

**Science**  
**Unit 1: Astronomy**

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| <b>Essential Understandings</b> | <ul style="list-style-type: none"> <li>▪ There are zones of habitability where life could exist.</li> <li>▪ Lighter elements form heavier elements inside stars.</li> <li>▪ Stars have “life” cycles.</li> <li>▪ When heavier elements are formed, some mass is converted to energy.</li> <li>▪ Scale is necessary for the study of astronomy.</li> <li>▪ Scientists use various tools to learn about and explore objects in outer space.</li> <li>▪ Objects in space rotate and revolve around other objects based on mass and gravitational forces.</li> </ul>   |
| <b>Essential Questions</b>      | <ul style="list-style-type: none"> <li>▪ How do scientists learn about objects in outer space?</li> <li>▪ What kinds of satellites have been launched and what information do they gather?</li> <li>▪ What are some of the challenges we face in collecting information about objects in space and traveling to places away from the Earth?</li> <li>▪ How do stars change over time?</li> <li>▪ How do elements form?</li> <li>▪ How did solar systems and galaxies form?</li> <li>▪ How does mass affect gravitational attraction?</li> </ul>  |
| <b>Essential Knowledge</b>      | <ul style="list-style-type: none"> <li>▪ The size of objects in the universe varies from matter as tiny as quarks to clusters of galaxies.</li> <li>▪ Vast distances exist in outer space.</li> <li>▪ Scientists have designed and tested various tools to study outer space.</li> <li>▪ Scientists have collected a great deal of information about the universe and how it was formed, by using these tools.</li> <li>▪ Different units of measurement are needed to measure vast distances in outer space.</li> <li>▪ Natural elements on the periodic table were formed in stars.</li> <li>▪ Planets, moons, solar systems, galaxies, and other space objects, rotate and revolve around other objects based on mass and gravity.</li> <li>▪ The phase of a stars “life” cycle depends on its mass.</li> </ul> |
| <b>Vocabulary</b>               | <ul style="list-style-type: none"> <li>▪ <u>Term Categories:</u> <ul style="list-style-type: none"> <li>○ Celestial Objects</li> <li>○ Forces</li> <li>○ Technological Tools Used in Astronomy</li> <li>○ Units of Measurement</li> </ul> </li> </ul>  |
| <b>Essential Skills</b>         | <ul style="list-style-type: none"> <li>▪ Identify and use tools used by scientists to learn about and explore objects in outer space.</li> <li>▪ Use data to explain how objects in space rotate and revolve around other objects based on mass and gravitational forces.</li> <li>▪ Use scale models and scientific notation.</li> </ul>  |

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| <b>Related<br/>Maine Learning<br/>Results</b> | <p><u>Science</u></p> <p>A. Unifying Themes</p> <p>A1. Systems<br/>Students apply the principles of systems, models, constancy and change, and scale in science and technology.</p> <p>a. Explain how individual parts working together in a system (including organisms, Earth systems, solar systems, or man-made structures) can do more than each part individually.</p> <p>A2. Models<br/>Students use models to examine a variety of real-world phenomena from the physical setting, the living environment, and the technological world and compare advantages and disadvantages of various models.</p> <p>a. Compare different types of models that can be used to represent the same thing including models of chemical reactions, motion, or cells, in order to match the purpose and complexity of a model to its use.</p> <p>b. Propose changes to models and explain how those changes may better reflect the real thing.</p> <p>A3. Constancy and Change<br/>Students describe how patterns of change vary in physical, biological, and technological systems.</p> <p>c. Describe rates of change and cyclic patterns using appropriate grade-level mathematics.</p> <p>A4. Scale<br/>Students use scale to describe objects, phenomena, or processes related to Earth, space, matter, and mechanical and living systems.</p> <p>a. Describe how some things change or work differently at different scales.</p> <p>b. Use proportions, averages, and ranges to describe small and large extremes of scale.</p> <p>C. The Scientific and Technological Enterprise</p> <p>C2. Understandings About Science and Technology<br/>Students understand and compare the similarities and differences between scientific inquiry and technological design.</p> <p>a. Compare the process of scientific inquiry to the process of technological design.</p> <p>b. Explain how constraints and consequences impact scientific inquiry and technological design.</p> |
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Results**

C4. History and Nature of Science

Students describe historical examples that illustrate how science advances knowledge through the scientists involved and through the ways scientists think about their work and the work of others.

- a. Describe how women and men of various backgrounds, working in teams or alone and communicating about their ideas extensively with others, engage in science, engineering and related fields.
- b. Describe a breakthrough from the history of science that contributes to our current understanding of science.
- c. Describe and provide examples that illustrate that science is a human endeavor that generates explanations based on verifiable evidence that are subject to change when new evidence does not match existing explanations.

D. The Physical Setting

D1. Universe and Solar System

Students explain the movements and describe the location, composition, and characteristics of our solar system and universe, including planets, the sun, and galaxies.

- a. Describe the different kinds of objects in the solar system including planets, sun, moons, asteroids, and comets.
- b. Explain the motions that cause days, years, phases of the moon, and eclipses.
- c. Describe the location of our solar system in its galaxy and explain that other galaxies exist and that they include stars and planets.

D2. Earth

Students describe the various cycles, physical and biological forces and processes, positions in space, energy transformations, and human actions that affect the short-term and long-term changes to the Earth.

- a. Explain how the tilt of Earth's rotational axis relative to the plane of its yearly orbit around the sun affects the day length and sunlight intensity to cause seasons.
- d. Describe the effect of gravity on objects on Earth.

D3. Matter and Energy

Students describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter.

- j. Describe how heat is transferred from one object to another by conduction, convection, and/or radiation.

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| <p style="text-align: center;"><b>Related<br/>Maine Learning<br/>Results</b></p>          | <p>D4. Force and Motion<br/>Students describe the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves.</p> <ul style="list-style-type: none"> <li>b. Explain the relationship among visible light, the electromagnetic spectrum and sight.</li> <li>c. Describe and apply an understanding of how the gravitational force between any two objects would change if their mass or the distance between them changed.</li> <li>e. Describe and apply an understanding of the effects of multiple forces on an object and how unbalanced forces will cause changes in the speed or direction.</li> </ul>  |
| <p style="text-align: center;"><b>Sample<br/>Lessons<br/>And<br/>Activities</b></p>       | <ul style="list-style-type: none"> <li>▪ Make a scale model to demonstrate the vast distances of space.</li> <li>▪ Research a specific astronomical topic and communicate findings in a multi-media format.</li> </ul>   |
| <p style="text-align: center;"><b>Sample<br/>Classroom<br/>Assessment<br/>Methods</b></p> | <ul style="list-style-type: none"> <li>▪ Multi-media presentation on an astronomical topic.</li> <li>▪ Explain the motions of objects in a fictitious solar system.</li> </ul>   |
| <p style="text-align: center;"><b>Sample<br/>Resources</b></p>                            | <ul style="list-style-type: none"> <li>▪ <u>Videos:</u> <ul style="list-style-type: none"> <li>○ Creation of the Universe</li> <li>○ The Future of the Milky Way</li> <li>○ <a href="http://hubblesite.org/explore_astronomy/black_holes/">http://hubblesite.org/explore_astronomy/black_holes/</a></li> <li>○ <a href="http://www.kineticcity.com/controlcar/activity.php?virus=terrora&amp;act=4">http://www.kineticcity.com/controlcar/activity.php?virus=terrora&amp;act=4</a></li> <li>○ <a href="http://primaxstudio.com/stuff/scale_of_universe/">http://primaxstudio.com/stuff/scale_of_universe/</a></li> <li>○ <a href="http://blogs.discovermagazine.com/badastronomy/">http://blogs.discovermagazine.com/badastronomy/</a></li> <li>○ <a href="http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html">http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html</a></li> <li>○ Origins DVD</li> </ul> </li> <li>▪ <u>Other Resources:</u> <ul style="list-style-type: none"> <li>○ Dark Matter: Scientific American</li> </ul> </li> </ul> |