### SOUTHERN REGIONAL SCHOOL DISTRICT
### SCIENCE CURRICULUM

**Content Area:** Science

<table>
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<tr>
<th>Course Title: Chemistry</th>
<th>Grade Level: 10-12</th>
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<td><strong>Unit Plan 1</strong></td>
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</tr>
</tbody>
</table>

**Date Revised:** June 2022

**Board Approved on:** August 2022
Content Area: Science

Unit Title: Quantitative and Structural Aspects of Matter

Target Course/Grade Level: Chemistry/10-12

Unit Summary:
This unit is designed to give students a clear understanding of how scientific thought and quantitative skills are applied to the classification of matter.

Primary interdisciplinary connections:
Science, Social Studies, Mathematics, Technology, Visual and Performing Arts

Social Studies Standards
Mathematics Standards
Technology Standards
Visual and Performing Art Standards

RST.9-10.4. 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 10-12 texts and topics.

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Technology Connections: Understand and use technology systems, select and use applications effectively and productively, and exhibit digital citizenship by practicing safe, legal, and responsible use of information and technology.

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.1.12.F.1 Critical Thinking, Problem Solving, Decision Making Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

21st Century Themes/Careers:
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately.

Technology connections:
- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.

**Cumulative Progress Indicator (CPI)**

All students understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service.

- Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.
- Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.
- Use atomic models to predict the behaviors of atoms in interactions.

**New Jersey Student Learning Standards**

**Content Standards**

This unit will assimilate the disciplines of the New Jersey Student Learning Standards. This includes the language of chemistry, chemical quantities, and engineering design. Students who demonstrate understanding can:

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<thead>
<tr>
<th>Code</th>
<th>Performance Expectation</th>
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<tbody>
<tr>
<td>HS-ETS1-2</td>
<td>Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</td>
</tr>
<tr>
<td>HS-ETS1-3</td>
<td>Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</td>
</tr>
<tr>
<td>HS-PS1-5</td>
<td>Apply specific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.</td>
</tr>
<tr>
<td>HS-PS1-8</td>
<td>Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.</td>
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</table>


**Unit Essential Questions**

- How is chemistry a quantitative and qualitative study of matter?
- How does studying chemistry affect your life?
- How does studying chemistry help us to mitigate the effects of global challenges such as with climate change?
- Where do elements come from?
- How do the processes of fission and fusion relate to the radioactive decay of unstable nuclei?
- How can choosing the property lab tool affect the accuracy and precision of measurements in a lab setting?

**Disciplinary Core Ideas**

Students will demonstrate understanding of:

**ETS1.A: Defining and Delimiting Engineering Problems**

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)

Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

**ETS1.B: Developing Possible Solutions**
When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)

ETS1.A: Defining and Delimiting Engineering Problems

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them (HS-ETS1-1)

ETS1.C: Optimizing the Design Solution

Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)


Each atom has a charged substructure 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), (secondary to HS-PS2-6)

A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)

In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction

- How can density be used to identify an unknown substance?
- How is matter classified?
- How are atoms differentiated from one another?
**Unit Objectives**

**Students will know...**
- Vocabulary and key terms
- Procedures at the core of scientific methodology
- Laboratory Safety procedures
- Essential laboratory equipment
- The difference between qualitative and quantitative measurements
- How to convert measurements to scientific notation
- Error analysis
- How to classify matter
- How to distinguish between chemical and physical properties
- How to distinguish between chemical and physical changes
- How to use chemical symbols
- The historical development of the atom
- Atomic Structure

**Unit Objectives**

**Students who demonstrate understanding can...**
- Choose appropriate lab tools for the most accurate and precise measurements.
- Practice safe lab habits
- Use the metric system
- Make temperature conversions
- Recognize that density is a physical property and use density to identify unknown substances.
- Solve problems in scientific notation
- Distinguish between accuracy and precision
- Calculate percent error
- Use analytical equipment
- Define the nature of chemistry, matter, and energy
- Classify matter
- Use chemical symbols
- Use the symbols of the elements
- Recognize physical & chemical changes in matter
- Describe an atom and its structure
- Trace the historical development of the atomic model (Dalton, Thomson, Rutherford, and Bohr)
- Know the significance of isotopes
- Discuss climate change

**Summative Assessments**
- Quizzes
- Chapter/Unit Test

**Benchmark Assessments**
- Quarterlies
- SGO’s
- New Jersey Student Learning Assessment for Science (NJSLA-S)
- Final Exam

determines the numbers of all types of molecules present. (HS-PS1-6)
The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

**PS1.C: Nuclear Processes**

Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)
### Alternate Assessments
- Online Programs
- Quizzes

### Modifications
**ELL**
- Vocabulary translation
- Translated Instructional Materials
- ELL after school help
- Alternate assessments
- Extra time
- Coordination with ELL staff

**Special Education**
- Accommodations consistent with IEP
- Provide a calculator
- Extended time
- Guided notes
- Preferential seating
- Chunking material
- Modified assignments

**504**
- Accommodations consistent with 504
- Extended time
- Preferential seating

### At-Risk
- MTSS
- I&R S
- Parent Communication

### Gifted and Talented
- Extended Learning Goals
- Challenge Problems
- Peer Tutoring
- Cooperative Learning Groups

### Curriculum development Resources/Instructional Materials/Equipment Needed Teacher Resources:
- [http://nextgenscience.org/overview-topics](http://nextgenscience.org/overview-topics)
- Textbook
- Laboratory manuals and equipment
- Science Website(s):
  - [https://www.khanacademy.org/](https://www.khanacademy.org/)
  - Kahoot, Quizizz, Quizlet, Edulastic, EdPuzzle, Google Apps for Education

### General Chemistry:
- [http://portal.acs.org/portal/acs/corg/content American Chemical Society](http://portal.acs.org/portal/acs/corg/content)
- [http://www.rsc.org/ royal chemical society](http://www.rsc.org/)
- [http://www.flinnsce.com/ Flinn Scientific](http://www.flinnsce.com/)
Testing:
http://www.ets.org/SAT and ACT
http://apcentral.collegeboard.com/apc/Controller.jsp College Board Periodic Table:
http://www.americanelements.com/Periodic Table
http://periodic.lanl.gov/default.htm Periodic Table
http://www.consol.ca/downloads/Periodic_Table.pdf Periodic Table Educator Websites:
http://www.adriandingleschemistrypages.com/
http://www.chemmybear.com/
http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/stoichiometry/acid_base.html
Titration Simulations
http://antoine.frostburg.edu/chem/senese/101/index.shtml General Chemistry
https://phet.colorado.edu/en/simulations/category/new General Chemistry
**Content Area:** Science  

**Unit Title:** The Language of Chemistry and Chemical Quantities  

**Target Course/Grade Level:** Chemistry/10-12  

**Unit Summary**  
This unit is designed to give students a clear understanding of how chemicals interact and rearrange during chemical reactions and how matter is conserved during this process.

**Primary interdisciplinary connections:**  
Science, Social Studies, Mathematics, Technology, Visual and Performing Arts  

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**Technology Connections:** Understand and use technology systems, select and use applications effectively and productively, and exhibit digital citizenship by practicing safe, legal, and responsible use of information and technology.

- **8.2.12.E.1** Demonstrate an understanding of the problem-solving capacity of computers in our world.
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- **9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice.
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**Technology connections:**

- **8.1.12.DA.1:** Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
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support different interpretations of real-world phenomena.

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### Cumulative Progress Indicator (CPI)

All students understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service.

Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.

Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.

Use atomic models to predict the behaviors of atoms in interactions.

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<td>HS-PS1-1</td>
<td>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.</td>
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<td>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.</td>
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<td>HS-PS1-4</td>
<td>Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy</td>
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<td>HS-PS1-5</td>
<td>Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.</td>
</tr>
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<td>HS-PS1-7</td>
<td>Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.</td>
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## Unit Essential Questions

- How do chemists use symbols to convey chemical reactions?
- How does the language of chemistry demonstrate systems, interactions, and patterns of change?
- What affects the patterns of change?
- How is the mole concept the foundation of chemistry?
- How can we determine both qualitative and quantitative changes in the interaction of systems?
- How does the number of valence electrons determine reactivity and proclivity to bond?
- How is the arrangement of the periodic table orchestrated?

## Disciplinary Core Ideas

**Students who demonstrate understanding of:**

**ETS1.B: Developing Possible Solutions**

When evaluating solutions, it is important to consider a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)

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The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3), (secondary to HS-PS2-6)

The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)
### Unit Objectives

**Students will know…**
- Vocabulary and key terms
- Procedures at the core of scientific methodology
- Laboratory Safety procedures
- Essential laboratory equipment
- Groups, periods and families in the Periodic table
- The law of conservation of matter and energy
- Chemical nomenclature
- Types of chemical reactions
- Predicting products and balancing reactions.
- Calculating percent composition, percent yield and percent error

**Students who demonstrate understanding can…**
- Organization of the periodic table
- Identify ionic and molecular compounds
- Write formulas for ionic and molecular compounds
- Calculate percent composition
- Determine empirical and molecular formulas
- Write a skeleton equation from a word equation
- Write a balanced equation
- Classify reaction types
- Solve % yield problems
- Environmental chemical reactions affecting climate change.

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**SOUTHERN REGIONAL SCHOOL DISTRICT**

**Evidence of Learning**

**Formative Assessments**
- Observation
- Homework
- Class participation
- Do Now
- Laboratory Activities/Lab Reports

**Summative Assessments**
- Quizzes
- Chapter/Unit Test

**Benchmark Assessments**
- Quarterlies
- SGO’s
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- Quizzes
Modifications
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- Science Website(s):
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  - Kahoot, Quizizz, Quizlet, Edulastic, EdPuzzle, Google Apps for Education

General Chemistry:
- http://portal.acs.org/portal/acs/corg/content American Chemical Society
- http://www.rsc.org/ royal chemical society
- http://www.flinnsci.com/ Flinn Scientific
- http://www.bozemanscience.com
- https://www.youtube.com/channel/UCuS6lUis8mITtAZnUytyu77Kg
- https://go.discovery.com/show/mythbusters-discovery
- https://phet.colorado.edu/
Testing:
http://www.ets.org/ SAT and ACT
http://apcentral.collegeboard.com/apc/Controller.jpf College Board Periodic Table:
http://www.americanelements.com/ Periodic Table
http://periodic.lanl.gov/default.htm Periodic Table
http://www.consol.ca/downloads/Periodic_Table.pdf Periodic Table Educator Websites:
http://www.adriandinglechemistrypages.com/
http://www.chemmybear.com/
http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/stoichiometry/acid_base.html

Titration Simulations
http://antoine.frostburg.edu/chem/senese/101/index.shtml General Chemistry
https://phet.colorado.edu/en/simulations/category/new General Chemistry
Content Area: Science

Unit Title: Chemical Periodicity and Bonding

Target Course/Grade Level: Chemistry/10-12

Unit Summary:

This unit is designed to give students a clear understanding of the patterns that exist among the various forms of matter and those factors that affect the stability of matter.

Primary interdisciplinary connections:

Science, Social Studies, Mathematics, Technology, Visual and Performing Arts

Social Studies Standards
Mathematics Standards
Technology Standards
Visual and Performing Art Standards

21st Century Themes/Careers:

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<td>Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.</td>
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<td>HS-PS1-2</td>
<td>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.</td>
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<tr>
<td>HS-PS1-3</td>
<td>Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.</td>
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<td>HS-PS1-4</td>
<td>Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.</td>
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**CONTENT STANDARDS LINK:** [nj.gov/education/cccc/2020/NJSLS-Science.pdf](nj.gov/education/cccc/2020/NJSLS-Science.pdf)

### Unit Essential Questions

- What patterns exist among the various forms of matter?
- What predictions about matter can be made from the periodic table?
- What affects the stability of matter?

### Disciplinary Core Ideas

*Students who demonstrate understanding of:*

**ETS1.B: Developing Possible Solutions**
Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)

**PS1.A: Structure and Properties of Matter**
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The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),(secondary to HS-PS2-6)
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Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

**PS2.B: Types of Interactions**
Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary to HS-PS1-1), (secondary to HS-PS1-3)

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<td>Write electron configurations for atoms and ions</td>
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<td>Use the periodic table to determine electron configuration</td>
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<td>Predict chemical and physical properties from the periodic table</td>
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<td>Determine valence electrons and predict types of bonding</td>
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<td>Explain intermolecular attractions and how their strength determines physical properties</td>
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- Accommodations consistent with IEP
- Provide a calculator
- Extended time
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- Laboratory manuals and equipment
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  - Kahoot, Quizizz, Quizlet, Edulastic, EdPuzzle, Google Apps for Education

## General Chemistry:
- [http://portal.acs.org/portal/acs/corg/content American Chemical Society](http://portal.acs.org/portal/acs/corg/content)
- [http://www.rsc.org/ royal chemical society](http://www.rsc.org/)
- [http://www.flinnsci.com/ Flinn Scientific](http://www.flinnsci.com/)
- [http://www.bozemanscience.com](http://www.bozemanscience.com)
- [https://www.youtube.com/channel/UCuS6lUi8mITtAZnUytu77Kg](https://www.youtube.com/channel/UCuS6lUi8mITtAZnUytu77Kg)
- [https://go.discovery.com/show/mythbusters-discovery](https://go.discovery.com/show/mythbusters-discovery)
- [https://phet.colorado.edu/](https://phet.colorado.edu/)
- [https://breakoutedu.com/](https://breakoutedu.com/)
- [https://www.acs.org/content/acs/en.html](https://www.acs.org/content/acs/en.html)
- [https://ptable.com/#Properties](https://ptable.com/#Properties)
- [https://www.compoundchem.com/](https://www.compoundchem.com/)
- [https://sciencespot.net/](https://sciencespot.net/)

## Testing:
- [http://www.ets.org/ SAT and ACT](http://www.ets.org/)

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http://apcentral.collegeboard.com/apc/Controller.jpf College Board Periodic Table:
http://www.americanelements.com/ Periodic Table
http://periodic.lanl.gov/default.htm Periodic Table
http://www.consol.ca/downloads/Periodic_Table.pdf Periodic Table Educator Websites:
http://www.adriandingleschemistrypages.com/
http://www.chemmybear.com/
http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/stoichiometry/acid_base.html

Titration Simulations
http://antoine.frostburg.edu/chem/senese/101/index.shtml General Chemistry
https://phet.colorado.edu/en/simulations/category/new General Chemistry
Content Area: Science

Unit Title: Topic: States of Matter

Target Course/Grade Level: Chemistry/10-12

Unit Summary:

This unit is designed to give students a clear understanding of how matter and energy drive the universe and how energy causes changes in matter.

Primary interdisciplinary connections:


RST.9-10.4. 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 10-12 texts and topics.

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

21st Century Themes/Careers:

- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately.

Technology connections:

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment

Cumulative Progress Indicator (CPI)

All students understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service
Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.

Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.

Use atomic models to predict the behaviors of atoms in interactions.

**New Jersey Student Learning Standards**

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<td>HS-PS3-4</td>
<td>Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).</td>
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<td>HS-ETS1-4</td>
<td>Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria.</td>
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**Unit Essential Questions**

- How do matter and energy drive the universe?
- How does the kinetic theory describe the relationship between the energy of particles in matter and its temperature?
- How does energy cause (or result from) changes in matter?
- How do the parameters of state determine the nature of matter?
- How do intermolecular attractions determine states of matter?

**Disciplinary Core Ideas**

Students will demonstrate understanding of:

**PS1.A: Structure and Properties of Matter**

The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HSPS1-3), (secondary to HS-PS2-6)

**PS2.B: Types of Interactions**

Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary to HS-PS1-1), (secondary to HS-PS1-3), (HS-PS2-6)

**PS3.A: Definitions of Energy**

Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is since a system’s total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HSPS3-1), (HSPS3-2)

At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3)

These relationships are better understood at the microscopic scale, at which all of the different
manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases, the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)

**PS3.B: Conservation of Energy and Energy Transfer**
Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4)

**PS3.D: Energy in Chemical Processes**
Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3), (HS-PS3-4)

**ETS1.B: Developing Possible Solutions**
Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)

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<td>• Laboratory Safety procedures</td>
<td>• Explain phase changes</td>
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<td>• Essential laboratory equipment</td>
<td>• Distinguish between various forms of energy</td>
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<td>• The postulates of the kinetic theory</td>
<td>• Evaluate data using gas law equations</td>
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<td>• Units of temperature, volume, and pressure</td>
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<td>• How the parameters of state (pressure, temperature, volume and moles) affect matter</td>
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General Chemistry:

- http://portal.acs.org/portal/acs/corg/content American Chemical Society
- http://www.rsc.org/ royal chemical society
- http://www.flinnsci.com/ Flinn Scientific
- http://www.bozemanscience.com
- https://www.youtube.com/channel/UCuS6lUii8mITtAZnUyYu77Kg
- https://go.discovery.com/show/mythbusters-discovery
- https://phet.colorado.edu/
- https://breakoutedu.com/
- https://www.acs.org/content/acs/en.html
- https://ptable.com/#Properties
- https://www.compoundchem.com/
- https://sciencespot.net/

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- http://www.americanelements.com/ Periodic Table
- http://periodic.lanl.gov/default.htm Periodic Table
- http://www.consol.ca/downloads/Periodic_Table.pdf Periodic Table
- Educator Websites:
  - http://www.adriandingleschemistrypages.com/
  - http://www.chemmybear.com/

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### Unit Overview

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<td>Unit Title: Aqueous Solutions</td>
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<td>Target Course/Grade Level: Chemistry/10-12</td>
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<td>Unit Summary:</td>
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This unit is designed to give students a clear understanding of the chemistry of aqueous solutions.

**Primary interdisciplinary connections:**

Science, Social Studies, Mathematics, Technology,
Visual and Performing Arts,
Social Studies Standards
Mathematics Standards
Technology Standards
Visual and Performing Art Standards

**RST.9-10.4.** 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 10-12 texts and topics.

**RST.9-10.5.** Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

**RST.9-10.7.** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

**Technology Connections:** Understand and use technology systems, select and use applications effectively and productively, and exhibit digital citizenship by practicing safe, legal, and responsible use of information and technology.

- **8.2.12.E.1** Demonstrate an understanding of the problem-solving capacity of computers in our world.
- **8.1.12.F.1** Critical Thinking, Problem Solving, Decision Making Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

**21st Century Themes/Careers:**

- **9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice.
- **9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
- **9.4.12.IML.2:** Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
- **9.4.12.IML.5:** Evaluate, synthesize, and apply information on climate change from various sources appropriately.
Technology connections:
- **8.1.12.DA.1**: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- **8.1.12.DA.5**: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- **8.2.12.ETW.2**: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.

Students will also be exposed to Career Ready Practices which describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success.

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence

### New Jersey Student Learning Standards

#### Content Standards

This unit will assimilate the disciplines of the New Jersey Student Learning Standards. This includes the language of chemistry, chemical quantities, and engineering design. Students who demonstrate understanding can:

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<td>Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.</td>
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<td>HS-PS1-1.</td>
<td>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.</td>
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<td>Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).</td>
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<td>HS-PS3-5.</td>
<td>Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.</td>
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<td>HS-ETS1-2.</td>
<td>Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</td>
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#### Unit Objectives

**Students will know…**
- Vocabulary and key terms
- Procedures at the core of scientific methodology
- Laboratory Safety procedures

**Students who demonstrate understanding can:**
- Discuss the factors that affect rate of solution
- Describe the solvation process
- Calculate concentrations of solutions
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<td>Identify the properties of acids and bases</td>
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<td>The nature of chemical reactions in an aqueous environment</td>
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**General Chemistry:**
- http://portal.acs.org/portal/acs/corg/content American Chemical Society
- http://www.rsc.org/ royal chemical society
- http://www.flinnsci.com/ Flinn Scientific
- http://www.bozemanscience.com
- https://www.youtube.com/channel/UCuS6iUi8mITtAZnUyty77Kg
- https://go.discovery.com/show/mythbusters-discovery
- https://phet.colorado.edu/
- https://breakoutedu.com/
- https://www.acs.org/content/acs/en.html
- https://ptable.com/#Properties
- https://www.compoundchem.com/
- https://sciencespot.net/

**Testing:**
- http://www.ets.org/ SAT and ACT
- http://apcentral.collegeboard.com/apc/Controller.jpf College Board Periodic Table:
- http://www.americanelements.com/ Periodic Table
- http://periodic.lanl.gov/default.htm Periodic Table
- http://www.consol.ca/downloads/Periodic_Table.pdf Periodic Table Educator Websites:
- http://www.adriandinglechemistrypages.com/

**Titration Simulations**
- http://antoine.frostburg.edu/chem/senese/101/index.shtml General Chemistry
- https://phet.colorado.edu/en/simulations/category/new General Chemistry