

**Next Generation Science Standards for Planetariums:**

Performance Expectations which are easily supported through planetarium programming; other standards may also apply.

Performance Expectation Code	Students who demonstrate understanding can...	Science and Engineering Practices	Crosscutting Concepts	Common Core Connections
<b>1-PS4-2.</b>	<b>1. Waves: Light and Sound</b> Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.	<b>Constructing Explanations and Designing Solutions</b> Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1-PS4-2)	<b>Cause and Effect</b> • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (1-PS4-1),(1-PS4-2)	<b>W.1.2</b> Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure. <b>W.1.7</b> Participate in shared research and writing projects (e.g., explore a number of “how-to” books on a given topic and use them to write a sequence of instructions). <b>W.1.8</b> With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. <b>SL.1.1</b> Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
<b>1-ESS1-1.</b>	<b>1. Space Systems: Patterns and Cycles</b> Use observations of the sun, moon, and stars to describe patterns that can be predicted.	<b>Planning and Carrying Out Investigations</b> Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2) <b>Analyzing and Interpreting Data</b> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.	<b>Patterns</b> • Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2) ----- Connections to Nature of Science  <b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b> • Science assumes natural events happen today as they happened in the past. (1-ESS1-1) • Many events are repeated. (1-ESS1-1)	<b>W.1.7</b> Participate in shared research and writing projects (e.g., explore a number of “how-to” books on a given topic and use them to write a sequence of instructions). <b>W.1.8</b> With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. <b>MP.2</b> Reason abstractly and quantitatively. <b>MP.4</b> Model with mathematics. <b>MP.5</b> Use appropriate tools strategically. <b>1.OA.A.1</b> Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations to represent the problem. <b>1.MD.C.4</b> Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
<b>1-ESS1-2.</b>	<b>1. Space Systems: Patterns and Cycles</b> Make observations at different times of year to relate the amount of daylight to the time of year.	<b>Analyzing and Interpreting Data</b> Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.		
<b>4-PS4-2.</b>	<b>4. Structure, Function, and Information Processing</b> Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	<b>Developing and Using Models</b> Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model to describe phenomena. (4-PS4-2)	<b>Cause and Effect</b> • Cause and effect relationships are routinely identified. (4-PS4-2)	<b>SL.4.5</b> Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-2),(4-LS1-2) <b>4.G.A.1</b> Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-2)
<b>4-ESS1-1.</b>	<b>4. Earth's Systems: Processes that Shape the Earth</b> Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	<b>Constructing Explanations and Designing Solutions</b> Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Identify the evidence that supports particular points in an explanation. (4-ESS1-1)	<b>Patterns</b> • Patterns can be used as evidence to support an explanation. (4-ESS1-1) <b>Cause and Effect</b> • Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1) ----- Connections to Nature of Science  <b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b> • Science assumes consistent patterns in natural systems.	<b>MP.2</b> Reason abstractly and quantitatively. (4-ESS1-1)

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<b>5-ESS1-1.</b>	<b>5. Space Systems: Stars and the Solar System</b> Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.	<p><b>Analyzing and Interpreting Data</b> Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> <li>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)</li> </ul> <p><b>Engaging in Argument from Evidence</b> Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> <ul style="list-style-type: none"> <li>Support an argument with evidence, data, or a model. (5-PS2-1),(5-ESS1-1)</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2)</li> </ul> <p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)</li> </ul> <p><b>Scale, Proportion, and Quantity</b></p> <ul style="list-style-type: none"> <li>Natural objects exist from the very small to the immensely large. (5-ESS1-1)</li> </ul>	<p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)</p> <p><b>MP.2</b> Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)</p> <p><b>MP.4</b> Model with mathematics. (5-ESS1-1),(5-ESS1-2)</p> <p><b>5.G.A.2</b> Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)</p>
<b>5-ESS1-2.</b>	<b>5. Space Systems: Stars and the Solar System</b> Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.			

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<b>MS-ESS1-1.</b>	<b>MS. Space Systems</b> Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	<p><b>Developing and Using Models</b> Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> <li>Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)</li> </ul> <p><b>Analyzing and Interpreting Data</b> Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</p> <ul style="list-style-type: none"> <li>Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3)</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Patterns can be used to identify cause-and-effect relationships. MS-ESS1-1</li> </ul> <p><b>Scale, Proportion, and Quantity</b></p> <ul style="list-style-type: none"> <li>Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. MS-ESS1-3</li> </ul> <p><b>Systems and System Models</b></p> <ul style="list-style-type: none"> <li>Models can be used to represent systems and their interactions. MS-ESS1-2</li> </ul> <p>-----</p> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p><b>Interdependence of Science, Engineering, and Technology</b></p> <ul style="list-style-type: none"> <li>Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)</li> </ul> <p>-----</p> <p>Connections to Nature of Science</p> <p><b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b></p> <ul style="list-style-type: none"> <li>Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1, MESS1-2)</li> </ul>	<p><b>MP.2</b> Reason abstractly and quantitatively. (MS-ESS1-3)</p> <p><b>MP.4</b> Model with mathematics. (MS-ESS1-1),(MS-ESS1-2)</p> <p><b>6.RP.A.1</b> Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)</p> <p><b>7.RP.A.2</b> Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2), (MS-ESS1-3)</p>
<b>MS-ESS1-2.</b>	<b>MS. Space Systems</b> Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.			
<b>MS-ESS1-3.</b>	<b>MS. Space Systems</b> Analyze and interpret data to determine scale properties of objects in the solar system.			
<b>MS-ESS2-2.</b>	<b>MS. History of Earth</b> Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	<p><b>Constructing Explanations and Designing Solutions</b> Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> <li>Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4),(MS-ESS2-2)</li> </ul>	<p><b>Scale Proportion and Quantity</b></p> <ul style="list-style-type: none"> <li>Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-4),(MS-ESS2-2)</li> </ul>	<p><b>MP.2</b> Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)</p> <p><b>SL.8.5</b> Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1), (MS-ESS2-2),(MS-ESS2-6)</p>
<b>MS-ESS2-1.</b>	<b>MS. Earth's Systems</b> Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	<p><b>Developing and Using Models</b> Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> <li>Develop and use a model to describe phenomena. (MS-ESS2-1)</li> </ul>	<p><b>Stability and Change</b></p> <ul style="list-style-type: none"> <li>Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)</li> </ul>	<p><b>SL.8.5</b> Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1)</p>

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<b>MS-ESS2-6.</b>	<b>MS. Weather and Climate</b> Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	<b>Developing and Using Models</b> Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and use a model to describe phenomena. (MS-ESS2-6)	<b>Systems and System Models</b> • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)	<b>SL.8.5</b> Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6)
<b>HS-ESS1-1.</b>	<b>HS. Space Systems</b> Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation.	<b>Developing and Using Models</b> Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). • Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1)	<b>Scale, Proportion, and Quantity</b> • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1)	<b>MP.2</b> Reason abstractly and quantitatively.
<b>HS-ESS1-2.</b>	<b>HS. Space Systems</b> Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.	<b>Constructing Explanations and Designing Solutions</b> Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS1-2) ----- <b>Connections to Nature of Science</b>  <b>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</b> • A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2)	<b>Energy and Matter</b> • Energy cannot be created or destroyed—only moved between one place and another place, between objects and/or fields, or between systems. (HS-ESS1-2) ----- <b>Connections to Engineering, Technology, and Applications of Science</b>  <b>Interdependence of Science, Engineering, and Technology</b> • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-2) ----- <b>Connections to Nature of Science</b>  <b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b> • Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-ESS1-2) • Science assumes the universe is a vast single system in which basic laws are consistent. (HS-ESS1-2)	<b>MP.2</b> Reason abstractly and quantitatively.

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<a href="#"><b>HS-ESS1-3.</b></a>	<b>HS. Space Systems</b> Communicate scientific ideas about the way stars, over their life cycle, produce elements.	<b>Obtaining, Evaluating, and Communicating Information</b> Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. <ul style="list-style-type: none"> <li>Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)</li> </ul>	<b>Energy and Matter</b> <ul style="list-style-type: none"> <li>In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3)</li> </ul>	<b>SL.11-12.4</b> Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-ESS1-3) <b>MP.2</b> Reason abstractly and quantitatively.
<b>HS-ESS1-4.</b>	<b>HS. Space Systems</b> Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	<b>Using Mathematical and Computational Thinking</b> Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. <ul style="list-style-type: none"> <li>Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)</li> </ul>	<b>Scale, Proportion, and Quantity</b> <ul style="list-style-type: none"> <li>Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-ESS1-4)</li> </ul> <p>-----</p> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p><b>Interdependence of Science, Engineering, and Technology</b></p> <ul style="list-style-type: none"> <li>Science and engineering complement each other in the cycle known as research and development (R&amp;D). Many R&amp;D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-4)</li> </ul>	<b>MP.2</b> Reason abstractly and quantitatively. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-4) <b>MP.4</b> Model with mathematics. (HS-ESS1-1),(HS-ESS1-4)