

# Grade 6-8 Physical Science Scope and Sequence

## St. Herman of Alaska Christian School

**Preface**     The Origins of Modern Mathematics and Science

Biographical Reference	Summary
<ul style="list-style-type: none"> <li>• Thales of Miletus (ca. 624 BC–ca. 546 BC) (Irene)</li>   <li>• Pythagoras of Samos (ca. 580 - 500 BC). (Irene)</li>   <li>• Johannes Kepler (1571 – 1630) (Benjamin)</li> <li>• Peter-Paul Rubens (1575-1640)</li> </ul> <div style="text-align: center; margin: 10px 0;">  </div> <ul style="list-style-type: none"> <li>• Galileo Galilei (1564 – 1642) (Alexandra)</li> <li>• Plimoth Plantation Founded (1620)</li>   <li>• Isaac Newton (1643 – 1727) (Dennis)</li> <li>• George Friderik Handel (1685 – 1742) <a href="http://www.hallelujah-chorus.com/download/mp3.html">http://www.hallelujah-chorus.com/download/mp3.html</a></li> </ul>	<ul style="list-style-type: none"> <li>• Thales aimed to explain natural phenomena via a rational explanation that referenced natural processes themselves.</li>   <li>• It is said that the Pythagoreans discovered most of the material in the first two books of Euclid's <i>Elements</i>. The discovery of the irrational numbers is usually attributed to the Pythagorean Hippasus of Metapontum, who produced a proof of the irrationality of the square root of 2.</li>   <li>• After approximately 40 failed attempts, in early 1605 he at last hit upon the idea of an ellipse for orbit of Mars. He announced Three Laws of planetary motion:             <ol style="list-style-type: none"> <li>I. The orbit of every planet is an ellipse with the sun at a focus;</li> <li>II. A line joining a planet and the sun sweeps out equal areas during equal intervals of time;</li> <li>III. The square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit.</li> </ol> </li>   <li>• The motion of uniformly accelerated objects, taught in nearly all high school and introductory college physics courses, was studied by Galileo as the subject of kinematics. His contributions to observational astronomy include the telescopic confirmation of the phases of Venus, the discovery of the four largest satellites of Jupiter (named the Galilean moons in his honor), and the observation and analysis of sunspots. Galileo also worked in applied science and technology, improving compass design.</li>   <li>• Newton described universal gravitation and the three laws of motion which dominated the scientific view of the physical universe for the next three centuries. Newton showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws by explaining Kepler's laws of planetary motion. Newton shares the credit with Gottfried Leibniz for the development of the differential and integral calculus.</li> </ul>

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### Unit 0 Historical Background

Concepts/Topic	Suggested Activities & Laboratories
0.1 The Grand Personae Science a. Thales and the Pythagoreans b. Johannes Kepler c. Galileo d. Newton	<u>Activities</u> - Brief reports on Grand Personae - Pendulum Lab  <u>Videos</u> - <i>Mechanical Universe</i> : Introduction
0.2 Why Science Is Difficult a. Conjectures b. Experiment c. Deduction and Synthesis	

### Unit 1 Physics: Force and Motion

Concepts/Topic	Suggested Activities & Laboratories
1.1 Kinematics e. Displacement f. Velocity g. Acceleration	<u>Activities</u>   <u>Demonstrations</u> - Independence of Vertical and Horizontal Motion - Collision of equal masses - Conservation of Mechanical Energy - Water Rocket
1.2 Mechanics d. Inertia (N1) e. Force (N2) f. Interactions (N3)	
1.3 Forces a. Mechanical b. Gravity c. Electromagnetic	<u>Videos</u> - <i>Mechanical Universe</i> : Newton's Laws - <i>Mechanical Universe</i> : Momentum - <i>Mechanical Universe</i> : Mechanical Energy

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### Unit 2 Physics: Energy and Momentum

Concepts/Topic	Suggested Activities & Laboratories
2.1 Momentum <ul style="list-style-type: none"> <li>a. Definition</li> <li>b. Conservation</li> </ul>	<u>Demonstrations</u> <ul style="list-style-type: none"> <li>- Collision of equal masses</li> <li>- Conservation of Mechanical Energy</li> <li>- Water Rocket</li> </ul> <u>Videos</u> <ul style="list-style-type: none"> <li>- <i>Mechanical Universe: Momentum</i></li> <li>- <i>Mechanical Universe: Mechanical Energy</i></li> </ul>
2.2 Work and Energy <ul style="list-style-type: none"> <li>a. Potential Energy</li> <li>b. Kinetic Energy</li> <li>c. Work</li> <li>d. Mechanical Energy</li> <li>e. Conservation</li> </ul>	

### Unit 3 Physics: Einstein and the Unification of Time and Space

Concepts/Topic	Suggested Activities & Laboratories
3.1 The Clock Experiment <ul style="list-style-type: none"> <li>- The Twin Paradox</li> <li>- Shrinking meter sticks</li> </ul>	
3.2 Events and Intervals <ul style="list-style-type: none"> <li>- Meson Decay</li> <li>- The Very Fast Runner</li> </ul>	
3.3 The Energy, Momentum and Mass Unified	
3.4 General Relativity: Gravity, Black Holes and GPS Clocks	

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### Unit 4 Review of Units and Measurement Skills

Concepts/Topic	Activities & Laboratories
4.1 Introduction 4.2 Atoms and Molecules 4.3 Measurement and Units 4.4 The Metric System 4.5 Manipulating Units 4.6 Converting Between Units 4.7 Converting Between Systems 4.8 Concentration	<u>Activities</u> - Worksheets on reading instruments - Math skills worksheets - Metric Family Tree - Problem-solving techniques  <u>Laboratories</u> - Experiment 1.1: Atoms and Molecules - Experiment 1.2: Cubits and Fingers - Experiment 1.3: Concentration - Experiment 1.4: Volume of Sand (open-ended)

### Unit 5 Matter and Change

Concepts/Topic	Suggested Activities & Laboratories
5.1 Matter and Change - Physical Change - Chemical Change - Conservation of Mass  5.2 Properties of Matter - Extrinsic Properties - Intrinsic Properties	<u>Laboratories</u> - Balance Lab - Conservation of Mass
5.3 Data Management - Table Construction - Graph Construction - Graphical Analysis  5.4 Density 5.5 Lab Determination 5.6 Identification by Density Methods	<u>Activities</u> - Graphing Worksheet - Graph Analysis - Density Worksheet  <u>Laboratories</u> - Experiment 2.1: Density of liquids - Experiment 2.2: Density of Solids - Experiment 2.3: Identifying Unknowns  <u>Materials</u> - Worksheets - Lab Notebook - Lab Equipment

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### Unit 6 Introduction to Chemistry

Concepts/Topic	Suggested Activities & Laboratories
6.1 Review of Atomic Theory <ul style="list-style-type: none"> <li>- Atomic structure</li> <li>- Elements and symbols</li> <li>- The periodic table</li> </ul>	<u>Activities</u> <ul style="list-style-type: none"> <li>- Modeling Chemical Reactions</li> <li>- Modeling Half-life</li> </ul>
6.2 Breaking and Making Chemical Bonds <ul style="list-style-type: none"> <li>- Ionic bonds</li> <li>- Covalent bonds</li> </ul>	<u>Laboratories</u> <ul style="list-style-type: none"> <li>- Decomposition of hydrogen peroxide</li> <li>- Zinc chloride</li> </ul>
6.3 Production of New Substances: Compounds <ul style="list-style-type: none"> <li>- Formulas</li> <li>- Equations</li> <li>- Reactants and Products</li> <li>- Balancing Equations</li> </ul>	<u>Activities</u> <ul style="list-style-type: none"> <li>- Problem worksheet on definite proportions</li> <li>- Worksheet on naming compounds and writing formulas</li> </ul>
6.4 Molar Weights <ul style="list-style-type: none"> <li>- Law of Definite Proportions</li> <li>- Avogadro's Number</li> <li>- Quantitative Analysis</li> </ul>	<u>Laboratories</u> <ul style="list-style-type: none"> <li>- Ionic and Covalent Properties</li> <li>- Conductivity</li> <li>- Synthesis of <math>ZnCl_2</math></li> <li>- Decomposition of <math>H_2O</math></li> </ul>

### Unit 7 Nuclear Change

Concepts/Topic	Suggested Activities & Laboratories
7.1 Isotopes	<u>Activities</u> <ul style="list-style-type: none"> <li>- Modeling Chemical Reactions</li> <li>- Modeling Half-life</li> </ul> <u>Laboratories</u> <ul style="list-style-type: none"> <li>- Decomposition of hydrogen peroxide</li> <li>- Zinc chloride</li> </ul>
7.2 Radioactive Decay <ul style="list-style-type: none"> <li>- Nuclear Equations</li> <li>- The Bomb(s)</li> <li>- Nuclear Power</li> </ul>	
7.3 Nuclear Fusion <ul style="list-style-type: none"> <li>- Powering the Sun</li> <li>- Building the Periodic Table</li> </ul>	