Unit 1: Chemical Building Blocks

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 1**
Length: **8-10 Weeks**
Status: **Published**

Unit Overview

This unit will help students formulate an answer to the question, "How do atomic and molecular interactions explain the properties of matter that we see and feel?". Students will be able to apply an understanding that substances have characteristics that are both physical and chemical. These substances are made by a single type of atom or bonded atoms called molecules or compounds. They will be able to provide molecular-level accounts to explain changes to states of matter. Students will use tools such as the Periodic Table to predict how atomic arrangement affects properties of atoms.

Performance Expectations

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-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
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-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.

Three Dimensions

Science and Engineering Practices

SEP.1	Asking Questions and Defining Problems
SEP.2	Developing and Using Models
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.5	Using Mathematics and Computational Thinking

SEP.7	Engaging in Argument from Evidence
SEP.8	Obtaining, Evaluating, and Communicating Information

Disciplinary Core Ideas

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2),(MS-PS1-3)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur withvariations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS3.A: Definitions of Energy

- The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. *(secondary to MS-PS1-4)*
- The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. *(secondary to MS-PS1-4)*

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. *(secondary to MS-PS1-6)*

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process - that is, some of the characteristics may be incorporated into the new design. *(secondary to MS-PS1-6)*
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. *(secondary to*

MS-PS1-6)

Crosscutting Concepts

	Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
CCC.2	Cause and effect: Mechanism and explanation.
CCC.3	Scale, proportion, and quantity.
CCC.4	Systems and system models.
CCC.5	Energy and matter: Flows, cycles, and conservation.
CCC.7	Stability and change.

Knowledge, Skills, and Assessment

Essential Insights and Understandings/Guiding Questions	Critical Knowledge and Skills	Recor
What is matter and what is it made of?	Matter is everything the has mass and takes up space. Chemistry is the study of matter and how it changes. All matter has physical and chemical properties that define it. Atoms are the smallest unit matter. An atom's nucleus is composed of protons with positive charge and neutrons with no charge. Electrons with negative charge travel in a cloud outside of the nucleus. **Skill: SWBAT...** • **Model atoms using appropriate scale to show distance and relation of protons, neutrons, and electrons.** • **Differentiate and identify chemical and physical properties in everyday matter.**	**Activity:** Students senses. Sc properties melting, a **Assessme** many pro has.
Why and how are elements organized?	Elements are defined by their number of protons, neutrons, and electrons. Elements are substances that cannot be broken down into anything else. Elements are made of only one type of atom. The Periodic Table organizes all discovered elements and is organized by atomic number, atomic mass, and symbol. **Skill: SWBAT...** • **Identify elements by symbol, atomic number, and atomic mass.** The Periodic Table is organized in groups like periods and groups/families that provide information about the properties of the	**Assessme** the Period characteri metalloid

element.

Skill: SWBAT...

- **Use element placement on the periodic table to find protons, neutrons, and electrons. Find properties as a metal, non-metal, or metalloid.**

How are different types of matter classified?

When two or more atoms join together, it creates a molecule. When two or more atoms of a different elements join together, it creates a compound. Symbols along with subscripts and coefficients can be used to represent the number of atoms/elements within a molecule or compound.

Activity: evidence homogen an examp

How can matter be measured?

Skill: SWBAT...

- **Identify which elements and how many of each a molecule/compound has.**

Activity: items or c balance, a and densi

Mixtures are two or more substances (elements, molecules/compounds) that are not chemically combined. Heterogeneous mixtures are easily separated with parts of a mixture visible. Homogeneous mixtures are more difficult to separate with different parts non visible to the naked eye.

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Skill: SWBAT...

- **Differentiate between heterogeneous and homogeneous mixtures.**

Students molecule

Mass is how much matter an object has. Volume is how much space an object takes up. Density is how much matter is packed into a space.

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Skill: SWBAT...

- **Measure volume using length x width x height and water displacement.**
- **Measure mass using a triple beam balance and digital balance.**
- **Calculate density based on mass and volume measurements.**

Objects with a density greater than 1 g/ml float while objects with a density less than 1 g/ml float.

Skill: SWBAT

- **Infer and predict an object's ability to float based on**

calculations.

Why does matter take different forms like solid, liquid, and gas?

Solids have a definite shape and definite volume. Liquids have a definite volume but no definite shape. Gases have neither definite shape nor definite volume. In solids, particles are arranged in a fixed, closely packed way, causing definite shape and volume. In liquids, particles are tightly packed but not fixed. In gases, particles spread far apart and move chaotically.

Skill: SWBAT...

- **Differentiate between solids, liquids, and gases by creating models of the particle state of matter.**

How do the particles in gas behave when pressure and temperature change?

Thermal energy can be added to solids to accelerate the particles and cause them to change phases. When thermal energy is added to solids, the particles will begin to move, causing the matter to melt. When thermal energy is added to liquids, the particles move more chaotically and become a gas (evaporate/vaporize). When thermal energy is subtracted from gas, it condenses into a liquid. When it is subtracted even more, matter becomes solid (freeze).

Skill: SWBAT...

- **Model changes in particles on a particle level.**

Boyle's Law expresses that when pressure on a gas is increased, volume is decreased. Charles' Law expresses that when thermal energy is added to gas in a flexible container , its volume increases.

Skill: SWBAT...

- **Use Boyle's and Charles' Law to predict behavior of gas in a variety of situations involving temperature and pressure.**
- **Graph the relationship between temperature, pressure, and volume in Charles' and Boyle's Law.**

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Suggested Resources

CK-12 Flexbook Content:

Module 1: Atoms and the Periodic Table

- Atoms: http://www.ck12.org/physical-science/Atoms-in-Physical-Science/lesson/Atoms-MS-PS/?referrer=featured_content
- The Periodic Table: http://www.ck12.org/physical-science/Modern-Periodic-Table-in-Physical-Science/lesson/Modern-Periodic-Table-MS-PS/?referrer=featured_content

Module 2: Describing and Measuring Matter

- Chemical and Physical Properties: http://www.ck12.org/physical-science/Chemical-Properties-of-Matter-in-Physical-Science/lesson/Chemical-Properties-of-Matter-MS-PS/
- Measurement of Matter: http://www.ck12.org/physical-science/Scientific-Measuring-Devices-in-Physical-Science/lesson/Scientific-Measuring-Devices-MS-PS/?referrer=concept_details
- Calculating Density: http://www.ck12.org/physical-science/Density-in-Physical-Science/lesson/Density-MS-PS/?referrer=concept_details

Module 3: Solids, Liquids, and Gases

- Solids: http://www.ck12.org/physical-science/Solids-in-Physical-Science/lesson/Solids-MS-PS/
- Liquids: http://www.ck12.org/physical-science/Liquids-in-Physical-Science/lesson/Liquids-MS-PS/
- Gases: http://www.ck12.org/physical-science/Gases-in-Physical-Science/lesson/Gases-MS-PS/

Technology Integration

iPads/smartphones, iMovie for filming of performance goals.

CK12 Flexbook

Glencoe online labs

Differentiation

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks

    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments
- Content specific modifications may include:
    - Labeled diagram of parts of Periodic Table
    - visual or hands on models of atoms
    - clear instructions for use of lab tools

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: Periodic Table, proton, neutron, electron, bonding, reaction, atomic, gas, liquid, solid, heterogeneous, homogeneous, compound, molecule, atom.

Differentiation to extend learning for gifted students may include:

7th Grade Class Blog: Choose a chemistry based topic from DNews, CrashCourse, CrashCourse Kids and write a brief response. Post response and link on class blog.

Exploration Topics:

- Other Sub-atomic Particles: Electrons, Protons, and Neutrons are the main subatomic particles. Research what other subatomic particles exist. Create a foldable explaining the function and properties of at least 3 other subatomic particles.
- Transition Metals: The class focuses on the rules of the other groups of elements. Research why the transition metals follow different rules Find 5 metals within the Transition Metals group that are important for everyday life.
- Spectroscope: Use the spectroscope to see what colors samples of pure elements give off when electricity flows through.
- Plasma: Include Plasma in your exploration of states of matter. Where on Earth do we find plasma ? How is it different that gas? What uses does it have?

21st Century Skills

CAEP.9.2.8.B.1	Research careers within the 16 Career Clusters ® and determine attributes of career success.
CAEP.9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
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.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
CAEP.9.2.8.B.5	Analyze labor market trends using state and federal labor market information and other resources available online.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.