MP1-2 Introduction to Chemistry

Content Area: **Science**
Course(s): **Science 7**
Time Period: **MP1-2**
Length: **MP1-2**
Status: **Published**

Essential Questions

- How is matter described?
- Why does a substance change states?
- How can bonding determine the properties of a substance?
- How is matter conserved in a chemical reaction?
- What determines the properties of a solution?

Big Ideas

- Atoms are the building blocks of matter.
- Mass and energy are conserved during physical and chemical changes.

Cross-Curricular Integration

Integration Area: Math

7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.NS.A Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Activity:

The students will conduct an experiment on thermal conductivity. The students will then create model to show the data that they collected. They will then express the relationship using mathematical expressions.

Integration Area: Language Arts/Math

RI.7.1. Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.7.3. Analyze the interactions between individuals, events, and ideas in a text (e.g., how ideas influence individuals or events, or how individuals influence ideas or events).

7.SP.A. Use random sampling to draw inferences about a population.

7.SP.B Draw informal comparative inferences about two populations.

Activity:

The students will read a section on the introduction of animals into an ecosystem. They will then create a random sampling data chart. The students will then use the data that they collected to analyze the interactions between the different parts of the ecosystem.

Integration Area: Language Arts

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

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 6-8.5 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.

Activity:

Matter & Synthetic Materials: How do materials created from natural resources impact society? Analyze the effects of using these materials. Using research from a variety of credible sources, create an informational brochure that describes synthetic materials that come from natural resources and their ultimate impact on society. Create a well-designed informational brochure on one synthetic material and its impact on the world. Make sure to include positive and negative factors. (Include features of non-fiction text such as: headings, bold, charts, graphics)

Integration Area: Pre-Algebra

Chapter 2: Integers and Rational Numbers

7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

Chapter 1: Algebraic Reasoning

7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Chapter 3: Applying Rational Numbers

7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Technology Integration

8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools.

8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.

Activity:

Students will create a brochure using a template. The project will gather and make sense of information to describe that synthetic materials come from natural resources and impact society. The end product will be a color, typed, and well-designed informative brochure on one synthetic material. Projects will be graded based on a rubric.

Enduring Understandings

MS. Matter and its Interactions

MS.PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures.

MS.PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

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

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.

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.

MS.PS1-6 Undertake a design project to construct, test, and modify a device that either releases or

absorbs thermal energy by chemical processes.

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 with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)
- Some chemical reactions release energy, others store energy.(MS-PS1-6)

PS3.A: Definitions of Energy

- The term “heat” as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and radiation (particularly infrared and light). In science, heat is used only for this second meaning; it refers to energy transferred when two objects or systems are at different temperatures. (secondary to MS-PS1-4)
- Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types states, and amounts of matter present. (secondary to MS-PS1-4)

Crosscutting Concepts

Patterns

Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Scale, Proportion, and Quantity

Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

Energy and Matter

Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

Structure and Function

Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

Focus Areas

Introduction to Matter

- Every form of matter has two kinds of properties – physical properties and chemical properties.
- Scientists know that all matter in the universe is made of more than 100 different substances, called elements.
- A mixture can be heterogeneous or homogeneous.
- A substance that undergoes a physical change is still the same substance after the change.
- Unlike a physical change, a chemical change produces new substances with new and different properties.
- Every chemical and physical change in matter includes a change in energy.

Solids, Liquids and Gases

- The fixed, closely packed arrangement of particles causes a solid to have a definite shape and volume.
- Because its particles are free to move, a liquid has no definite shape. However, it does have a definite volume.
- As gas particles move, they spread apart, filling all the space available. Thus, a gas has neither definite shape nor definite volume.
- At a solid's melting point, its particles vibrate so fast that they break free from their fixed positions.
- Vaporization occurs when the particles in a liquid gain enough thermal energy to move independently.
- During sublimation, particles of a solid do not pass through the liquid state as they form a gas.
- When the temperature of a gas at constant volume is increased, the pressure of the gas increases.
- When the temperature of a gas at constant pressure is increased, its volume increases.
- When the pressure of a gas at constant temperature is increased, the volume of the gas decreases.

Elements and the Periodic Table

- Atomic theory grew as a series of models that developed from experimental evidence.
- At the center of the atom is a tiny, dense nucleus containing protons and neutrons. Surrounding the nucleus is a cloudlike region of moving electrons.
- The physical properties of metals include luster, malleability, ductility, and conductivity.
- Metals are classified as alkali metals, alkaline earth metals, and transition metals, metals in mixed groups, lanthanides, and actinides.
- During radioactive decay, the identity of an atom changes.

- Radioactive decay can produce alpha particles, beta particles, and gamma rays.
- Uses of radioactive isotopes include determining the ages of fossils, tracing the steps of chemical and industrial processes, and providing sources of energy.

Atoms and Bonding

- The number of valence electrons in each atom of an element helps determine the chemical properties of that element.
- Attraction between the shared electrons and the protons in the nucleus of each atom hold the atoms together in a covalent bond.
- Molecular compounds have a low melting point and do not conduct electrical current.
- Unequal sharing of electrons causes bonded atoms to have slight electrical charges.
- A metal crystal is composed of closely packed, positively charged metal ions. The valence electrons drift among the ions.
- Properties of metals include a shiny luster, and high levels of malleability, ductility, electrical conductivity, and thermal conductivity.

Chemical Reactions

- Changes in matter can be described in terms of physical change and chemical changes.
- Chemical reactions involve changes in properties and in energy that you can often observe.
- A chemical equation tells you the substance you start with in a reaction and the substances that are formed at the end.
- In a chemical reaction, all of the atoms present at the start of a reaction are present at the end of the reaction.
- Three types of chemical reactions are synthesis, decomposition, and replacement.
- All chemical reactions need a certain amount of activation energy to get started.
- Factors that can affect rates of reaction include surface area, temperature, concentration, and the presence of catalysts and inhibitors.

Acids, Bases, and Solutions

- A mixture is classified as a solution, colloid, or suspension based on the size of its largest particles.
- A solution forms when particles of the solution separate from each other and become surrounded by particles of the solvent.
- You can change the concentration of a solution by adding solute. You can also change it by adding or removing solvent.
- Factors that can affect the solubility of a substance include pressure, the type of solvent, and temperature.
- An acid reacts with metals and carbonates, tastes sour and turns blue litmus paper red.
- A base tastes bitter, feels slippery and turns red litmus paper blue.
- An acid produces hydrogen ions (H^+) in water.
- A base produces hydroxide ions (OH^-) in water
- In a neutralization reaction, an acid reacts with a base to produce a salt and water.

*See Appendix E for Cross Content

Resources

Scientific Inquiry

MS-PS1-1 (5.2.8.A.2) *Modeling Particles*, p. 40
MS-PS1-4 (5.2.8.A.3) *Melting Ice*, p. 44-48
MS-PS1-5 (5.2.8.B.1) *Did You Lose Anything*, p. 148