									Scientific and Engineering Practices (SP / EP)							
Inv	**Inv Title**	**Part**	**Part Summary**	**Sessions**	**Content**	**NGSS Standards Addressed (Performance Expectations)**	**Disciplinary Core Ideas (Framework)**	**Crosscutting Concepts**	**Asking questions (SP) / Defining problems (EP)**	**Developing and using models**	**Planning and carrying out investigations**	**Analyzing and interpreting data**	**Using mathematics and comp. thinking**	**Constructing explanations (SP) / Designing solutions (EP)**	**Engaging in argument from evidence**	**Obtaining, evaluating, and communicating information**
1	**Where Am I?**	1	**School to Space** Students use web-based images centered on their school to observe and describe where they are as their point of view moves away from Earth's surface in powers of ten. When students retreat to a distance of 10,000 km above their school, they can see that they are on Earth, a planet surrounded by the darkness of space. The ideas of frame of reference and point of view are incorporated into their description of where they are.	2	● Location or position can be described in terms of a frame of reference (relationship to other objects). ● Point of view is the position from which a visual observation is made. ● Altitude is the distance above Earth's surface. ● Elevation is the distance above average sea level.			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),(MS-ESS1-4)				**SP**		**SP**		**SP**
1	**Where Am I?**	2	**Moon Watch** Students go outdoors, turn their gazes away from Earth, and discover the Moon. After observing the shape, tilt, color, size, and location of the Moon, students share what they know about how the Moon changes over time. To check their ideas, students start a Moon log to chart daily changes in the Moon's appearance.	1	● The Moon can be observed both day and night.	MS-ESS1-1. 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.		Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1)	**SP**		**SP**	**SP**				**SP**
2	**A Round, Spinning Earth**	1	**Sailing Ships** Students are asked to generate evidence that Earth is a sphere. They sail a small ship across models of flat and spherical Earths. They work with a multimedia simulation of ships sailing across a flat sea and a curved sea. Students develop a rational argument for a spherical Earth.	1-2	● Line of sight is the straight, unimpeded path taken by light from an object to an eye. ● Objects appear to sink when they move across the ocean and slip below the horizon on a curved surface.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2)		**SP**	**SP**	**SP**		**SP**	**SP**	**SP**
2	**A Round, Spinning Earth**	2	**Earth/Sun Relationship** After writing an explanation for what causes day and night, students imagine one of their eyes as an observer on Earth and position themselves around a lamp to observe night and day. Students discover that rotation of Earth results in day and night and, in the process, figure out which direction Earth rotates on its axis. The day/night mechanism is reinforced with globes. Students also learn about the tilt of Earth's axis and Earth's yearly rotation around the Sun.	3	● At all times, half of Earth is illuminated (day), and half is dark (night). ● Daytime and nighttime are the result of Earth's rotation on its axis. ● Earth's axis tilts at an angle of 23.5° and points toward the North Star.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2)		**SP**	**SP**	**SP**		**SP**	**SP**	**SP**

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3	Seasons	1	**Summer Heat** Students investigate the variables that describe seasons. They observe that a flashlight beam shining directly perpendicular to the floor produces a round spot, and the same beam directed at an angle produces an elongated, oval spot. The area covered by the same beam of light changes, depending on the angle. Beam spreading is introduced as the mechanism that affects the energy density of light falling on Earth's surface. Students find that beam spreading and duration of sunshine are the main variables that affect the temperature during the seasons.	1-2	● The lower the angle at which light strikes a surface, the lower the density of the light energy. ● Beam spreading affects the intensity of solar radiation on Earth's surface.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1)		**SP**	**SP**	**SP**		**SP**	**SP**	**SP**
3	Seasons	2	**Day Length** Students read an account of day length around the planet and graph the duration of daylight throughout the year. They determine that tilt of Earth on its axis, and the invariable angle of the tilt, can account for variable day length. They determine that the tilt and direction of Earth's axis and Earth's position in its orbit around the Sun account for seasons.	5	● The tilt of Earth's axis and Earth's revolution around the Sun results in seasons. ● The duration of daylight at a position on Earth's surface varies as Earth revolves around the Sun, due to the tilt of Earth's axis.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1)		**SP**	**SP**	**SP**	**SP**	**SP**	**SP**	**SP**
4	Moon Study	1	**A Close Look at the Moon** Students focus on the Moon's surface features. They study an image of the Moon to observe and catalog the major features. They also read a myth that originated in Maori culture to explain the appearance of the Moon. Students then generate a set of questions about the Moon, organize them into categories, and use them to guide their continued inquiry into the Moon.	2	● The Moon has surface features that can be identified in telescope images: craters, maria, and mountains. ● The Moon, Earth's satellite, is slightly more than one-fourth Earth's diameter and orbits at a distance of about 384,000 kilometers.	MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.			**SP**							**SP**

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4	**Moon Study**	2	**How Big/How Far?** Students explore the Earth/Moon relationship by creating a scaled model of the system.Using a small globe as a starting point, they calculate the diameter of a ball to represent the companion Moon, and then position it at the right distance to represent the Moon's orbital distance.	1-2	● Scale is the size relationship between a representation of an object and the object. ● Scale can be expressed as a ratio when an object and its representation are measured in related units.	MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2)	**SP/ EP**	**SP**	**EP**		**EP**			**SP/ EP**
5	**Phases of the Moon**	1	**Observed Patterns** Students update and study their Moon Logs to determine the sequence of changes. They learn phase vocabulary, then study moonrise. Students use small polystyrene balls and a light source to simulate Moon phases. They incorporate their small globes into the system to obtain another point of view on Moon-phase mechanics. Finally, they use a light source and a large Moon globe to study Sun/Earth/Moon relationships, including eclipses.	2	● The Moon goes through phases: "new" to "full" and back to "new" in a 4-week cycle. ● The Moon shines as a result of reflected light from the Sun. Half of the Moon is always illuminated (except during a lunar eclipse). ● The Moon revolves around Earth once in 4 weeks, resulting in the Moon's rising about 50 minutes later each day. ● The revolution of the Moon around Earth and the rotation of Earth on its axis account for the phases of the Moon and the time of day (or night) when the Moon is visible.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1)	**SP**	**SP**	**SP**	**SP**		**SP**	**SP**	**SP**
5	**Phases of the Moon**	2	**Moon-Phase Models** Students complete a Moon-phase sheet that displays images of phases from two points of view simultaneously. To help them visualize the points of view, students assemble an Earth-Moon model, using their globes and polystyrene balls, and work with a Moon-phase puzzle.	1	● The Moon shines as a result of reflected light from the Sun. Half of the Moon is always illuminated (except during a lunar eclipse). ● Moon phase depends on how much of the Moon's illuminated surface is visible from Earth, which is determined by the relative positions of Earth and the Moon in their orbits around the Sun. ● The revolution of the Moon around Earth and the rotation of Earth on its axis account for the phases of the Moon and the time of day (or night) when the Moon is visible.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)		**SP**	**SP**	**SP**		**SP**	**SP**	**SP**

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5	**Phases of the Moon**	3	**Moon-Phase Simulation** Students work with multimedia simulations—"Phases of the Moon" and "Lunar Calendar"—to reinforce their understanding of what causes the phases of the Moon.	2	• Moon phase depends on how much of the Moon's illuminated surface is visible from Earth, which is determined by the relative positions of Earth and the Moon in their orbits around the Sun. • The revolution of the Moon around Earth and the rotation of Earth on its axis account for the phases of the Moon and the time of day (or night) when the Moon is visible.	MS-ESS1-1. 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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)		**SP**	**SP**	**SP**		**SP**	**SP**	**SP**
6	**Craters**	1	**Moon Craters** Students are introduced to the historical controversy regarding the origin of the craters on the Moon: impacts or volcanism? Students design experiments using flour and marbles or rocks to investigate different variables and determine if impact events could be responsible for the extensive cratering on the Moon's surface.	3	• Craters of various sizes and types result when meteoroids of various sizes impact the surface of planets and satellites. • Craters can be categorized by size and physical characteristics: simple, complex, terraced, ringed (or basin), and flooded.		Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1)	**SP**	**SP**	**SP**	**SP**	**SP**	**SP**	**SP**	**SP**
6	**Craters**	2	**Target Earth** Students scrutinize the Moon's maria to determine the frequency of major impacts since mare formation 4 billion years ago. They use these data to determine the number of major Earth impacts over the same period and to determine the frequency of such events on Earth.	3	• Earth and the Moon have been, and continue to be, subjected to the same rate of bombardment by meteoroids. • Earth's record of impacts has been erased by the actions of wind, water, and tectonic activity.		The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)	**SP**		**SP**	**SP**	**SP**	**SP**		**SP**
7	**Beyond the Moon**	1	**What's Out There?** Students generate drawings depicting all the objects in the solar system. They then work in pairs with a set of cosmos cards that represent objects in the universe. Students use images and information to organize the cards, including putting them in order based on distance from Earth. To do so, students learn to think of celestial distance in astronomical units and light-years. They analyze cosmos objects that fall into three categories: solar system, Milky Way galaxy, and universe.	2	• The solar system includes the Sun; eight planets and their satellites; and a host of smaller objects, including dwarf planets, asteroids, comets, Kuiper Belt objects, and Oort Cloud matter.	MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	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),(MS-ESS1-4)	**SP**		**SP**					**SP**

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7	**Beyond the Moon**	**2**	**Origins** Students study and sequence ten Solar System Origin cards, starting with a nebula. As a result of reasoning and class discussion, students determine the cards' most likely sequence, which should vary only slightly from nebula, contracting, heating, disk forms, Sun turns on, condensing, accreting, gas giants, rocky planets, and flinging. Students are presented with four theories to explain the formation of our Moon: capture, daughter, big impact, and sisters. After seeing video animations of the four theories, students choose and defend one of the theories.	2-3	● The solar system formed during a sequence of events that started with a nebula of dust and gas. ● The Moon formed after a massive collision between the forming Earth and a planetesimal about the size of Mars.	MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3) The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)	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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)		**SP**				**SP**	**SP**	**SP**
8	**The Solar System**	**1**	**Where Are the Planets?** Students attempt to understand the relative sizes and spacing of the planets and the Sun. First they determine how big to make the Sun and how far away to place it to be a proportional companion for their 12 cm Earth globe. Next they make a model of the inner solar system, scaled 1 cm = 1 million km. Finally they imagine a 1m Sun in their classroom, and place the planets on a map of their community.	2	● The distance between solar system objects is enormous.	MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2)		**SP**	**EP**		**EP**			**SP/ EP**
8	**The Solar System**	**2**	**Comparing Temperatures and Atmospheres** Students predict the temperature range and average temperature for each of the eight planets. They use actual atmospheric data and temperature data to look for a relationship between atmosphere and temperature. Finally, students think about the interactions of several planetary environmental factors that make it possible for the liquid water to be present, a key factor in the search for life.	2	● Liquid water is essential for life as we know it. ● The temperature on a planet depends on two major variables: distance from the Sun and the nature of the planet's mediating atmosphere.		Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)	**SP**	**SP**	**SP**	**SP**		**SP**	**SP**	**SP**

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8	**The Solar System**	3	**Where Is the Water?** Students study satellite images of typical water-related landforms on Earth. They identify bodies of liquid water (ocean, lake, river) and deposits of ice and snow, as well as landforms that suggest the presence of water at earlier times. They search images of planets and satellites for evidence of water on extraterrestrial bodies in the solar system.	3	● Images can convey information about the presence and history of liquid water on planetary surfaces.		Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)		**SP**			**SP**		**SP**	**SP**	**SP**
9	**Space Exploration**	1	**Light Spectra** Students learn that most of the information used by astronomers comes to them as light. Students learn that light travels in waves of many different wavelengths, and the wavelength determines its color. They use a spectroscope to observe the radiant spectra of a number of light sources, including the Sun, fluorescent lamps, and incandescent lamps. They learn that bright emission lines and dark absorption lines in a spectrum provide information about the composition of the light source.	2	● A spectroscope analyzes the wavelengths of light (spectrum) coming from a light source. ● Scientists use spectral data from distant moons, planets, and stars to determine their temperature, composition, motion, and more	MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)	Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)			**SP**	**SP**		**SP**		**SP**
9	**Space Exploration**	2	**Exploration of the Solar System** Students review what they've been learning about big questions in astronomy. Having researched past, present, and future NASA missions, students reflect on what answers the missions found and what methods are planned for answering the questions that frame current and future missions.	3	● Scientific missions provide data about the composition and environmental conditions on the planets, moons, and other bodies in the solar system.		Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	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) Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)	**SP/ EP**					**SP/ EP**		**SP/ EP**

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10	**Orbits and New Worlds**	**1**	**The Moons of Jupiter** Students study images of Jupiter to discover that it has four bright moons. Just as Galileo did more than 400 years ago, students track the motion of the moons to determine their orbit radii and periods, using records of observed data collected over 19 consecutive nights.	1	● Planetary-system objects move in measurable and predictable patterns.		Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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),(MS-ESS1-4) 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) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1) Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)		**SP**		**SP**	**SP**	**SP**	**SP**	**SP**
10	**Orbits and New Worlds**	**2**	**Looking for Planets** Students investigate techniques that scientists use to find and study planets orbiting other stars. Using an orrery and light sensor, they generate transit graphs and analyze them to draw conclusions about unknown planets. They are introduced to the NASA Kepler Mission and its goal to find Earth-size planets in our galaxy.	2	● A transit occurs when a planet passes between a star and an observer, causing a dip in the intensity of light from the star. ● The magnitude and duration of the dip in light intensity during a transit reveals information about the planet.		Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) Models can be used to represent systems and their interactions. (MS-ESS1-2) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2) Graphs and charts can be used to identify patterns in data. (MS-PS4-1) Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)	**SP**	**SP**		**SP**	**SP**	**SP**	**SP**	**SP**

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10	**Orbits and New Worlds**	**3**	**What Is Our Cosmic Address?** Students review what they have learned in the course and restate their cosmic address.	2	● Location can be described in relation to a frame of reference			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),(MS-ESS1-4) 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) Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)	**SP**					**SP**	**SP**	**SP**