

# Unit 3: Atomic Structure, Periodic Table, Chemical Interactions

Content Area: **Science**  
Course(s):  
Time Period: **Marking Period 3**  
Length: **45 days**  
Status: **Published**

## Summary

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**Introduction:** In this unit, students will work to discover the connection between atomic structure, the Periodic Table, and chemical interactions while utilizing the scientific method and problem solving. Students will research current atomic theory and the history and use of the Periodic table to predict chemical interactions. Students will explore laboratory fundamentals while highlighting the concept of electron configuration as it relates to the set up of the Periodic Table. This will be used to determine atomic reactivity in chemical interactions. Students will gain experience in communicating results, scientific writing, and data representation and analysis through a unit project.

**Revision Date:** July, 2020

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| CS.6-8.8.1.8.DA.5 | Test, analyze, and refine computational models.  |
| CS.6-8.8.1.8.DA.6 | Analyze climate change computational models and propose refinements.   |
| CS.6-8.DA         | Data & Analysis  |
| CS.K-12.1         | Fostering an Inclusive Computing and Design Culture  |
| CS.K-12.2         | Collaborating Around Computing and Design  |
| CS.K-12.2.a       | Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.                                     |
| CS.K-12.2.b       | Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.   |
| CS.K-12.2.c       | Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.                                |
| CS.K-12.3         | Recognizing and Defining Computational Problems  |
| CS.K-12.3.a       | Identify complex, interdisciplinary, real-world problems that can be solved computationally.   |
| CS.K-12.3.b       | Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.                        |
| CS.K-12.7         | Communicating About Computing and Design   |
| LA.W.8.1          | Write arguments to support claims with clear reasons and relevant evidence.  |
| LA.W.8.1.A        | Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. |
| LA.W.8.1.C        | Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.           |
| LA.W.8.1.D        | Establish and maintain a formal style.   |

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| LA.W.8.1.E  | Provide a concluding statement or section that follows from and supports the argument presented.  |
| LA.W.8.2.B  | Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.   |
| LA.W.8.2.C  | Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.   |
| LA.W.8.2.D  | Use precise language and domain-specific vocabulary to inform about or explain the topic.   |
| LA.W.8.2.E  | Establish and maintain a formal style/academic style, approach, and form.   |
| LA.W.8.2.F  | Provide a concluding statement or section that follows from and supports the information or explanation presented.  |
| LA.W.8.4    | Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)  |
| LA.W.8.7    | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.   |
| LA.RL.8.7   | Evaluate the choices made by the directors or actors by analyzing the extent to which a filmed or live production of a story or drama stays faithful to or departs from the text or script.   |
| MA.8.F.A.1  | Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.  |
| MA.8.F.A.2  | Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).   |
| MA.8.F.A.3  | Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.  |
| MA.8.F.B    | Use functions to model relationships between quantities.  |
| MA.8.F.B.4  | Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two $(x, y)$ values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. |
| MA.8.F.B.5  | Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.   |
| MA.8.G.A    | Understand congruence and similarity using physical models, transparencies, or geometry software.   |
| MA.8.G.A.1  | Verify experimentally the properties of rotations, reflections, and translations:   |
| MA.8.EE.A.1 | Know and apply the properties of integer exponents to generate equivalent numerical expressions.  |
| MA.8.EE.A.2 | Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$ , where $p$ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.  |
| MA.8.EE.A.4 | Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.                                |

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| MA.8.EE.B       | Understand the connections between proportional relationships, lines, and linear equations.  |
| MA.8.EE.B.5     | Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.  |
| MA.8.EE.C.7     | Solve linear equations in one variable.  |
| MA.8.SP.A       | Investigate patterns of association in bivariate data.   |
| MA.8.SP.A.1     | Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.   |
| MA.8.SP.A.2     | Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.  |
| MA.8.SP.A.4     | Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.  |
| MA.K-12.1       | Make sense of problems and persevere in solving them.  |
| MA.K-12.5       | Use appropriate tools strategically.   |
| CRP.K-12.CRP2   | Apply appropriate academic and technical skills.   |
| CRP.K-12.CRP2.1 | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.  |
| CRP.K-12.CRP4   | Communicate clearly and effectively and with reason.   |
| CRP.K-12.CRP5   | Consider the environmental, social and economic impacts of decisions.  |
| CRP.K-12.CRP5.1 | Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.   |
| CRP.K-12.CRP6   | Demonstrate creativity and innovation.   |
| CRP.K-12.CRP6.1 | Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization. |
| CRP.K-12.CRP7   | Employ valid and reliable research strategies.   |
| CRP.K-12.CRP8   | Utilize critical thinking to make sense of problems and persevere in solving them.   |
| CRP.K-12.CRP9   | Model integrity, ethical leadership and effective management.  |
| SCI.MS.PS1.A    | Structure and Properties of Matter   |
| SCI.MS-ETS1-1   | Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.   |

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| SCI.MS-ETS1      | Engineering Design   |
| SCI.MS-PS3-5     | Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.   |
| SCI.MS-PS3-4     | Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.             |
| SCI.MS-PS3       | Energy   |
| SCI.MS-PS4-1     | Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.  |
| SCI.MS-PS2-3     | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.  |
| SCI.MS-PS2-5     | Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.  |
| SCI.MS-PS1-3     | Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.  |
| SCI.MS-PS1       | Matter and its Interactions  |
| SCI.MS-PS2-4     | Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.  |
| SCI.MS-PS1-1     | Develop models to describe the atomic composition of simple molecules and extended structures.   |
| SCI.MS-PS3-3     | Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.  |
| SCI.MS-PS1-2     | Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.  |
| SCI.MS-PS1-4     | Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.  |
| SCI.MS-PS1-6     | Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.   |
| WRK.9.2.8.CAP    | Career Awareness and Planning  |
| CAEP.9.2.8.B.3   | Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.   |
| TECH.8.1.8.A.3   | Use and/or develop a simulation that provides an environment to solve a real world problem or theory.  |
| TECH.8.1.8.A.4   | Graph and calculate data within a spreadsheet and present a summary of the results.  |
| TECH.8.1.8.C.CS1 | Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.  |
| TECH.8.1.8.D.2   | Demonstrate the application of appropriate citations to digital content.   |
| TECH.8.1.8.D.4   | Assess the credibility and accuracy of digital content.  |
| TECH.8.1.8.E.CS2 | Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  |
| TECH.8.1.8.E.CS3 | Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.   |
| TECH.8.1.8.F     | Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. |

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| TECH.8.1.8.F.CS1 | Identify and define authentic problems and significant questions for investigation.   |
| TECH.8.1.8.F.CS3 | Collect and analyze data to identify solutions and/or make informed decisions.  |
| TECH.8.2.8.C.1   | Explain how different teams/groups can contribute to the overall design of a product.   |
| TECH.8.2.8.C.3   | Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.   |
| TECH.8.2.8.D.CS1 | Apply the design process.   |
| TECH.9.4.12.CI   | Creativity and Innovation   |
| TECH.9.4.12.CT   | Critical Thinking and Problem-solving   |
| TECH.9.4.12.TL   | Technology Literacy   |
| TECH.9.4.12.IML  | Information and Media Literacy  |
|                  | Innovative ideas or innovation can lead to career opportunities.  |
|                  | Data is represented in many formats. Software tools translate the low-level representation of bits into a form understandable by individuals. Data is organized and accessible based on the application used to store it. |

## **Essential Questions/Enduring Understandings**

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### **Essential Questions**

How do scientists communicate?

Why study atoms?

Why is the Periodic Table useful?

### **Enduring Understanding**

Understand how to carry out proper lab safety techniques, create a testable hypothesis and utilize the scientific method.

Understand the relationship between atomic structure, chemical properties, and chemical behaviors.

## **Objectives**

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Students will be skilled at distinguishing between properties and changes, both physical and chemical.

Students will be skilled at explaining how mass is conserved during physical and chemical changes.

Students will be skilled at assembling the structure of the atom using average atomic mass and atomic number to develop a model for an atom with an accurate number of protons, neutrons, and electrons.

Students will be skilled at using the periodic table to classify and predict the characteristics of an element.

Students will be skilled at explaining how atoms combine to form compounds and molecules that are chemically stable.

Students will be skilled at distinguishing between ionic and covalent bonds.

Students will be skilled at writing and naming chemical compounds.

## Learning Plan

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Discuss periodic table of the elements, its history and its uses.

Color code a periodic table to become familiar with similarities in structure and properties.

Practice reading the periodic table to determine the number of protons, neutrons and electrons in a given element.

Discuss Bohr diagrams.

Distinguish between elements and compounds.

Discuss counting the number of elements in a given compound. Discuss rules involving coefficients, subscripts and parentheses.

Introduce the relationship between mass, volume and density.

Introduce Archimedes Principle and buoyant forces.

Introduce molecular attraction, adhesion, cohesion capillary action and surface tension.

Properties of Water Lab

Create a graphic organizer to define and discuss homogeneous and heterogeneous substances, pure substances and mixtures, colloids and suspensions, solutes and solvents and elements and compounds.

Define and discuss solutions, solvents and solvents. Compare and contrast unsaturated, saturated and supersaturated solutions.

Introduce the Lewis dot structure for drawing elements and the Octet rule.

Discuss how to write and name the chemical formulas for molecular compounds.

Discuss how to use oxidation numbers to find subscripts for these compounds.

Un-Mix a Mixture Activity. Students hypothesize and test their ability to accurately separate a beaker of mixed sand, salt and iron filings.

## Assessment

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Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

### Formative Assessments:

Worksheets

Exit Tickets

Class Discussion

*Quizzes*

### *Some Suggested Options:*

*Parts of an Atom*

*Functions of Subatomic Particles*

*How to use a Periodic Table*

*Number of Atoms in a Molecule*

*Number of Electrons per Energy Level*

*Number of Valence Electrons*

*Drawing Lewis Dot and Bohr Diagrams*

**Bench Marks:**

*Formal Lab Reports/Lab Write-ups*

Lab Work

***Some Suggested Options:***

Properties of Metals

Flame Color/ Firework Test

Do Oil and Water Mix?

Mg in HCl

Speedy Solution

Laboratory Techniques

**Summative:**

*Quizzes*

***Some Suggested Options:***

*Parts of an Atom*

*Functions of Subatomic Particles*

*How to use a Periodic Table*

*Number of Atoms in a Molecule*

*Number of Electrons per Energy Level*

*Number of Valence Electrons*

*Drawing Lewis Dot and Bohr Diagrams*

## *Unit Tests*

Atomic Structure

Periodic Table

Chemical Interactions

## ***Alternative:***

*Long-Term Projects*

*Adopt an Element*

*Elemental Superheros*

*Laboratory Practical*

## **Materials**

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General lab equipment

General lab kits

General classroom supplies

Safety Equipment

Science Textbook

Physical Science McGraw Hill

Science Explorer Modules Physical Science Prentice Hall

Computer(s)

Smartboard

Access to Internet

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

Various Lab Chemicals



Pennies

Periodic Table

pH paper

Antacid