# Unit #2: Physical Science 8- Chemical Interactions

Content Area: **Science**
Course(s): **Science 8**
Time Period: **Second Marking period**
Length: **January through March**
Status: **Published**

## Unit Overview

Science is central to the lives of all Americans. Our science education program must prepare our students to be informed citizens and knowledgeable consumers. If the nation is to compete and lead in the global economy and if American students are to be able to pursue expanding employment opportunities in science-related fields, all students in Linden must have a solid K–12 science education that prepares them for college and careers.

The latest standards are based on learning progressions that provide students with opportunities to investigate core ideas in science in increasingly complex ways over time. The target goals for the curriculum are to help students know and use scientific explanations of the natural world and the designed world; to understand the nature and development of scientific knowledge and technological capabilities; and to participate productively in scientific and engineering practices.

**Goals** The focus of the module is the physical and chemical properties that characterize matter and energy. Students examine several characteristic properties and investigate how these properties relate to pure substances and mixtures. They engage in a series of inquiries carefully designed to develop their understanding of the properties of matter, energy transfer and chemical reactions.

## STAGE 1- DESIRED RESULTS

## 2020 New Jersey Student Learning Standards- Science

## Physical Science

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| 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. |
| SCI.MS-PS1-3 | Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. |
| SCI.MS-PS1-2 | Analyze and interpret data on the properties of substances before and after the |

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| | substances interact to determine if a chemical reaction has occurred. |
| 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-PS1-5 | Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. |
| SCI.MS-PS3-3 | Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. |
| 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-PS1-1 | Develop models to describe the atomic composition of simple molecules and extended structures. |

## Engineering, Technology, and Applications of Science

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| SCI.MS-ETS1-3 | Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. |
| 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. |
| SCI.MS-ETS1-4 | Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. |
| SCI.MS-ETS1-2 | Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. |

## Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

## Cross Cutting Concepts

- Cause and Effect
- Energy and Matter

- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

## Disciplinary Core Ideas

## Physical Sciences

- PS1A: Structure and Properties of Matter
- PS1B: Chemical Reactions
- PS3A: Definitions of Energy
- PS3B: Conservation of Energy and Energy Transfer

## Earth and Space Sciences

- ESS3C: Human Impacts on Earth Systems

## Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution
- ETS2: Links among Engineering, Technology, Science and Society

## Essential Questions

### Investigation 1: Substances

Part 1: How can we find out what two substances are in the mystery mixture?

Part 2: How can we find out what two substances are in the mystery mixture?

### Investigation 2: Elements

Part 1: What is the periodic table of the elements?

Part 2: What makes up all the substances on Earth?

**Investigation 3: Particles**

Part 1: How can the gas produced in a chemical reaction be studied?

Part 2: Is air matter? Does air have mass and take up space?

Part 3: What is the relationship between particles in matter?

**Investigation 4: Kinetic Energy**

Part 1: What happens to particles in a sample of air when the air is heated and cooled?

Part 2: What happens to particles in a sample of liquid when the liquid is heated and cooled?

Part 3: What happens to particles in a sample of solid when the solid is heated and cooled?

**Investigation 5: Energy Transfer**

Part 1: If two equal volumes of hot and cold water are mixed, what will the final temperature be?

Part 2: How does energy transfer from one substance to another?

Part 3: How is heat measured?

**Investigation 6: Thermo Engineering**

Part 1: How can you reduce energy transfer to or from a sample of water?

Part 2: What is the the best thermos design?

**Investigation 7: Solutions**

Part 1: What is the difference between dissolving and melting?

Part 2: Do all substances form solutions in water?

**Investigation 8: Phase Change**

Part 1: What happens at the particle level when a substance melts?

Part 2: What is the relationship between melting and freezing?

Part 3: How can you freeze water in the classroom?

Part 4: What are all the ways that a substance can change state?

**Investigation 9: Reaction**

Part 1: How do atoms combine to make new substances?

Part 2: What happens at particle level during a chemical reaction?

Part 3: What is the chemical reaction between hydrochloric acid and sodium bicarbonate?

**Investigation 10: Limiting Factors**

Part 1: What is a limiting factor in a chemical reaction?

Part 2: What have I learned about chemical interactions?

## Enduring Understanding

This unit is the systematic unveiling of the nature of matter—its properties, composition, and structure—and the energy dynamics that accompany matter transformations. Chemistry is also the intellectual process of uncovering the nature of matter and energy that contributes to the ever-expanding body of chemical knowledge.

## Students will know…

**Investigation 1: Substances** chemical formula, chemical name, chemical reaction, common name, matter, substance

**Investigation 2: Elements** Element, periodic table of the elements, symbol

**Investigation 3: Particles** Compress, compression, expand, expansion, gas, liquid, particle, solid

**Investigation 4: Kinetic Energy** Contract, contraction, kinetic energy, temperature, thermometer

**Investigation 5: Energy Transfer** Calorie, conduction, conservation of energy, cooling, energy transfer, equilibrium, heating

**Investigation 6: Thermos Engineering** Constraint, criterion, engineering problem, insulation

**Investigation 7: Solutions** Dissolve, melt, mixture, solubility, solute, solution, solvent

**Investigation 8: Phase Change** Condensation, deposition, evaporation, freeze, freezing point, melting point, phase change, state of matter, sublimation

**Investigation 9: Reaction** Atom, bond, burning, compound, conservation of matter, crystal, ionic compound, molecule, precipitate, product, reactant

**Investigation 10: Limiting Factors** Concentration, limiting factor

**Science Resource Vocabulary**

**Investigation 2: Elements** Atmosphere, carbohydrate, carbon dioxide, chemical property, core, crust, dissolve, element, fundamental gas, lipid, liquid, mantle, mass, matter, metal, nitrogen, noble gas, particle, periodic table of the elements, phase, physical property, potash, predict, protein, radiation, radioactivity, solution, substance

**Investigation 3: Particles** Bond, chemical formula, compressed, force, gaseous, solid, volume

**Investigation 4: Kinetic Energy** Contraction, density, engineer, expansion, kinetic energy, mixture, room temperature, vibrating, water vapor

**Investigation 5: Energy Transfer** Conduction, conserved, energy transfer, equilibrium

**Investigation 6: Thermos Engineering** Constraint, criterion, insulation, vacuum

**Investigation 7: Solutions** Bioaccumulation, blood plasma, climate change, concentrated, concentration, dilute, extinct herbicide, insoluble, melt, ratio, soluble, solute, solvent, transparent

**Investigation 8: Phase Change** Calorie, condensation, deposit, dry ice, evaporation, freeze, heat of fusion, lava, sublimation

**Investigation 9: Reaction** Alchemy, atom, chemical equation, chemical reaction, combustion compound, crude oil, exothermic reaction, hydrocarbon, molecule, octane, organic compound, oxidizer, petroleum, precipitate, product, pyrotechnics, reactant, synthetic

**Investigation 10: Limiting Factors** atomic number, cyclotron, electron, nucleus, proton, scanning tunneling microscope, well-ordered array

Misconceptions

- mass is affected by change in shape
- density and weight are the same
- mass and weight are the same
- mass and volume are both used to measure quantities and the terms can be interchanged
- mass determines floating and sinking
- interchange the terms heat and temperature
- reactions disappear with a new substance
- loss of mass occurs when matter changes state
- classify phase change as a chemical reaction
- melting and dissolving are the same thing
- relate the term pure to clean or clear
- solutes disappear when added to water
- the addition of a solute does not add any volume to the solution
- all liquids contain water
- elements are the only pure substances
- all metals are magnetic and solid
- all chemical reactions are associated with a release of heat
- matter can disappear during a chemical reaction
- expansion of matter is due to the experience of the particles rather than increased space between the

particles.

## Students will be able to…

- Mix substances with water in an effort to determine the identify of an unknown mixture of substances
- Analyze and interpret data on the properties of substances before and after a chemical reaction
- Explain that as a result of a reaction initial substances change into new, different substances
- Explain how to identify the two substances in a mystery mixture
- Use graphical displays of information in the periodic table to analyze substances in terms of their elemental composition
- Explain that all common matter is made of elements
- Consider the composition of natural resources and synthetic materials
- Carry out an investigation to determine the volume of gas produced in a chemical reaction
- Plan experimentation to observe the effects of pressure on gases
- Develop a model of gas as individual particles in constant motion
- Apply the gas model to explain compression and expansion
- Carry out an investigation heating and cooling gas, liquid, and solid matter to observe expansion and contraction
- Develop a model of kinetic energy at the particle level
- Construct an explanation of how a thermometer works
- Plan an investigation to mix hot and cold water to observe energy transfer
- Explain energy transfer in terms of the change of particle kinetic energy resulting from conduction
- Calculate and discuss energy transfer in calories
- Analyze data to develop ideas about conservation of energy
- Apply principle of energy transfer and conduction to design, construct, and test a device that minimizes thermal-energy transfer
- Collect energy-transfer data over multiple trials and multiple design iterations
- Analyze data from tests of design solutions to identify characteristics that can be combined to satisfy the criteria for success
- Carry out an investigation to determine that some solids dissolve and others don’t
- Develop a particle model to explain the process of dissolving
- Design methods to separate aqueous solutions
- Engage in argumentation from evidence to distinguish between dissolving and melting
- Carry out investigations to transfer heat to ad from substances to observe phase change
- Develop a model of state in terms of the relationship of particles to one another in a substance
- Communicate information about phase change in terms of kinetic energy and energy transfer
- Undertake a design project to construct, test, and modify a device that absorbs thermal energy by chemical processes.
- Use chemical formulas and atom tiles to show that the total number of atoms does not change in a chemical reaction and thus that mass is conserved
- Use limewater to collect evidence that carbon dioxide is produced when hydrochloric acid and sodium bicarbonate react
- Develop an explanation of a chemical reaction as a process in which atoms rearrange to form new substances
- Collect data by measuring the volume of gas produced in a reaction to develop explanations about the

concentrations of reactants
- Use a model of the concept of limiting factor in chemical reactions
- Reflect on and communicate key points from the entire Chemical Interactions Course

## STAGE 2- EVIDENCE OF LEARNING

### Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions & Answers
- Quiz
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

### Authentic Assessments

- follow lab procedures
- complete assignments

- develop and utilize models
- cooperate in groups and with partners
- complete a written science journal
- maintain class notes and vocabulary in MacBook Airs
- complete data tables
- complete and interpret graphs

## Benchmark Assessments

- Final module exam.
- End of investigation assessments.

## STAGE 3- LEARNING PLAN

## Instructional Map

**Investigation 1: Substances – 5 sessions**

Students observe a mystery-mixture reaction and begin to consider the definition of substance and chemical reaction. They identify the two substances in the mystery mixture by observing the characteristics of the reactions that occur when they mix pairs of known substances.

**Investigation 2: Elements- 4 sessions**

Students learn about the periodic table of elements. They use online resource to consider properties and categories of elements, and to research individual elements. Students read consumer product labels to think about the presence of elements in familiar substances.

**Investigation 3: Particles- 7 sessions**

Students recreate the mystery mixture reaction, using a setup that allows them to capture and study the resulting gas. They learn that the gas is carbon dioxide, which leads them to the study of air. They use syringes to discover that air can be compressed and expanded. Students start to develop a particular model for matter.

**Investigation 4: Kinetic Energy- 6 sessions**

Students observe expansion and contraction of solids, liquids, and gases, and explain the phenomena in terms of kinetic theory-the constant motion of particles.

**Investigation 5: Energy Transfer- 7 sessions**

Students learn one way that energy moves and how to conceptualize energy transfer as changes of the kinetic energy of particles resulting from particle collisions. Students mix equal volumes of hot and cold water and predict the final temperature. They use the result to determine an algorithm for calculating final temperature. Students are introduced to the calorie as a unit of energy transfer.

**Investigation 6: Thermo Engineering- 5 sessions**

Students use their understanding of energy transfer to face an engineering problem: how to build a container that keeps hot liquids hot and cold liquids cold. They test materials for their insulating properties in preparation for the design challenge. They determine criteria and constraints in the engineering design process and test their designs.

**Investigation 7: Solutions- 3 sessions**

Students explore the difference between melting and dissolving. They go on to study dissolving by comparing aqueous mixtures, one with soluble solid and one with an insoluble solid. They compare the two mixtures and then attempt to separate them with filters and evaporation.

**Investigation 8: Phase Change- 7 sessions**

Students experience three common phases of matter- solids, liquid, and gas- and investigate the conditions that induce substances to change from one phase to another. Students engage in an engineering challenge to design a classroom freezer that will freeze water.

**Investigation 9: Reaction- 8 sessions**

Students blow bubbles into limewater, observe the precipitate, and move atom tiles to simulate the rearrangement of atoms to form new substances. Students study another reaction involving hydrochloric acid and baking soda and learn to use models to balance chemical equations.

**Investigation 10: Limiting Factors- 3 sessions**

Students conduct more chemical reactions learning about limiting factors and reactants in excess.

## Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials

- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary

- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials
- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

**504 Plans**

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

## Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

## Differentiation Strategies

## High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

## Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts

- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

## Horizontal Intergration- Interdisciplinary Connections

**Student Learning Standards for Mathematics**

Grade 8

8.EE.B. Understand the connections between proportional relationships.

8.EE.C. Solve real world problems and mathematical problems.

8.F.A. Define, evaluate, and compare functions.

8.F.B Use functions to model relationships between quantities.

**Reading Science and Technical Subjects**

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

RST.6-8.7.Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

RST.6-8.8.Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

**Writing History, Science and Technical Subjects**

WHST.6-8.1. Write arguments focused on *discipline-specific content*.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.

B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

D. Use precise language and domain-specific vocabulary to inform about or explain the topic.

E. Establish and maintain a formal/academic style, approach, and form.

F. Provide a concluding statement or section that follows from and supports the information or explanation presented

WHST.6-8.3(See note; not applicable as a separate requirement)

WHST.6-8.4. Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.

WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. 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.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

WHST.6-8.9. Draw evidence from informational texts to support analysis, reflection, and research.
WHST.6-8.10. Write routinely over extended time frames (time for research, reflection, metacognition/self-correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

**2020 New Jersey Student Learning Standards- Computer Science and Design Thinking**

**Computer Science and Design Thinking Practices**

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| CSDT.K-12.CSDTP1 | Fostering an Inclusive Computing and Design Culture |
| CSDT.K-12.CSDTP2 | Collaborating Around Computing and Design |
| CSDT.K-12.CSDTP3 | Recognizing and Defining Computational Problems |
| CSDT.K-12.CSDTP4 | Developing and Using Abstractions |
| CSDT.K-12.CSDTP5 | Creating Computational Artifacts |
| CSDT.K-12.CSDTP6 | Testing and Refining Computational Artifacts |
| CSDT.K-12.CSDTP7 | Communicating About Computing and Design |

**8.2 Design Thinking**

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| 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.<br>8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.<br>8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).<br>8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.<br>8.2.8.ED.5: Explain the need for optimization in a design process.<br>8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.<br>8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). |
| 8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, |

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| and cultural issues.<br><br>8.2.8.ITH.2: Compare how technologies have influenced society over time.<br><br>8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system.<br><br>8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact.<br><br>8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another. |
| 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.<br>8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function.<br>8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose.<br>8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product. |
| 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs.<br>8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).<br>8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.<br>8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best. |
| 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.<br>8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development. |

## 2020 New Jersey Student Learning Standards- Career Readiness, Life Literacies, and Key Skills

## Career Readiness, Life Literacies, and Key Skills Practices

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| CRP.K-12.CRP1 | Act as responsible and contributing community members and employee. |
| CRP.K-12.CRP2 | Attend to financial well-being. |
| CRP.K-12.CRP3 | Consider the environmental, social and economic impacts of decisions. |

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| CRP.K-12.CRP4 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP5 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP6 | Model integrity, ethical leadership and effective management. |
| CRP.K-12.CRP7 | Plan education and career paths aligned to personal goals. |
| CRP.K-12.CRP8 | Use technology to enhance productivity, increase collaboration and communicate effectively. |
| CRP.K-12.CRP9 | Work productively in teams while using cultural/global competence. |

## 9.2 Career Awareness and Planning

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| 9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.<br><br>9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.<br><br>9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.<br><br>9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement. |
| 9.2.8.CAP.11: Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.<br><br>9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential. |

## 9.4 Life Literacies and Key Skills

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| 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).<br><br>9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).<br><br>9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).<br><br>9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries. |
| 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or |

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| global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (MS-ETS1-2).<br><br>9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).<br><br>9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. |
| 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.<br><br>9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).<br><br>9.4.8.DC.3: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.<br><br>9.4.8.DC.4: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.<br><br>9.4.8.DC.5: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.<br><br>9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation.<br><br>9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.<br><br>9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities). |
| 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).<br><br>9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. |
| 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.<br><br>9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.<br><br>9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).<br><br>9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.<br><br>9.4.8.IML.5: Analyze and interpret local or public data sets to summarize and effectively communicate the data.<br><br>9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.<br><br>9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8).<br><br>9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change |

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| (e.g., 1.1.8.C1b).<br><br>9.4.8.IML.9: Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2).<br><br>9.4.8.IML.10: Examine the consequences of the uses of media (e.g., RI.8.7).<br><br>9.4.8.IML.11: Predict the personal and community impact of online and social media activities.<br><br>9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.<br><br>9.4.8.IML.13: Identify the impact of the creator on the content, production, and delivery of information (e.g., 8.2.8.ED.1).<br><br>9.4.8.IML.14: Analyze the role of media in delivering cultural, political, and other societal messages.<br><br>9.4.8.IML.15: Explain ways that individuals may experience the same media message differently. |
| 9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.<br><br>9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).<br><br>9.4.8.TL.3: Select appropriate tools to organize and present information digitally.<br><br>9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3).<br><br>9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.<br><br>9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem. |

## Vertical Integration- Discipline Mapping

Grade 5: Mixtures and Solutions

Preparation for High School Science Curriculum.

## Additional Materials

Word wall

Video on matter

FOSS Website

Study jam videos (various topics)

student guide and source book

colored pencils for recording

safety procedure poster

periodic table of elements

materials poster

argumentation bulletin board