored. The quantum mechanical model of the atom will be studied as well as the trends of elemental properties on the periodic table.

Revised June 2022

## Standards

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| 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. |
| 9.4.12.CI.1 | Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a). |
| LA.K-12.NJSLSA.R1 | Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. |
| PS1.A | Structure and Properties of Matter |
| 9.4.12.CT.2 | Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). |
| MA.N-Q.A.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| PS2.B | Types of Interactions |
| MA.N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| LA.K-12.NJSLSA.R8 | Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. |
| 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. |
| LA.K-12.NJSLSA.W1 | Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. |
| LA.K-12.NJSLSA.W4 | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| LA.K-12.NJSLSA.W6 | Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. |
| LA.K-12.NJSLSA.W8 | Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism. |

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| HS-PS4-1 | Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. |
| PS4.A | Wave Properties |
| HS-LS2 | Ecosystems: Interactions, Energy, and Dynamics |

## Essential Questions

**Essential Questions**

What is the significance of wave or quantum mechanics in describing the modern view of atomic structure?

How does electronic structure govern the properties of an element?

How can the position of elements on the Periodic Table be used to predict how they form compounds with other elements?

**Enduring Understandings**

The quantum model is used to determine an element's electronic structure.

Trends in atomic radii, ionic radii, charge, metallic character, ionization energy, and electronegativity can be predicted based on location of an element on the Periodic Table.

## Students Will Know/Students Will be Skilled At

Students will know that light is a form of electromagnetic radiation and, therefore, has the properties of wavelength, frequency, and energy.

Students will know the different types and applications of the different types of radiation that make up the electromagnetic spectrum.

Students will know how wavelength, frequency and energy are related.

Students will be skilled at solving calculations involving light.

Students will know how an atomic spectrum is produced and what is its significance.

Students will know the limitations of the Bohr model.

Students will know how the Quantum model of the atom was based on Heisenberg’s uncertainty principle and Schrodinger’s equation.

Students will be skilled at writing electron configuration, noble gas configurations, and orbital notations for atoms and ions utilizing the 3 rules that govern them: Pauli Exclusion Principle, Hund’s Rule, and Aufbau Principle.

Students will know the exceptions to the Aufbau rule with some transition metals.

Students will know quantum numbers, their meaning and values, and their dependence on each other.

Students will be skilled at identifying an element or its position on the periodic table based on its electronic structure.

Students will know how to predict the trends in atomic radii, ionic radii, charge, metallic character, ionization energy, and electronegativity based on an element's location on the Periodic Table.

## Learning Plan

Preview the essential questions and connect them to learning throughout the unit.

Discuss the dual wave-particle nature of light including experimental evidence.

Introduce the relationships among the frequency, wavelength, and energy and model how to solve problems utilizing these relationships.

Discuss the electromagnetic spectrum and its applications.

Use spectroscopes to view line emission spectra of certain elements and discuss their significance.

Compare and contrast the Bohr model with the quantum model of the atom.

Demonstrate how to write electron configurations, noble gas configurations, orbital notation, and quantum numbers utilizing the 3 rules that govern them.

Present lesson on historical development, features, and current relevance of the periodic table.

Define the period law and how it can be used to determine the properties of elements.

Discuss the trends of atomic radii, ionic radii, metallic character, ionization energy, and electronegativity.

Unit Test

Labs/Activities:

Graphing periodic trends inquiry activity

Which metal is more reactive inquiry lab?

Line Emission Spectra (in-class activity with spectroscopes or Phet simulation)

Flame tests (in class and virtual option)

## Evidence/Performance Tasks

**Formative**

Completed worksheets on light calculations and electronic structure.

Identifying elements based on properties and/or electronic structure.

Analysis questions for line emission spectra

Assigned homework problems in CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013.

**Summative**

Unit Quizzes and Test

**Benchmark**

Midterm Exam

**Alternative**

CER on Which is more reactive Lab

Lab report on Flame Tests Lab

## Materials

CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Approved Textbook Link

In addition to general lab and safety equipment as noted in lab handouts:

spectroscope

spectral tubes and related equipment

bunsen burner

lithium chloride

calcium chloride

sodium chloride

potassium chloride

strontium chloride

copper (II) chloride

laptop

## Suggested Strategies for Modifications

**FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS**

**https://docs.google.com/spreadsheets/d/1pQwsQoD_QLot65BTdHFEHN5dXIiqS54iQ5iDL8C4q6o/edit?usp=sharing**