

**\*Standards listed in bold font are Utah Core Science Standards. Those that are not in bold are supplemental.**

**\*\*Words that are in bold font in the lesson are vocabulary words that your child should know by the end of the lesson.**

**\*\*\*LM = Library Media, ELA.ST= English Language Arts, Science and Technology, K= Keyboarding, TS.W= History/Social Studies & Sciences and Technical Studies Writing**

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**Title of Lesson 1:** All about the Planets

<b>Standards Taught:</b> S.4, S.4.1, S.4.1.a, S.4.1.b, S.4.1.c, S.4.1.d, <b>S.6.1.3</b> , S.S.3, S.S.3.1, S.S.3.1.a, S.S.3.1.b, S.S.3.1.c, LM.4, L.M.4.1, LM.4.1.b, LM.4.1.d, LM.4.2, LM.4.2.a, LM.5, LM.5.1, LM.5.1.a, LM.5.1.b, LM.5.1.d, LM.5.1.e, LM.5.2, LM.5.2.a, LM.5.2.c, LM.5.2.d, LM.5.2.e, LM.6, LM.6.1, LM.6.1.a, LM.6.1.c, LM.6.1.f, LM.6.1.g, LM.6.2, LM.6.2.A, LM.7, LM.7.1, LM.7.1.c, LM.7.1.e, 6.ELA.ST.2, 6.ELA.ST.4, 6.ELA.ST.7		
<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
<p>This <a href="#">video</a></p> <p>This <a href="#">website</a></p> <p>This <a href="#">website</a></p> <p>Blank papers and a pencil/pen</p> <p>Colored pencils, markers, or crayons</p>		<p>Give your child the paper and pencil/pen. Tell them that today we are going to learn about our <b>universe</b> (all existing matter in space), our galaxy, and our solar <b>system</b> (the system of planets and objects that orbit around a star) today. Explain that they should take notes as they explore and learn on the following subjects:</p> <p><b>Our galaxy: The Milky Way</b> <b>The Sun</b> Each of the <b>Planets</b> (including classification, shape, side, color, makeup, temperature, <b>orbits</b>, and location within the solar system)</p> <p>Allow your child to watch the video and explore the websites, looking for this information. Encourage them to organize their notes and keep them neat, as they will need them for the next lesson. Explain that they will be building a model of the solar system and need details such as color, size, and <b>distance</b> between planets, as their model will be to <b>scale</b>. Note the use of the term <b>light-year</b>. Explain that space is so vast and distances are so large that we measure in light-years, or the amount of distance light can travel in one year. Due to the <b>speed of light</b>, this is a very large distance. A light year is just a little less than 6 trillion miles.</p> <p>Answer any questions your child may have, or help them research and find the answers. This is a great time to visit a planetarium (in person or virtual), check out books about space from the library, or explore different activities and information that can be found online (for ideas, see the More Resources section of the website).</p> <p>Finally, ask your child to draw out a rough sketch of the solar system that includes the sun, the planets, their orbits, and any other items or groups of <b>celestial objects</b> (any object located outside of the earth's atmosphere) they took notes on. Allow your child to color this model using their notes. Point out that it doesn't have to be perfectly to scale or look exactly right as it is just a rough draft.</p> <p>Begin researching different ways to model the solar system and have your child choose a method they like. An online image search is a great way to find ideas. Begin gathering supplies.</p>

## Title of Lesson 2: Modeling the Planets

<b>Standards Taught:</b> S.4, S.4.1, S.4.1.a, S.4.1.b, S.4.1.c, S.4.1.d, <b>S.6.1.3</b> , S.S.3, S.S.3.1, S.S.3.1.a, S.S.3.1.b, S.S.3.1.c, LM.4, L.M.4.1, LM.4.1.b, LM.4.1.d, LM.4.2, LM.4.2.a, LM.5, LM.5.1, LM.5.1.a, LM.5.1.b, LM.5.1.d, LM.5.1.e, LM.5.2, LM.5.2.a, LM.5.2.c, LM.5.2.d, LM.5.2.e, LM.6, LM.6.1, LM.6.1.a, LM.6.1.c, LM.6.1.f, LM.6.1.g, LM.6.2, LM.6.2.A, LM.7, LM.7.1, LM.7.1.c, LM.7.1.e, 6.ELA.ST.2, 6.ELA.ST.4, 6.ELA.ST.W.2, 6.ELA.ST.W.2.a, 6.ELA.ST.W.2.b, 6.ELA.ST.W.2.c, 6.ELA.ST.W.2.d		
<b>Materials:</b>  This <a href="#">website</a>  Supplies will vary depending on which model your child chose	<b>Preparation:</b>  Gather supplies needed for your child's choice of solar system model	<b>Implementing the Lesson:</b>  Ask your child to briefly review some of their notes from the previous lesson, using the model rough draft they created in the previous lesson. Allow them to reference their notes as needed, pointing out that organizing those notes helps them find information they need more quickly.  Have your child begin their model, first by identifying supplies for each planet and the sun. Allow your child to accurately scale down the planet size as much as possible. Scaling can be calculated at the website listed in the materials section. Explain that scaling something down simply means making it smaller, but keeping the same ratios of diameter and distance. Allow your child to color, paint, and texture, each planet, paying close attention to their notes for details. As the planets dry, help your child scale and draw out the orbits of each planet around the sun. Add any other celestial bodies your child took notes on and would like in their model (i.e. the Kuiper belt). Allow your child to build, color, and texture those pieces.  Finally, help your child put it all together. If your child's model has a movement aspect, this is the time to turn it on. Note your child's attention to detail and precision. Point out that models like this help scientists learn about our solar system and can help us understand how something works, even if it is very large in real life.  *This project may take more than one day. Allow your child to take their time and attend to precision as needed. The idea is not to pressure your child to finish quickly, but to help them focus on an accurate representation.

**Title of Lesson 3: Technology in Space**

<p><b>Standards Taught:</b> S.6.1.3, S.S.3, S.S.3.1., S.S.3.1.e, S.S.3.2, S.S.3.2.a, S.S.3.2.b, S.S.3.2.c, S.S.3.2.d, LM.4, L.M.4.1, LM.4.1.b, LM.4.1.d, LM.4.2, LM.4.2.a, LM.5, LM.5.1, LM.5.1.a, LM.5.1.b, LM.5.1.d, LM.5.1.e, LM.5.2, LM.5.2.a, LM.5.2.c, LM.5.2.d, LM.5.2.e, LM.6, LM.6.1, LM.6.1.a, LM.6.1.c, LM.6.1.f, LM.6.1.g, LM.6.2, LM.6.2.A, LM.7, LM.7.1, LM.7.1.c, LM.7.1.e, 6.ELA.ST.2, 6.ELA.ST.4, 6.ELA.ST.7, K.3.1, K.3.2, 6.TS.W</p>		
<p><b>Materials:</b></p> <p>Internet access</p> <p>Library books about space technology</p> <p>Blank paper and pen/pencil</p> <p>A document typing program (i.e. Word)</p>	<p><b>Preparation:</b></p>	<p><b>Implementing the Lesson:</b></p> <p>*This project is meant to take more than one day. Allow your child a day or two for research, a day to write their first draft, and a day to revise their work after you add your corrections and suggestion. Encourage your child to note their sources as they research so they can cite them in their paper.</p> <p>Tell your child that, this week, we are going to learn about different types of space technologies. Explain that technology is a machine, process, or technique that helps us to do something better or faster, or helps us to understand something better. Explain that humans have been using technology in space for hundreds of years, beginning with simple star charts and expanding and improving until today. Over time, technology improvements have helped us to better understand how the solar system, planets, sun, moon, and stars interact and exist.</p> <p>Ask your child to research the following subjects, note sources, organize information, write a report (at least an introduction, one paragraph per subject, and a conclusion), and revise and correct that report. Emphasize that your child should include what each object is, how it is used in learning about space, an example of how it is currently being used, and how it has changed the way we understand space/what we have learned from it:</p> <p><b>Telescopes</b> (including hobby telescopes, telescopes used by scientists, and those used in space)          Space probes          Space rovers          Space station          Space shuttles  <b>Satellites</b>          Computers</p> <p>After your child has gathered their research, help them to organize and write their first draft. Then, correct your child's work using common proofreader's marks (see table below) and ask them to revise and correct it into a final draft. Remind them that they need to cite their sources using APA style (this <a href="#">website</a> is a great resource for that)</p>

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a. Transpose ~
b. Insert ^
c. Lowercase <i>lc</i>
d. Capitalize ≡
e. Paragraph ¶
f. Add a space #
g. Move Left [
h. Move right ]
i. Delete ↵
j. Insert a period \.

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**Title of Lesson 4:** Comets, Asteroids, and Meteors

**Standards Taught:** 6.1.3, S.S.3, S.S.3.1, S.S.3.1.d

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
<p>This <a href="#">website</a></p> <p>This <a href="#">video</a></p> <p>Air dry clay in various colors</p>		<p>Ask your child to review a few of the things they've learned in the previous three lessons. Then, ask if they can name which celestial bodies we haven't researched yet: <b>comets, asteroids, and meteors</b>. Explain that these three space rocks are very similar, but have some important differences, too.</p> <p>Watch the video with your child. Then, allow your child to learn more by exploring the website. Finally, ask your child to use the clay to make a model comet, asteroid, and meteor and place them in their space model. Don't worry too much about scale as many of these objects can be a variety of sizes. Ask your child to focus on the similarities and differences between each type of space rock.</p>

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**Title of Lesson 5:** The Sun, Moon, and Earth (2 pages)

**Standards Taught:** S.6.1, S.1, S.1.1, S.1.1.c

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Globe  Flashlight  Mirror  Materials for the model your child chooses to make		<p>Review with your child what they've learned about the solar system so far. Discuss in detail the Earth, Moon, and Sun. Discuss size of each and the distance between. Ask your child what the sun provides to the Earth and other planets (heat and light), how the planets orbit (gravity), and why the moon glows (reflects the sun's light).</p> <p>The Sun: The sun is not a planet, but a star. The sun has a mass of <math>1,988,500 \times 10^{24}</math> kg. It is extremely hot and glowing ball of fiery gases at the center of our solar system. The sun is the largest star in our solar system and, with its large mass, creates a gravitational pull that causes the other planets to <b>orbit</b> (or <b>rotate</b>) around it. Planets are traveling at a high rate of speed constantly and would fly off in a straight line if the force of gravity from the Sun (objects with more mass have more gravitational pull) didn't pull them towards the Sun. The force of gravity combined with the kinetic (movement) force of the planets creates an orbit, or circular shaped movement around the huge mass of the Sun. The Sun sits at a fixed point at the center of our solar system and does not move.</p> <p>The Earth: The Earth is the only known planet in the universe that contains life. It is perfectly positioned at a distance between 91,400,000 and 94,500,000 miles away from the Sun. The distance of the Earth during its rotation around the Sun creates slight changes in temperature, creating the four seasons. This distance, along with the Earth's protective atmosphere, keeps the planet at the right temperature and climate for life. The Earth's mass is <math>5.9724 \times 10^{24}</math> kg. Much smaller than the Sun's.</p> <p>Like the other planets, Earth orbits the Sun. One trip all the way around the Sun creates a year on Earth, or 365 days. While orbiting, the Earth also <b>revolves</b> (or spins) on an <b>axis</b>. One revolution, or one time spinning all the way around, creates a day, about 24 hours. This revolution causes one side of the Earth to be in the sunlight (day) while the other side is in the dark (night). The Earth's axis can be found by drawing an imaginary line from the North Pole to the South Pole. This line is the center around which the Earth rotates. However, the Earth does not sit perfectly upright and has a slight <b>tilt</b> as it spins. This tilt changes the angles at which the sunlight hits different parts of the Earth. This creates a warm equator, cold poles, and helps in the creation of our four seasons, just as the distance from the Sun does. This explains why the Northern Hemisphere experiences the opposite season as the Southern Hemisphere (winter in Utah is summer in Australia). The combination of the Earth's tilt and the change in the distance from the Sun also cause winter days to be shorter (the Sun comes up later and goes down earlier) and summer days to be longer.</p> <p>Use a globe (representing the Earth) and flashlight (representing the Sun) to demonstrate the rotation and revolution pattern of the Earth. Ask your child to explain day and night, seasons, and years from this model. See this <a href="#">animation</a> for clarification.</p> <p>The Moon: Many planets have moons orbiting them as the planets orbit the sun. Earth has a single moon, which both rotates and revolves as it follows the Earth around the Sun. It is close enough to the Earth that it does not escape the</p>

gravitational pull of the planet and follows it, rather than the Sun. Point out that, in the previous animation, the moon was shown orbiting the Earth. Watch this [video](#) with your child. Explain that the moon's orbit is the same speed as its rotation, so from Earth, we only ever see one side of the moon. It takes about 28 days for the moon to complete its orbit around the Earth, roughly creating the cycle we know as a month.

The moon does not give off its own light like the sun, but **reflects** the light of the Sun back onto the Earth. Using the globe (to represent Earth), flashlight (to represent the Sun) and mirror (to represent the Moon), demonstrate how the light of the Sun also shines on the Moon. The Moon then reflects this light back onto the Earth. From Earth, this makes it look like the Moon is glowing.

The Earth relies upon the Moon for several functions which support life. The Moon's gravitational force controls tides, or water levels of the sea throughout the day. This affects wildlife and plants in and near the ocean. This change in gravitational force is also said to affect animals on land in various way. The Moon also slows down the Earth's natural wobble. As the Earth turns on its axis, it has a slight wobble, like a top that is slowing and about to fall down. Though the moon's mass is much smaller, the moon helps keep that wobble slow with its gravitational pull. Without it, the Earth's revolution pattern would change and the axis would not be at as constant an angle of tilt. This would likely lead to extreme weather changes and an unstable environment for life.

Ask your child to create a model of the mass, positions, and movement of the Sun, Earth, and Moon. This may be a physical model, a drawing, or a computer programmed model. Search online for ideas and help your child create their model. Ask them to explain the movements of the Earth and Moon and the need for the Sun and Moon to sustain life on Earth to someone in your family.

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**Title of Lesson 6:** Lunar Phases

<b>Standards Taught:</b> S.1, S.1.1, S.1.1.a, S.1.1.b, S.1.1.c, S.1.1.d, <b>S.6.1, S.6.1.1</b>		
<b>Materials:</b>  Observation Sheet 6	<b>Preparation:</b>	<b>Implementing the Lesson:</b>  Briefly review the previous lesson with your child. Remind them of the video you watched about the moon and ask them to tell you what they learned from that video.  Next, show your child this <a href="#">video</a> . Explain that the orbit of the moon around the Earth changes the angle at which the Sun's light hits the moon. This changes the appearance of the Moon from Earth, creating the different shapes we see in the night sky. These changes cycle through, according to the Moon's orbit, about once a month. This cycle is known as The Lunar Cycle and each phase is known as a <b>Lunar Phase</b> . Lunar simply means moon.  Show your child this <a href="#">image</a> and discuss the different lunar phases. Relate these to the phases you saw in the video. Then, ask your child to spend the next 30 days observing the moon. Each night, your child should record the moon phase by drawing the moon they see in the appropriate box and then labeling it with the correct phase. Help them to notice the slight changes in the moon as the days go by. Point out that the cycle begins to repeat itself around 28-29 days.  *You can also relate this to the social studies lesson about Egypt. Egyptians were one of the first known civilization to use the phases of the moon to understand time, creating months and years based on this cycle. This is where we got the idea of months from and why our calendar shows months are 28-31 days. Explain that the orbit of the Earth is actually 365.25 days, and the Egyptians didn't account for the 0.25 day (which we handle with leap year) so their months were exactly 28 days.

Observation Sheet 6

Day 1	Day 2	Day 3	Day 4	Day 5
Day 6	Day 7	Day 8	Day 9	Day 10
Day 11	Day 12	Day 13	Day 14	Day 15
Day 16	Day 17	Day 18	Day 19	Day 20
Day 21	Day 22	Day 23	Day 24	Day 25
Day 26	Day 27	Day 28	Day 29	Day 30

**Title of Lesson 7: Eclipses**

**Standards Taught: S.6.1, S.6.1.1**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>  <p>Ask your child to review what they've learned about the Sun, Moon, and Earth so far. Then, explain that the movement of planets and moons around the Sun sometimes create unique occurrences in which different celestial bodies line up and cast a shadow over each other. These occurrences are known as eclipses.</p> <p>Read the article <a href="#">here</a> with your child to learn more about lunar and solar eclipses. Then visit the gallery <a href="#">here</a> and explore the videos <a href="#">here</a>, <a href="#">here</a>, and <a href="#">here</a>. Ask your child if they've ever experienced an eclipse or tell them about one you have seen. Explain that eclipses are a normal part of life and have been happening for thousands of years.</p> <p>Next, explore some of the following scriptures and ask your child what they may be referring to: Isaiah 13:10, Joel 2:31, Mark 13:24, and Revelation 6:12.</p> <p>Look online for the date of the next eclipse that will be visible from your location and put it on your calendar. Remind your child of this lesson as you observe the eclipse with them.</p>
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## Title of Lesson 8: Stars and Culture

**Standards Taught:** S.4.2, S.4.2.a, S.4.2.b, S.4.2.c

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
A Star Chart  A clear, dark night  Observation Sheet 8  Telescope (optional)		<p>Ask your child to share what they know about stars. Explain that stars are not five-pointed like the shape we normally draw. They are actually very hot balls of gas formed when clouds of particles in space are pushed together and begin to spin. Stars can take millions of years to form in these clouds and can burn for millions of years afterwards. It is believed that the Milky Way alone contains around 400 billion stars. The <b>distances</b> between these stars can vary and all of them are several light-years away from Earth. The closest star system (other than our own sun) is known as Alpha Centauri, which is 4.25 light-years away from Earth.</p> <p>Like the sun and moon, stars appear to move across the night sky and change position during different seasons. Of course, this is really the Earth moving (rotation on its axis and orbit around the Sun). However, if you understand the regular patterns in this movement, the stars can help with navigation and have been used to create calendars (like the moon). See this <a href="#">video</a> for a time-lapse of the stars moving across the sky.</p> <p>Some groups of stars, known as <b>constellations</b>, have been named for a dot-to-dot picture they make. The stars in these groups are not actually connected and are usually very far away from each other. However, from Earth, humans see them as an image. There are 88 recognized constellations in the sky. These groups of stars, like landmarks in the sky, help with navigation and give humans an opportunity to share stories and ideas that were, at one point, a major part of religious beliefs.</p> <p>Many constellations are named after a mythological being. Often named after a god, goddess, or hero these groups of stars draw an image in the sky (with a little imagination) and preserve some part of ancient cultures. Go to this <a href="#">website</a> and choose 5 constellations you would like to know more about. Use Observation Sheet 8 to record what you learn. Then, go outside this evening and try to find the ones that are currently visible in your area. Use a star chart for reference. Show a friend or family member the ones you can find and share the stories of each constellation with them.</p>

Observation Sheet 8

Constellation Name	Drawing of Constellation	Its Story

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**Title of Lesson 9:** The Night Sky

**Standards Taught:** S.4.2.d, S.4.2.e

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Star Chart		<p>Review with your child what you've learned about stars so far. Discuss constellations and how they can act as landmarks in the night sky. Ask your child to describe ways this may be useful (i.e. navigation at night) and how the stories behind them can help us share the culture and beliefs of the past.</p> <p>Then, remind your child of the video from the previous lesson. Discuss how the rotation of the Earth on its axis makes it appear that the stars move across the sky each night, just like the Sun during the day. Then, explain that, because of the orbit of the Earth around the Sun, different stars are visible during different seasons. The stars we see in the spring are not the same ones we see in the fall. This is because stars are at a fixed point in space, they do not move. As Earth orbits the Sun, it travels across the areas where different stars and constellations are. Show your child the second image on this <a href="#">webpage</a> to illustrate. Use the star chart, too.</p> <p>If we know the patterns of the stars movement and the position of stars in our night sky for each part of the year, constellations can become landmarks in the sky. Like street signs, they can tell us which direction we are traveling. Sailors, astronauts, and even robotic spacecraft use constellations to tell where they are and in which direction they need to go. Polaris, or the North Star, is a common way to find North. This evening, use the directions <a href="#">here</a> to find Polaris and figure out where North, South, East, and West are.</p> <p>In ancient times, nature was used as a way to calculate time. Calendars were based on the length of sunlight for each day (as in Stonehenge), the harvest seasons (like in Babylon), the nearby rivers (like in Egypt), and the lunar phases (like in Rome). However, some ancient cultures used the stars and their seasonal appearance to create their own calendars. Read more <a href="#">here</a> about how the ancient Maya culture created one of the most accurate calendars ever made using the constellations. Then, add the appearance of landmark constellations to your own calendar to help you track the year. Take time in each season to go out and find each one.</p>

**Title of Lesson 10:** The Earth: Seasons

**Standards Taught:** S.2, S.2.1, S.2.1.a, S.2.1.b, S.2.1.c, S.2.2, S.2.2.a, S.2.2.b, S.2.2.c, S.2.2.d, S.2.2.e

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Globe  Internet access  Observation Sheet 10		<p>Review the following concepts with your child: Earth, the planet we live on is the only known planet in our solar system that supports life. The other planets are too hot, too cold, and/or too toxic for plants, animals, and humans to survive there. Earth rotates on its axis with one rotation creating 24 hours (a day and night). It orbits the Sun and a single orbit creates a year (365.25 days). Earth is also orbited by its moon, which goes through lunar phases, an entire cycle through which creates a month.</p> <p>Show your child the globe. Ask them to model the movement of the Earth in its rotation and orbit. Remind your child that Earth's axis is tilted. Explain that this tilt, along with Earth's movements is the reason we have <b>seasons</b>. Watch this <a href="#">video</a> with your child and discuss the light source angle, the length of daylight, and the temperature of the earth in each hemisphere during different seasons. Emphasize that the Northern hemisphere (north of the equator) and the Southern hemisphere (south of the equator) are in opposite seasons throughout the year because of the Earth's tilt.</p> <p>Help your child search online for the sunrise and sunset times for your area for a week during each season and record these times on Observation Sheet 10. Then, ask your child to calculate the average amount of sunlight your hemisphere gets during these times. Discuss how this, along with an angle the sun hits the earth would affect temperatures. Ask your child to model the position of the Earth relative to the sun in each of these seasons and explain what is happening during each season in each hemisphere. This <a href="#">website</a> is a great one to collect data from.</p>

**Observation Sheet 10**

<b>Day</b>	<b>Sunrise Time</b>	<b>Sunset Time</b>	<b>Total Hours of Sunlight</b>
April 10			
April 11			
April 12			
April 13			
April 14			
April 15			
April 16			
Average Daylight Hours for Spring			
July 10			
July 11			
July 12			
July 13			
July 14			
July 15			
July 16			
Average Daylight Hours for Summer			
October 10			
October 11			
October 12			
October 13			
October 14			
October 15			
October 16			
Average Daylight Hours for Autumn			
January 10			
January 11			
January 12			
January 13			
January 14			
January 15			
January 16			
Average Daylight Hours for Winter			

**Title of Lesson 11: Earth's Weather (2 pages)**

**Standards Taught: 6.3, 6.3.2, 6.3.3, 6.3.4**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
<p>Ice cold water with blue food coloring added</p> <p>Warm water with red food coloring added</p> <p>A clear container</p>		<p>Review the previous lesson with your child, asking them to explain how we get seasons and why the temperature of the different hemispheres changes throughout the year. Then, ask your child to explain the typical weather for each season in your area. Ask your child if the weather is exactly the same throughout the entire season or if it changes from day to day. Explain that, though there are weather patterns, it can be sunny during the winter and snow in the fall. These weather differences come because there are several other things working to create weather in your area.</p> <p>The water cycle: Ask your child to review the water cycle. Discuss how energy from the sun causes water to become vapor. This vapor then cools as it rises into the air, creating clouds. Clouds are then blown to different areas. When saturated, they send precipitation (rain, snow hail, etc.) back down to the Earth. The water cycle is one thing that affects weather.</p> <p>Gravitational forces: Briefly ask your child to review what a gravitational force is. Remind them that each piece of matter has mass (or weight). Everything with mass has an attraction, or pull towards, everything else with mass. This is why the planets orbit the Sun, they are within the range of distance at which the Sun's huge mass pulls them towards it. It is also why the moon stays in orbit around the Earth. The moon's orbit, however, also exerts a gravitational force back on the Earth, especially on water. Show your child the animations found <a href="#">here</a> and explain how tides affect water levels and local weather. Show your child this <a href="#">image</a> to compare high and low tide.</p> <p>Water and air density: Review density with your child (the amount of molecules in each area is higher = more dense). Water density and temperature can affect Earth's weather. Air acts a lot like water. This means that it can change densities at different temperatures. This is why warm air rises while cold air falls.</p> <p>Give your child the warm red water and ask them to pour it into the clear container. Then, ask them to pour in the cold blue water. Observe what happens. The warm water should rise to the top while the cooler water falls to the bottom. Air and water molecules change position based on their density.</p> <p>Air masses and pressure: Explain that the movement of hot and cold water and air, based on their densities, can affect weather. When warm air trades places with cool air, it can create wind and air masses. Watch this <a href="#">video</a> with your child and discuss how air masses and pressure can affect weather. Point out that lower temperatures bring higher air pressure while warm temperatures reduce the pressure (pressure = the amount of force the air mass on the Earth's surface).</p> <p>Throughout the week, ask your child to check the weather forecasts and record them on Observation Sheet 11. Ask them to predict the weather for each day based on the pressure and record whether or not their predictions (and those of the weatherperson) were correct.</p>

		<p>In our area, an example of how air masses, temperature, and density affect weather is lake-snow effect. When cold, dry air goes over the Great Salt Lake, it picks up warmth and moisture. This, when coupled with the correct wind speed and temperature, creates a snow storm. Another example is cold-weather inversions. During this event, warm air rises above the cold air below, trapping the denser cold air like a lid. Pollutants in the air then have no way to escape the valley until a windy day or storm comes along, leaving the air dirty and unhealthy.</p> <p>Finally, Earth is unique in all the planets because it has a controlled atmosphere. The atmosphere cloaks our planet, holding in the oxygen and allowing our weather systems to stay contained to our planet. It also acts as a natural greenhouse, keeping the earth at the perfect warm temperature to sustain life but not allowing us to get too hot. No other planet has an atmosphere quite like Earth's, which is why life only exists here.</p>
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Observation Sheet 11

Date	Air Pressure	Humidity	Weather Prediction	Actual Weather

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## Title of Lesson 12: Forces in the Solar System

**Standards Taught:** S.3.3, S.3.3.a, S.3.3.b, S.3.3.c, **S.6.1.2**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Ball or other object that can easily be thrown and swung by your child  String		<p>Review with your child all they have learned about the Solar System, Earth, the Sun, and the Moon. Discuss how different forces affect the movement and weather on our planet. Then, ask your child what a <b>force</b> is. Explain that a force is a strength or energy as an attribute of action or movement. In short, a force is something that makes things do things.</p> <p><b>Gravity</b> is one force. It is what holds us down on Earth, rather than us just floating away. It is the reasons things fall. Gravity is directly related to the <b>mass</b> of an object. Everything with mass (mass = the quantity of matter something contains) has a <b>gravitational force</b>, or pull on other objects. Objects with a higher mass have a stronger pull as long as it is the same distance away from whatever it is pulling on.</p> <p>The most massive object in our solar system is the sun. This means that it also has the most gravitational pull. This gravity is what keeps the planets in the same orbital patterns. The sun is constantly pulling the planets towards it. However, there is another force at work in these orbits. Inertia (the tendency of objects to keep doing what they were doing before – moving objects want to keep moving, stopped objects will stay stopped) is pushing the planets away from the sun at the same time the sun is pulling them closer. Scientists believe that the Big Bang pushed planets outward and that inertia from that explosion is still working on the planets now. However, the gravity from the sun counteracts the inertia just enough that the planets orbit in their relative positions.</p> <p>Likewise, the moon orbits the earth because of these two forces. The Earth's gravity is pulling on the moon. The moon, of course, is pulling back. You can see evidence of this in tides. However, the moon also has inertia that causes it to move forwards. The result is an orbit around the Earth. The moon is close enough to the Earth that Earth's gravity affects it more than the far-away sun. So, while the moon does orbit the sun with the Earth, it does not fly into its own Earth-free orbit because Earth's gravitational force is holding it in place.</p> <p>Give your child the ball/object. Ask them to drop this object and observe what happens. Then, ask them to explain why the ball fell to the ground. Point out that the gravitational force of the Earth pulled on the object and made it fall. Next, ask your child to throw the ball. Ask them to share their observations in what changed when they threw, rather than dropped the object. Point out that the ball traveled further because it had another force applied to it, the force of your hand pushing it forward. However, it still fell to the ground, overcome by gravity. Finally, ask your child to secure the string around the ball and spin it around at the end of the string while holding the sting securely. Point out that the inertia of them spinning the ball keeps it in motion, but the pull of the string keeps it at the same difference. This is how inertia and gravity work together to keep orbits relatively constant.</p>

**Title of Lesson 13: Microorganisms (2 pages)**

**Standards Taught:** S.5, S.5.1, S.5.1.a, S.5.1.b, S.5.1.c

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Poster board  Masking tape  Meter stick  Ruler that measures cm  Microscope  Slides with a sample of each of the following: bacteria, algae, fungi, protozoa (This is a great <a href="#">website</a> to gather these materials)		<p>Watch this <a href="#">video</a> with your child to introduce microorganisms. Then, discuss the following information.</p> <p>Microorganisms are small, sometimes single-celled organisms. Singled-celled means that their entire body is made up of only one cell. (Unlike humans, who are made up of at least 30 trillion cells). Microorganisms (or microbes) are so small that you need a microscope to see them.</p> <p>Ask your child to separate a single hair on their head. Discuss its size. Explain that a human hair is 0.1 mm wide. Using a scale of 10,000:1, measure out an area that is 1 meter long and mark that area with the masking tape, writing <i>Human Hair</i> on top of the tape. Then, explain that a human red blood cell is 0.01 mm wide and measure out an area that is 10 cm long. Mark it with masking tape and label. Finally, measure out the following in scale and mark each with labeled masking tape: paramecium 0.2 mm or 2 cm in scale. Scenedesmus 0.03 mm or 30 cm in scale. E. coli 0.002 mm or 2 cm in scale. Polio 0.00002 or 0.2 mm in scale. Discuss the various sizes and compare the size of microorganisms with each other and with the other items. Point out that viruses (like polio) are the smallest microorganisms.</p> <p>There are millions of different types of microbes around the world, each surviving in different environments (even where humans cannot survive) and with different characteristics. Scientists separate these different microbes into five different categories.</p> <p><b>Bacteria-</b> Single-celled organisms, that sometimes pair together. Oldest living things on Earth (about 3 billion years). Come in different shapes, such as spheres, rods, or spirals. Bacteria is plural, bacterium is singular. Decomposers. Can also cause illness in living organisms. E. Coli is an example of bacteria.</p> <p><b>Algae-</b> Single or multi-celled organism capable of producing oxygen. Single-celled versions are microorganisms. Some types considered a plant, and can engage in photosynthesis (produce their own food). Produces an estimated 70% of the oxygen on earth. Grow in water. Algae is plural. Alga is singular. Usually green in color, but not always.</p> <p><b>Fungi-</b> Decomposers which cannot produce their own food or engage in photosynthesis. Reproduce using spores (small, seed-like cells). Can be singular or multicellular. Connect to food sources through hyphae (thread-like filaments). Mushrooms and mold are an example of fungi. Can be beneficial (yeast helping bread to rise, discovery of penicillin) or harmful (mold ruining foods, cause of illnesses)</p> <p><b>Viruses-</b> Microorganisms which contain DNA or RNA coupled with proteins and can infect a host, sometimes causing illness and disease (not all viruses make you sick). Multiplies within a host, but cannot reproduce on its own. Acellular (they don't have cells).</p> <p><b>Protozoa-</b> Microorganisms that have the ability to move and hunt. Most are single-celled. Some parasites are protozoa (if they are small enough) and can cause harm to humans. Feed on and destroy other microorganisms. See the information and images <a href="#">here</a>, too.</p>

Ask your child to observe each type of microorganism under the microscope as you discuss them. Explain that, because of the small size of viruses, a special type of microscope is used and you will likely not be able to see it with your simple one. Then, ask your child to use what they've learned about types of microorganisms to create a poster board like the one below and fill in the information. Encourage your child to make their poster board presentable and neat and fill in as many boxes as they can.

Microorganisms								
What is a microorganism:								
Classification:	Size:	Color and Structure:	Name and Image of an Example:	Needs & Environment:	How can it be Beneficial:	How can it be Harmful:	Reproduction	Interesting Notes:
<b>Bacteria</b>								
<b>Algae</b>								
<b>Fungi</b>								
<b>Viruses</b>								
<b>Protozoa</b>								

Hang your child's poster board somewhere it is visible while you work on school. Leave it there as a reference for the next few lessons.

\*Some of the information for this lesson was found [here](#)

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**Title of Lesson 14: Microorganisms Environmental Experiment**

**Standards Taught:** S.5, S.5.2, S.5.2.a, S.5.2.b, S.5.2.c

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
3 Bowls, microwave safe  1 cup of water, divided  1 package yeast, divided  2 Tbsp. sugar, divided  Microwave		<p>Review the previous lesson with your child, using their poster board for reference. Remind your child that there are several different types of microorganisms with different characteristics, needs, and abilities. Many are able to survive in environments that humans wouldn't. Microorganisms can be found where it is very cold, very hot, where the radiation levels are high or the oxygen levels are low. Microorganisms live all around, and even inside of us. However, like larger organisms, not all microorganisms can thrive in all environments. Some are adapted to live in one extreme, but would not survive in another. Watch this <a href="#">video</a> with your child and discuss the things you learned there.</p> <p>Briefly discuss the yeast fungus with your child. Explain that yeast is a microorganism that helps breads rise and become fluffy through a process called fermentation. Yeast can also cause infections in humans and animals. However, yeast needs certain things (types of food, temperatures within a certain range, moisture levels) to survive. In the absence of these things, yeast will lie dormant, or not work to produce the carbon dioxide, which make the bubbles that help bread rise.</p> <p>Ask your child the following question: What would happen to yeast if one or more of the things that it needs to survive in an active state were altered, or changed?</p> <p>Next, conduct the following experiment with your child. In each of the three bowls, place 1/3 c. of water. Heat one bowl in the microwave for about 30 seconds, until warm. Add 1 Tbsp. sugar to the heated bowl and stir. Add 1 Tbsp. to one of the cold bowls and stir. Label each bowl accordingly: sugar but no heat, no heat and no sugar, heated with sugar. Next, open the package of yeast. Review the fact that yeast is a fungus, a living thing. Discuss why the yeast is not growing in the package (no food, no moisture). Divide the yeast between the three bowls and stir. Allow the bowls to sit for 5 minutes. Return to observe the bowls. What happened to the yeast with no heat and no sugar? The yeast that was cold, but had sugar? The yeast that was warm with sugar. Point out that the foam created is a sign that the yeast is eating. Ask your child to observe which bowl is doing the best, or thriving. Point out that the yeast needed the water, heat, and sugar, or food, to thrive. Then, ask your child if there are signs that the yeast in the other bowls are surviving. Point out that the cold bowl with sugar is also foaming, but not as much. Though yeast can survive with cooler temperatures, it does better in warm climates or areas. Finally, point out that the cold yeast with no food does not show signs of activity. Moisture alone is not enough to activate yeast. Take a photo of the bowls, with labels for next week's lesson. Allow the bowls to sit overnight and re-observe and photograph, noting any changes.</p>

**Title of Lesson 15:** Microorganisms Environmental Experiment Results

<b>Standards Taught:</b> S.5, S.5.2, S.5.2.a, S.5.2.b, S.5.2.c, S.5.2.d, S.5.2.e, ELA.ST.R.1, ELA.ST.R.2, ELA.ST.R.3, ELA.ST.R.4, ELA.ST.R.7, ELA.ST.R.9, ELA.ST.R.10, ELA.ST.W.1, ELA.ST.W.1.b, ELA.ST.W.1.e, ELA.ST.W.2, ELA.ST.W.2.a, ELA.ST.W.2.b, ELA.ST.W.2.c, ELA.ST.W.2.d, ELA.ST.W.2.e, ELA.ST.W.2.f, ELA.ST.W.4, ELA.ST.W.5, ELA.ST.W.6, ELA.ST.W.7, ELA.ST.W.8, ELA.ST.W.9, ELA.ST.W.10		
<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Notes, images, and observations from previous lesson  Poster boards or tri-fold project board (like the ones you see at science fairs)  Markers, Crayons, Construction Paper and other supplies your child might need  Index Cards		<p>Ask your child to review what they learned through the science experiments in the previous two lessons. What question did they set out to answer? What did they guess would happen? What steps did they take to learn more about it? What research did they do? What answers did they find?</p> <p>Praise your child for their hard work and success in finishing the project and striving to learn more. Then, tell your child that they are going to prepare a presentation for their experiment. Give your child the materials and explain that they can organize the information any way they want. It should be neat and show the learning process that they went through during the experiment. It should include the following:</p> <p>A title (usually the question you set out to answer) Hypothesis (your guess) Procedure (or steps taken to carry out the experiment) Research information relevant to the experiment (with sources cited) Conclusion (what did you learn? Was your hypothesis correct?) Photographs, drawings, and/or models of the experiment</p> <p>Next, ask your child to create presentation cards, outlining the script for presenting their experiment. This should be in a formal style, include an introduction, walk through the procedure, explain how research is relevant, contain domain-specific and transitional wording, and provide a concluding statement. Ask your child to type this script, allow an adult to proofread it, and make corrections.</p> <p>Finally, allow your child to practice their presentation a few times until they are comfortable. Provide feedback and ideas for improvement. Allow your child to present their work (in-person or through video) to a friend, family member, or other group.</p> <p>*This project should take about a week to complete.</p>

**Title of Lesson 16:** Ecosystem Interactions

**Standards Taught:** 6.4, 6.4.1, 6.4.2

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
A computer with internet access  A printer		<p>Review with your child what an ecosystem is. Remind them that an ecosystem consists of living and non-living things that depend upon and interact with each other in order to survive. Ask your child to name a few examples of ecosystems (e.g. tundra, desert, rainforest, lake, ocean, forest, mountain). Briefly discuss some of the plants and animals in each ecosystem. Point out some of the physical and behavioral adaptations that help each animal survive in their ecosystem.</p> <p>Next, ask your child how these plants and animals interact. Point out that the organisms in an ecosystem rely upon each other. For example, if snakes disappeared from a desert, there would be so many rodents that food would be scarce and disease would likely spread. Likewise, if rodents disappeared, snakes would starve and hawks would have to find alternative prey. Explain that each organism has a relationship with the others in the ecosystem.</p> <p>Explain that there are three different types of ecosystem relationships: competition, predation, and mutualism. In a competition relationship, the plants and/or animals are competing for the same resources. They each have the same needs. An example of this is water in the African savannah. Often, you can observe a variety of animals gathered at watering holes all at the same time. Animals that wouldn't usually be close to each other, such as zebra, elephants, gazelle, and lions, all compete for the water. A predation relationship consists of a predator and prey. Lions and gazelle are examples of this, as the lions hunt gazelle and eat them to survive. Finally, in a mutualism relationship, the animals rely upon and need each other to survive. In Africa, an example of this type of relationship is ants and the acacia tree. The tree has hollow areas where the ants are able to build their hive and find shelter. If the tree is attacked by a predator (e.g. a giraffe tries to eat it) the ants come out of their hive and protect the tree. In this way, both the ants and the tree obtain something they need to survive from each other.</p> <p>Ask your child to choose an ecosystem that interests them and research the types of plants and animals found there. Then, ask them to create a poster that shows different types of interactions within that ecosystem. Print images of each organism and draw arrows, boxes, or charts that show these interactions. Be sure to include examples of competition, predation, and mutualism and label them as such. Finally, ask your child to share what they've learned.</p>

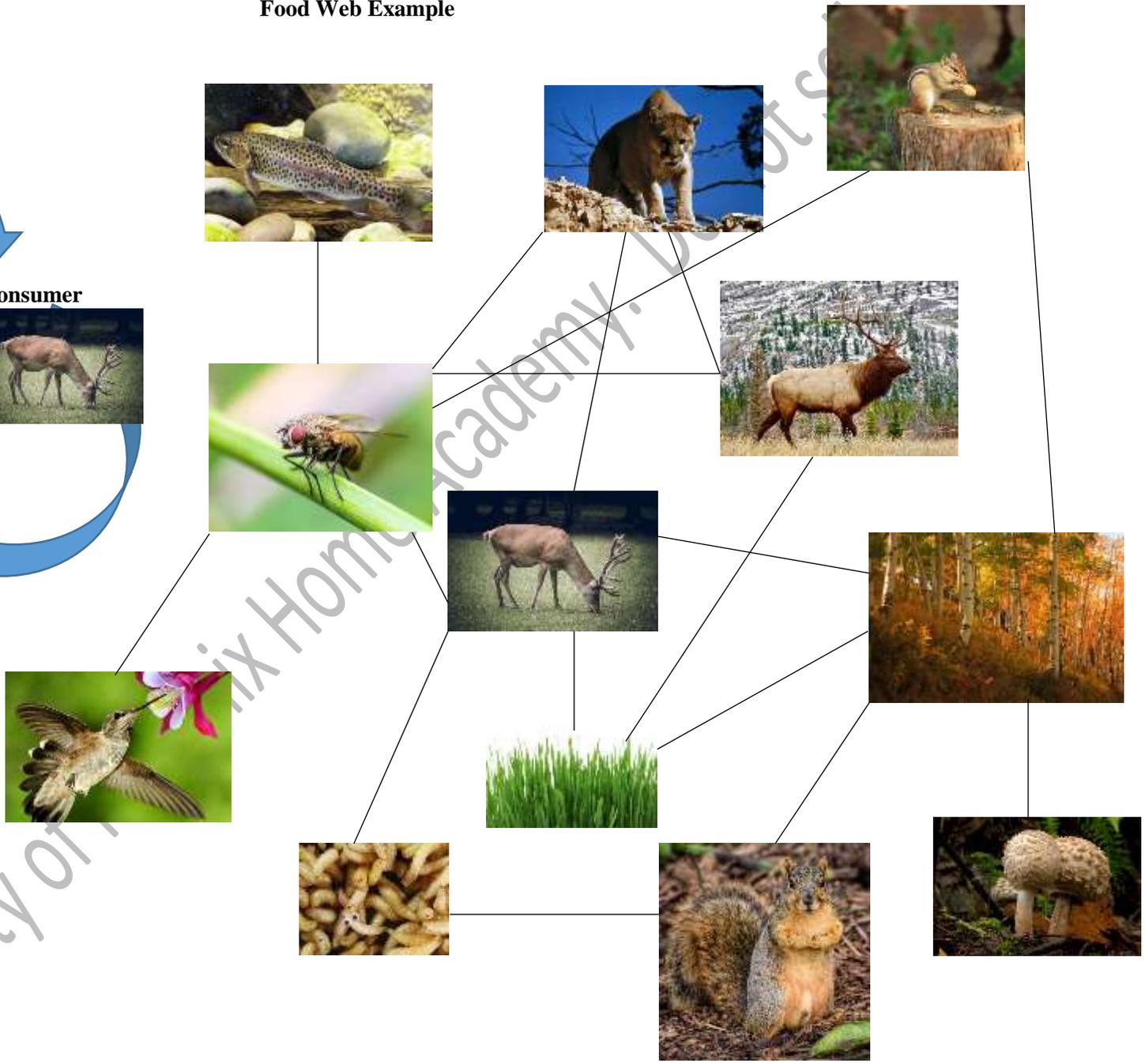
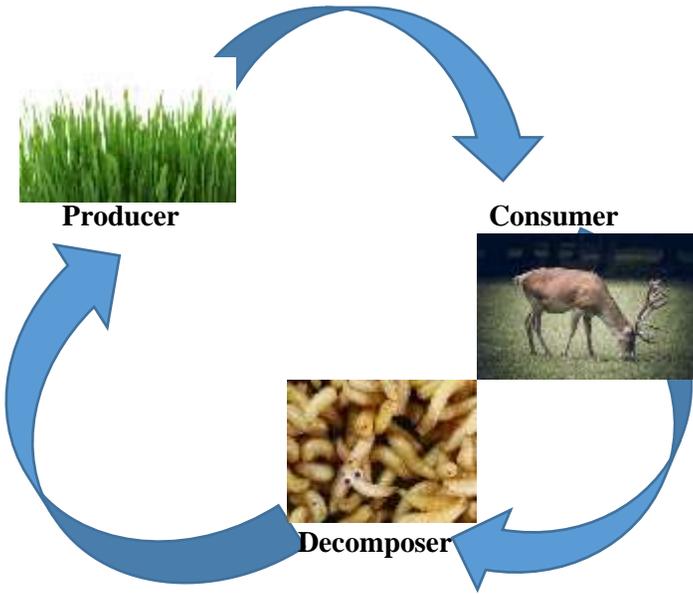
**Title of Lesson 17: Ecosystems Flow of Matter**

**Standards Taught: 6.4, 6.4.1, 6.4.2, 6.2.3**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
An account on canva.com or other like program  Computer with internet access  Food Web Example Printout		<p>Briefly review the previous lesson with your child, asking them to define ecosystem, competition, predation, and mutualism and provide examples.</p> <p>Then, remind your child that each of the organisms in the ecosystem depends and is influenced by the others. This means that the reduction, increase, or extinction of a single species can affect the entire ecosystem.</p> <p>Show your child the Food Web Example. Explain that this food web shows the interactions between plants and animals in a Utah forest that sits on a mountain. Most of the relationships shown are predation. Point out that each animal is, in some way, connected to the others and a change in one would result in a change in the others. For example, if there were suddenly a population explosion in mountain lions, the deer would be over-hunted and become very scarce. In turn, the plants that the deer eat would become overgrown (because they are not being eaten), likely leading to more insects and bugs. Bugs may then begin to feed on, kill, and decompose trees. One small change in an ecosystem can change the whole thing.</p> <p>Next, point out that there are three different types of organisms in the food web: producers, consumers, and decomposers. Producers, like the plants that deer eat, and, in turn, the deer themselves, create food for other animals. Consumers are those who eat the food from producers (e.g. the deer eat the plants and the mountain lions eat the deer). Finally, decomposers (e.g. fungus, insects, bacteria) break down the dead plant and animal matter so that it can return to the soil and feed the plant producers the nutrients they need. Show your child the flow of energy model, explaining that this shows how energy passes from producers to consumers to decomposers and back to producers.</p> <p>Ask your child to choose a Utah ecosystem (e.g. mountains, Great Salt Lake, wetlands, desert) and create their own food web, including at least 12 species and showing the interactions between them. Allow them to use a computer to research. They may want to create this food web by hand, print out pictures and labels, or create it all on Canva (or a like program) digitally. Ask your child to choose a change that could happen to their food web and explain how it would affect each of the other organisms. Encourage them to point out producers, consumers, and decomposers from their web and explain the flow of energy that is taking place.</p>

# Food Web Example

## Flow of Energy



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**Title of Lesson 18: Ecosystems Population Stability**

**Standards Taught: 6.4.1, 6.4.4**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Your child's food web from the previous lesson  Computer with internet access		<p>Briefly review the previous lesson about the flow of energy and food webs with your child. Remind them that all the organisms in an ecosystem affect each other and that small changes in one species can affect the stability and population of all the species.</p> <p>Using your child's food web, point out that changes in non-living portions of the ecosystem can also create radical change. Use examples such as changes in the availability of water, weather changes, rock slides, floods, and invasive species to discuss how each of these non-living aspects would greatly impact the organisms in the ecosystem.</p> <p>Next, help your child research challenges that their chosen ecosystem is currently facing. Ask your child to choose one that interests them and that they would like to see changed. Help your child create a list of ways this challenge is impacting the ecosystem, including populations of different organisms. Be sure to research the impact to each of the animals in your child's food web and consider ecosystem interactions.</p> <p>Finally, collect data on a single population that is most affected over previous years and create a chart to show the incline or decline of the population. Save this information for the next lesson.</p>

**Title of Lesson 19: Preserving Ecosystems**

**Standards Taught: 6.4.1, 6.4.5**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
<p>A computer with internet access</p> <p>Information from the previous lesson</p> <p>Your child's food web</p>		<p>Help your child research the ideas and practices now in effect for the challenge they are studying in their ecosystem. Ask your child to choose 2-3 solutions (e.g. laws and policies, physical responses, etc.) and evaluate how each of these solutions will affect your child's chosen species and, by extension, the entire food web.</p> <p>Discuss which solution has the biggest reward and the least amount of negative impact. Help your child get involved in that solution (e.g. planting a bee garden, helping to clean up litter, learning about and advocating for policies and legislation, planting trees, etc.).</p>

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## Title of Lesson 20: Making a Molecule

Standards Taught: S.6.2.1

Materials:	Preparation:	Implementing the Lesson:
<p>A molecule model kit such as <a href="#">this</a> one</p> <p>This <a href="#">chart</a></p>		<p>Review with your child the fact that all matter is made up of atoms, or small particles of different materials that stick together to create molecules. Molecules, or combinations of atoms, then gather together to create larger amounts of matter. Water molecules, for example, it made of 2 hydrogen atoms stuck to one oxygen atom. When several of these molecules are together, they create a glass full of water.</p> <p>Give your child the chart, pointing out familiar molecules on it: hydrogen (used to make balloons float), oxygen (which our bodies use to refuel cells), nitrogen (used in fertilizer), chlorine (used to keep pools clean), nitrogen oxide (used in surgeries as pain relief and anesthesia), water (which we drink), nitrogen dioxide (used in the process of creating fertilizers), and carbon dioxide (used to cool food and drinks). Point out that the molecules on the chart are each made up of different atoms and different amounts of each atom. Each molecule has its own recipe and adding or taking away atoms from it would create a different molecule. The recipe for each molecule is written on the chart using chemical elements (see chart <a href="#">here</a>), which are the most basic ingredients for every type of matter. Point out the recipe for hydrogen: H<sub>2</sub>. Explain that the H stands for hydrogen and find it on the periodic table. Then, explain that the 2 means there are two hydrogen atoms in every molecule of hydrogen. Next, point out the water recipe: H<sub>2</sub>O. Find oxygen on the periodic table and ask your child to tell you what the recipe for a water molecule is: 2 hydrogen atoms and one oxygen atom.</p> <p>Finally, use the molecule model kit to help your child build each of the molecules shown on the chart. Focus on matching the correct atoms together to create a molecule of each example on the chart. If your child is interested, discuss different types of bonds, though that will be covered in a later grade.</p>

**Title of Lesson 21: Moving Molecules (2 pages)**

**Standards Taught: S.6.2.2, S.6.2.3**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
<p>This <a href="#">image</a></p> <p>Pot or pan with a lid</p> <p>Stove</p> <p>5 cups Ice Cubes</p> <p>Thermometer(s) to measure the temperature of ice, water, and boiling water</p> <p>Observation Sheet 21</p> <p>Balloon</p> <p>Empty water bottle</p> <p>¼ c. vinegar</p> <p>1 Tbsp. baking soda</p>		<p>Review what your child learned in the previous lesson, discussing the definitions of matter, atoms, and molecules, the process of reading the recipe for creating molecules, and the building of a molecule using that recipe. Remind your child that every molecule is made up of matter and review the states of matter: solid, liquid, and gas.</p> <p>Use the image to discuss the movement and position of particles (which can be either an atom or a molecule) in different states of matter. Explain that particles within matter are constantly moving. However, the state of matter defines how much each particle is allowed to move. In the solid state, particles are relatively still. They can only vibrate within their fixed position. Demonstrate this type of motion with your hands, asking your child to mimic you, by shaking your hands in place, point out that they do not move away from or towards each other. Ask your child to describe characteristics of the solid state such as inability to mold to a container and rigid shape. Point out that the fact that the particles aren't able to move much creates the solid, rigid state. In the liquid state, particles begin to gain kinetic (or movement) energy. They start to spread out from each other and move around a little. Demonstrate this movement with your hands, slightly wiggling them around as they vibrate and ask your child to do the same. Explain that this kinetic energy allows liquids to have the ability solids do not have: liquids can take the shape of a container. When you pour water in a glass, the particles within the water move position so they fit perfectly into the shape of the glass. Gases have particles with a high amount of kinetic energy, allowing the molecules to move around at higher rates of speed and across further distances. Demonstrate this movement by waving your hands wildly and asking your child to do the same. Explain that this allows gases to expand to the volume of the container it is in. This means that, if a gas like oxygen is pumped into a room, the oxygen particles will spread out until they fill the entire room.</p> <p>Ask your child if they remember how to change matter between states. Using the example of an ice cube (solid), ask how it turns into a liquid (water), or a gas (steam). Point out that at each stage, heat is added. Heat adds kinetic energy to the particles within the water, making them move more quickly with each stage and spread apart from each other. The ice melts and the steam evaporates. If we wanted to reverse the process, we would take heat away from the particles, allowing the steam to condense and the water to freeze. Melting, evaporating, condensing, and freezing are called transitions or phase changes. During a phase change, the particles within the matter are using the added or subtracted heat to quicken or slow their kinetic energy. This changes their movement and distance from each other.</p> <p>Give your child the ice cubes, asking them to describe the state of matter these water particles are in and how they know that. Ask your child to use an appropriate thermometer to measure the temperature of the ice and record it on Observation Sheet 21. Ask your child to draw the images for the solid stage on the observation sheet, too. Then, ask your child to place the ice cubes on the pan, place the pan on the stove, and turn the burner on. Discuss what happens to the particles as the ice melts and where they are gaining their energy from (heat). As the ice turns to water, discuss the movement of the particles and the changes in characteristics. Record the temperature, state, and particle movement again, noting the changes. Then, as the water turns to steam, ask your child to note the temperature of the boiling water,</p>

pointing out that it is close to becoming steam. Place the lid on the pan/pot, and ask your child to record their observations for the gas state. After a few minutes, ask your child to carefully check the bottom of the lid for condensation. Point out that the steam molecules began to collect and cool, slowing down the molecules and creating water again. Explain that if the steam had been allowed out of the pot/pan, it would've expanded to fit the room, leaving water molecules in the air, though we wouldn't be able to see them.

Finally, explain that there is a way to watch gas particles expand to fit a container. Ask your child to put the baking soda into the empty water bottle. Hand your child the vinegar, pointing out that the chemical reaction between the baking soda molecules and the vinegar molecules will create heat and a gas. Ask your child to quickly pour the vinegar into the water bottle and help them secure the balloon opening around the top of the water bottle. Then, watch as the balloon fills with gas from the reaction. Point out that the gas is expanding because the kinetic energy in the particles allows them to move and spread out quickly.

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Observation Sheet 21

	Temperature	State of Matter	Particle Movement
Ice Cubes			
Water			
Steam			
Draw a water molecule (H <sub>2</sub> O)			

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**Title of Lesson 22: Preventing or Maximizing Phase Transitions Part I**

**Standards Taught: S.6.2.4**

<b>Materials:</b>	<b>Preparation:</b>	<b>Implementing the Lesson:</b>
Ice cubes  Water  Various items for your child's design  Thermometer		<p>Using Observation Sheet 21, review with your child what they've learned about molecules and particle movement. Discuss what happens when heat energy is transferred into different states of matter, how matter transitions into different states, and how particles change location and movement in different states of matter. Point out that the magic ingredient for changing states is heat.</p> <p>Next, review the definitions of the following words: conductor, insulator. Remind your child that a conductor allows for the transfer of energy from one form of matter to another, such as when metal in wires allows electricity to transfer to a lightbulb in your home. An insulator, such as a piece of plastic, stops the transfer of energy. Then, ask your child how they think a conductor may help maximize the transfer of heat energy if we want matter to change states. Using the example of ice, point out that your child used a metal (conductor) pan in the previous experiment to maximize the transfer of heat from the stove to the ice cubes. This allowed them to change states more quickly. Then, ask your child what they would do if they didn't want the water to change states and the freezer was not working. Point out that to keep the ice from melting, they may place it in a cooler or insulated cup. Both of these materials are insulators, made of molecules that prevent or slow the transfer of heat, protecting the ice.</p> <p>Finally, ask your child to develop their own plan and design their own tool or process that maximizes or minimize heat transfer. Help them decide whether they want to find a way to heat the ice into water or steam faster or if they want to find a better way to protect their cold ice cubes from melting. Explain that they will have two weeks to design, test, change, and modify their project. Encourage them to use different conductors (if trying to maximize) or insulators (if trying to minimize) and test the temperatures at regular intervals, collecting data to see which is the most efficient. Spend the first week building and testing, setting a time goal for phase change or continuity (how fast should it boil or turn to steam, or how long should the ice last), and researching methods already in place. This lesson will continue into the next week.</p>

**Title of Lesson 23: Preventing or Maximizing Phase Transitions Part II**

<b>Standards Taught: S.6.2.4</b>		
<b>Materials:</b>  Ice cubes  Water  Various items for your child's design  Thermometer	<b>Preparation:</b>	<b>Implementing the Lesson:</b>  Continue to work on your child's project for maximizing or minimizing phase changes to their ice cubes. Discuss the data they've collected, what works and what doesn't, and help them finalize their design. Test it against the criteria they created last week. How close did you get to your time goal?

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**Title of Lessons 24-25:** Explore

**Standards Taught:** Review

<p><b>Materials:</b></p> <p>Varies</p>	<p><b>Preparation:</b></p>	<p><b>Implementing the Lesson:</b></p> <p>Part of science is being willing to ask questions and work to find answers.</p> <p>Ask your child to tell you what they would like to learn about or build in science during these two weeks. Maybe they've seen an experiment someone else did. Perhaps they've been wondering how something works. Or maybe they have a new book full of engineering ideas.</p> <p>Allow your child to choose two science experiments based on their own interests. Collect supplies, prepare, and carry out these experiments with your child. Spend time researching the science behind them and teach your child what you learn.</p> <p>Chart, graph, record, and collect and present data from your experiments. Encourage your child to share what they learn with family, friends, or others.</p> <p>*This is a great time for a co-op science fair</p>
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