



Grade 8 Science - Unit 3 - Chemistry

Unit Focus

Students will develop an understanding of the structure of matter at the atomic level, including how atoms combine to form molecules, how substances can be identified by their properties, and how chemical reactions involve the rearrangement of atoms to create new substances with different properties, emphasizing the concept of conservation of mass during chemical reactions. Students will be able to synthesize and apply these concepts to laboratory experiences where they will need to identify if a chemical reaction has occurred and analyze reactions to determine the reactants, products, and types of solutions produced. Students will model chemical reactions and create balanced equations to illustrate the atomic and molecular changes that occurred. Additionally, students will gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Next Generation Science Standards Performance Expectations: Middle School Physical Sciences <ul style="list-style-type: none">Develop models to describe the atomic composition of simple molecules and extended structures. (MS-PS1-1)Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2)Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (MS-PS1-3)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-PS1-4)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-PS1-5)Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (MS-PS1-6) Next Generation Science Standards (DCI) Science: 8 <ul style="list-style-type: none">Substances are made from different types of atoms, which combine with one another in various ways. Atoms form	<i>Students will be able to independently use their learning to...</i> T1 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery. T2 Use the scientific process to generate evidence that addresses the original questions. T3 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Everything is made of matter. U2 Different kinds of matter exist and many of them can be either solid or liquid, depending on the temperature. Matter can be described by its observable properties. U3 Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. U4 Matter of any type can be subdivided into particles that are too small to see. U5 When a change in matter occurs, the total mass remains the same (conservation). U6 In a chemical reaction, the particles that make up the original substances can be regrouped into different substances. These new substances may have different properties than the original substances.	<i>Students will keep considering...</i> Q1 How can models help us understand the atomic composition of different substances? Q2 How do we determine whether a chemical reaction has occurred, and why is mass conserved in these reactions? Q3 How do changes in thermal energy affect the motion of particles and the state of a substance? Q4 How are synthetic materials made from natural resources, and what impact do they have on society?

Stage 1: Desired Results - Key Understandings

<p>molecules that range in size from two to thousands of atoms. (PS1.6.A1)</p> <ul style="list-style-type: none"> Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (PS1.6.A2) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (PS1.6.A3) 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. (PS1.6.A4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (PS1.6.A5) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (PS1.6.A6) 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. (PS1.6.B1) The total number of each type of atom is conserved, and thus the mass does not change. (PS1.6.B2) Some chemical reactions release energy, others store energy. (PS1.6.B3) 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. (PS3.6.A1) Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (PS3.6.A5) 	<p>U7 Substances can be identified by their physical and chemical properties.</p> <p>U8 Molecules in solids, liquids, and gases are in constant motion.</p> <p>U9 The total thermal energy of a system depends on the total number of atoms, average temperature of each, and the state of the material.</p> <p>U10 Energy can be described on a microscopic level which describes the motion/behavior of the particles.</p> <p>U11 Matter is made up of different types of atoms which can combine to form molecules. (In MS discussions are not to include types of bonds or valence electrons.)</p> <p>U12 Substances can be identified by their physical and chemical properties.</p> <p>U13 Molecules in solids, liquids, and gases are in constant motion. In solids, particles vibrate in place. In liquids, particles slide past each other but remain close together. In gases, particles have random motion and are far apart.</p> <p>U14 Changes in temperature and pressure can cause a change in state.</p> <p>U15 In a chemical reaction atoms can be rearranged and new substances with new properties are created.</p> <p>U16 Chemical reactions can absorb or release thermal energy</p> <p>U17 Scientists examine evidence to formulate interesting questions and solve problems.</p>	
Acquisition of Knowledge and Skill		
	Knowledge	Skill(s)
	<p><i>Students will know...</i></p> <p>K1 A physical property of a substance is a characteristic that can be observed or measured without changing the composition of the substance. A chemical property is a property that causes a change in the composition of a substance.</p> <p>K2 When matter undergoes a chemical change, the composition of matter changes. When matter undergoes a physical change, the composition of matter remains the same</p> <p>K3 Acids taste sour, react with certain metals, and turn blue litmus to red and have a pH below 7. Bases taste bitter, feel slippery, and turn red litmus to blue and have a pH above 7.</p>	<p><i>Students will be skilled at...</i></p> <p>S1 Use and design models to describe atomic structure.</p> <p>S2 Determine properties of an element based on its location in the periodic table.</p> <p>S3 Look for connections in the data based on observations of science phenomena</p> <p>S4 Exchange and evaluate ideas with lab partner(s) critically and respectfully.</p>

Stage 1: Desired Results - Key Understandings

Madison Public Schools Profile of a Graduate

- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

K4 The total number of each type of atom is conserved and thus the mass does not change.

K5 The periodic table provides important information about elements and their atoms that inform how these elements can react with others.

K6 Valence electrons are those electrons that are able to bond with other atoms.

K7 The number of valence electrons that an atom has dictates how it reacts with other atoms.

K8 All matter is composed of particles that are in constant motion.

K9 Chemical processes are used to create synthetic materials from natural resources.

K10 Vocabulary: pure substances, elements, compounds, mixtures, ions, atoms, molecules, physical property and chemical property, physical change and chemical change, acid, base, pH, solids, liquids, gases, protons, phase changes, neutrons, electrons, energy levels, endothermic reaction, exothermic reaction, valence electrons, reactants, products, Conservation of Mass, subscripts and coefficients, Kinetic Theory of Matter, synthetic and natural resources.