

**Science**  
**Geophysical Science**  
**Unit 5: Nature of Matter**

<b>Essential Understandings</b>	<ul style="list-style-type: none"> <li>▪ Causation: Nothing “just happens”. Everything is caused.</li> <li>▪ Interrelatedness: Everything in the universe is connected to everything else in the universe.</li> <li>▪ Dynamism: Everything is changing in some way all the time.</li> <li>▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder.</li> <li>▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.</li> </ul>
<b>Essential Questions</b>	<ul style="list-style-type: none"> <li>▪ What is matter?</li> <li>▪ What is the kinetic theory of matter?</li> <li>▪ What are the macroscopic characteristics of each state of matter?</li> <li>▪ What are the microscopic characteristics of each state of matter?</li> <li>▪ What constitutes a physical property and physical change?</li> </ul>
<b>Essential Knowledge</b>	<ul style="list-style-type: none"> <li>▪ All matter is made of moving particles.</li> <li>▪ All matter exists in one of the four states but can change state based on the gain or loss of energy.</li> <li>▪ Scientific laws and principles govern how matter responds to changes of density, pressure, and temperature.</li> </ul>
<b>Vocabulary</b>	<ul style="list-style-type: none"> <li>▪ <u>Terms:</u> <ul style="list-style-type: none"> <li>○ matter, solid, liquid, gas, plasma, crystals, heat of fusion, heat of vaporization, thermal expansion</li> </ul> </li> </ul>
<b>Essential Skills</b>	<ul style="list-style-type: none"> <li>▪ Calculate the relationships among temperature, pressure and volume.</li> <li>▪ Use the relationship among force, area, and pressure.</li> <li>▪ Distinguish among solid, liquid, gas and plasma.</li> </ul>
<b>Related Maine Learning Results</b>	<p><u>Science and Technology</u></p> <p>A. Unifying Themes</p> <p>A2.Models</p> <p>Students evaluate the effectiveness of a model by comparing its predications to actual observations from the physical setting, the living environment, and the technological world.</p>

**Science**  
**Geophysical Science**  
**Unit 5: Nature of Matter**

<p><b>Related Maine Learning Results</b></p>	<p>B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis.</p> <ul style="list-style-type: none"><li>a. Identify questions, concepts, and testable hypotheses that guide scientific investigations.</li><li>b. Design and safely conduct methodical scientific investigations, including experiments with controls.</li><li>c. Use statistics to summarize, describe, analyze, and interpret results.</li><li>d. Formulate and revise scientific investigations using logic and evidence.</li><li>e. Use a variety of tools and technologies to improve investigations and communications.</li><li>f. Recognize and analyze alternative explanations and models using scientific criteria.</li><li>g. Communicate and defend scientific ideas.</li></ul>
--	---

**Science**  
**Geophysical Science**  
**Unit 5: Nature of Matter**

<p><b>Related Maine Learning Results</b></p>	<p>D. The Physical Setting D3.Matter and Energy</p> <p>Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy.</p> <ol style="list-style-type: none"><li>a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties.</li><li>b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions.</li><li>c. Explain the essential roles of carbon and water in life processes.</li><li>d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance.</li><li>e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules.</li><li>f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions.</li><li>g. Describe nuclear reactions, including fusion and fission, and the energy they release.</li><li>h. Describe the radioactive decay and half-life.</li><li>i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems.</li><li>j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction.</li><li>k. Apply an understanding of energy transformations to solve problems.</li><li>l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.</li></ol>
--	---

**Science**  
**Geophysical Science**  
**Unit 5: Nature of Matter**

<b>Related Maine Learning Results</b>	<p>D4. Force and Motion</p> <p>Students understand that the laws of force and motion are the same across the universe.</p> <ol style="list-style-type: none"> <li>a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation.</li> <li>b. Explain and apply the ideas of relative motion and frame of reference.</li> <li>c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies.</li> <li>d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude.</li> <li>e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption.</li> <li>f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.</li> </ol>
<b>Sample Lessons And Activities</b>	<ul style="list-style-type: none"> <li>▪ Lecture</li> <li>▪ "Boiling is a Cooling Process Lab"</li> <li>▪ Heat of fusion and heat of vaporization demonstration</li> <li>▪ 1, 4 - dichlorobenzene Lab</li> <li>▪ Soda Can Combined Gas Law demonstration</li> </ul>
<b>Sample Classroom Assessment Methods</b>	<ul style="list-style-type: none"> <li>▪ Matter Quizzes</li> <li>▪ Chapter Tests</li> <li>▪ Laboratory Reports</li> </ul>
<b>Sample Resources</b>	<ul style="list-style-type: none"> <li>▪ <u>Publications:</u> <ul style="list-style-type: none"> <li>○ Glencoe <u>Physical Science</u></li> <li>○ MARVEL Data bases*</li> <li>○ GALE Resource Data bases**</li> </ul> </li> <li>▪ <u>Videos:</u> <ul style="list-style-type: none"> <li>○ Connections Series</li> <li>○ The World of Chemistry</li> </ul> </li> </ul>