

Astronomy - Surfin' Through the Solar System

Grade Level: Third Grade

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Length of Unit: Five Lessons--2 Days Per Lesson

I. ABSTRACT

This unit introduces the solar system as found in the *Core Knowledge Sequence* for the Third Grade. It incorporates a variety of auditory, visual, and kinesthetic activities to explore the solar system. The sun and the moon will be connected with the nine planets showing the relationship they have within the solar system. Continuing through the solar system, the students engage in the illuminating patterns and findings that make up the quilted universe.

II. OVERVIEW

A. Concept Objectives

1. Demonstrate an understanding of the inquiry process through the study of the Earth and space systems.
2. Explore, demonstrate, communicate, apply and evaluate knowledge of the properties of Earth and space systems.
3. Demonstrate an understanding of the connections and applications of Earth and space systems.
4. Gain an understanding of space and the impact it plays on our life.
5. Explore, demonstrate, apply and evaluate knowledge of the properties of the moon.

B. Content from the *Core Knowledge Sequence*

1. Our Solar System-the sun: source of energy (heat and light); the nine planets and their moons: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto
2. Planetary Motion-orbit and rotation-How day and night are caused by the Earth's rotation; Sunrise in the east and sunset in the west; How the seasons are caused by the Earth's orbit around the sun; tilt of the Earth's axis.
3. Moon-phases of the moon, gravitational pull of the moon (and to a lesser degree, the sun) causes ocean tides on Earth.
4. Asteroids, meteors ("shooting stars"), comets, Halley's Comet
5. Stars and Constellations

C. Skill Objectives

1. The students will select the appropriate equipment and utilize technology and mathematics in the inquiry of Earth/space systems. (Arkansas State Standards Strand 3.1.2)
2. The students will analyze the features and motions of the sun, moon, and other celestial bodies. (3.2.8)
3. The students will analyze features, phases, and gravitational pull of the moon.
4. The students will demonstrate an understanding of planetary motion by their actions and written response.
5. The students will demonstrate and understanding of the locations of each of the nine planets in relation to the sun.

6. The students will generate graphs, writings, and charts to communicate Earth/space system investigations. (3.1.3)
7. The students will use skills (describing and writing) and technology (computers) in scientific investigations. (1.1.2; 1.3.6)
8. The students will understand how Earth/space systems connect to other disciplines. (3.3.5)
9. The students will be able to observe, illustrate, and show verbal understanding of the sun.
10. The students will be able to list at least one characteristic about each planet.

III. BACKGROUND KNOWLEDGE

A. For Teachers:

1. Hirsch, Jr., E. D. *What Your Third Grader Needs to Know: Fundamentals of a Good Third-Grade Education*. New York: Dell Publishing, 1992, ISBN 0-385-31257-1
2. Knoblock, Kathleen. *Reading to Learn About Space, Stars, and Planets*. Duncanville, Texas: Bryan House Publishers, 1998
3. Miles, Lisa & Smith, Alastair. *The Usborne Complete Book of Astronomy and Space*. New York: Scholastic, ISBN 0-590-63142-x

B. For Students

1. The students will have a basic understanding of the sun, the moon, and the nine planets. In this unit we will build upon the students' prior knowledge.

IV. RESOURCES

- A. Bendick, Jeanne. *Comets and Meteors: Visitors From Space*.
- B. Bendick, Jeanne. *The Sun: Our Very Own Star*.
- C. Branley, Franklyn. *What Makes Day and Night*.
- D. Cole, Joanna. *The Magic School Bus: On the Ocean Floor*.
- E. Cole, Joanna. *The Magic School Bus: Lost in the Solar System*.
- F. Henbest, Nigel. *The Night Sky*.
- G. Jackson, Kim. *Planets*.
- H. Santrey, Laurence. *Discovering the Stars*.
- I. Schecter, Darrow. *I Can Read About Planets*.
- J. Simon, Seymour. *Comets, Meteors, and Asteroids*.
- K. Sipiera, Paul P. *A True Book of Constellations*.

V. LESSONS

Lesson One: The Sizzling Sun

A. Daily Objectives

1. Concept Objective
 - a. The students will demonstrate an understanding of space and the impact it plays on our life.

Lesson Content

- a. The Sun-source of energy (heat and light)
3. Skill Objective
 - a. The students will be able to observe, illustrate, and show verbal understanding of the sun.

B. Materials

1. Picture of the sun
2. Golf ball (to represent the moon)
3. Baseball (to represent the earth)
4. Basketball (to represent the sun)
5. Appendix A--Sun Camera
6. Appendix B--Heat
7. Appendix C--Sun Stumpers
8. Black construction paper
9. Crayons (red, orange, yellow)
10. Tennis balls

C. *Key Vocabulary*

1. Sun-a medium-sized star in the solar system
2. Sunspots-small, dark patches on the sun that are slightly cooler than their surroundings
3. Energy-usable power
4. Solar flares-waves of energy produced by the sun

D. *Procedures/Activities*

1. Discuss vocabulary and background knowledge needed to understand the sun.
2. Using black construction paper, the students will illustrate the sun using vibrant colors of orange, yellow, and red.
3. The sun is over 100 times the size of the earth. To better understand the size of the sun, the students will create a sun camera. See Appendix A.
4. The sun creates its own heat. Heat from the sun is a source of energy. The temperature at the surface of the sun is 5510 degrees Celsius (9950 degrees Fahrenheit). To better understand the heat of the sun, the students will participate in an experiment using a baseball cap brought from home. See Appendix B.
5. The sun creates its own light. Light from the sun is a source of energy. Thermonuclear fusion changes hydrogen into helium producing the energy that provides light to the solar system. See Appendix C.
6. The students will create a Space Journal using several sheets of construction paper. The teacher will aid in the binding, and students will decorate the outside cover. The students will then journal how they feel the sun affects them.

E. *Evaluation/Assessment*

1. The teacher will assess students' learning through verbal responses in journal and the illustration of the sun.

Lesson Two: The Propelling Planets

A. *Daily Objectives*

1. Concept Objective
 - a. The students will gain an understanding of space and the impact it plays on our life.
- Lesson Content
 - a. The nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto
3. Skill Objectives
 - a. Students will demonstrate an understanding of the location of each of the nine planets.
 - b. Students will be able to list at least one characteristic about each planet.

- B. *Materials*
1. Black construction paper
 2. Crayons
 3. Glue
 4. Space journal
 5. Appendix D--Planet Worksheet
- C. *Key Vocabulary*
1. Planet-a large body of matter that revolves around the sun
 2. Mercury-planet closest to the sun
 3. Venus-brightest planet
 4. Earth-planet where we live
 5. Mars-red planet
 6. Jupiter-largest planet
 7. Saturn-planet that has 23 moons and several rings
 8. Uranus-planet that has vertical rings
 9. Neptune-blue planet with ice
 10. Pluto-planet farthest from the sun
 11. Terrestrial planets-having a solid “earthy” surface
 12. “Gas Giant” planets-a planet with little or no solid material
- D. *Procedures/Activities*
1. The teacher will read pages 313-319 from *What Your Third Grader Needs to Know*. This will introduce the planets to the students. The vocabulary will also be discussed at this time.
 2. The students will make a model of the planets including the sun and the moon. The planets will be placed in the correct order from the sun. The students will need two pieces of black paper, crayons, and Appendix D
 3. The students will label the Terrestrial planets on their planet model to show where they are located in the solar system.
 4. The students will label the gas giants on their planet model to show where they are located in the solar system. Reference should be noted that Pluto is not one of the two types of planets.
 5. If time allows, *The Magic School Bus: Lost in the Solar System* may be read to the class. Encarta Encyclopedia from the computer may also be used for reinforcement.
 6. The students will identify their favorite planet and write in their journals what they have learned about that planet and why it is their favorite.
- E. *Evaluation/Assessment*
1. The teacher will assess students’ learning through verbal responses in class discussion and written journal responses.
 2. The teacher will evaluate the students’ models of the planets.

Lesson Three: Spinning Through the Sky

- A. *Daily Objectives*
1. Concept Objective
 - a. The students will gain an understanding of planetary motion and the impact it plays on our lives.
 2. Lesson Content

- a. Earth's orbit, rotation, and tilt of its axis causes days, nights, and seasons.
- 3. Skill Objective
 - a. The students will demonstrate their understanding of planetary motion by their actions and written responses.
- B. *Materials*
 - 1. Orrery (pronounced *aw ruh ree*)
 - 2. Flashlight
 - 3. Space journal
- C. *Key Vocabulary*
 - 1. Axis-an imaginary straight line through the center of the Earth around which the Earth rotates
 - 2. Orbit-the path of one object as it revolves around another
 - 3. Orrery-a mechanical model of the solar system
 - 4. Revolve-movement of an object in an orbit around another object
 - 5. Rotate-the act of spinning on an axis
- D. *Procedures/Activities*
 - 1. The teacher will introduce the vocabulary words with the students.
 - 2. The teacher will read *What Makes Day and Night* to the class. On pages 20-23, there is an activity that will aid in the discovery of planetary motion.
 - 3. To reinforce understanding of planetary motion, the students will be divided into groups of three. One student in each group will represent the sun, one will represent the Earth, and the third will represent the moon. The "sun" will hold the flashlight on the spinning "Earth" as the "moon" orbits the "Earth" while facing it at all times. (Refer to pages 20-23.)
 - 4. The teacher will explain to the students that in the eighteenth century, the orrery was named for Charles Boyer, the fourth Earl of Orrery. The orrery was used to demonstrate the Earth's orbit around the sun. The teacher will then display an orrery to the class. The teacher will turn off the lights in the classroom, light up the orrery, and model how the moon orbits the Earth as the Earth orbits the sun. The teacher will then explain how day and night occur as the Earth spins on its axis and alternately faces the sun and then away from the sun. To further understand this concept, five volunteers will form a circle, holding hands with each person facing the outside of the circle. They will represent the Earth, and will rotate, as a sixth student, representing the sun, shines a flashlight upon them.
 - 5. The students will explain in their journals why the Earth rotates and tell why they cannot feel the Earth as it is rotating.
- E. *Evaluation/Assessment*
 - 1. The teacher will assess the students' learning through students' verbal responses and observations of their actions while participating in planetary motion activities.

Lesson Four: Moon on the Move

- A. *Daily Objectives*
 - 1. Concept Objective
 - a. Students will explore, demonstrate, apply and evaluate knowledge of the properties of the moon.
 - 2. Lesson Content
 - a. Moon-phases of the moon; gravitational pull of the moon

3. Skill Objective
 - a. The students will analyze the features, phases, and gravitational pull of the moon.
- B. *Materials*
1. Flashlight
 2. Aluminum foil
 3. Golf ball (or other small round object)
 4. Apple (or other larger round object)
- C. *Key Vocabulary*
1. Phases-the shape of the lighted part of the moon as it is seen from Earth
 2. Gravity-a gentle pull from the center of the Earth
 3. Satellite-any object in outer space which orbits another object
 4. Moon-the ball of rock which orbits the Earth
- D. *Procedures/Activities*
1. The teacher will go over the background notes (Appendix G) and the vocabulary to introduce the lesson.
 2. The students will understand how the moon changes through its phases. The teacher will need the materials listed in the lesson. The display will need to be located on a large surface so that groups of students can come to observe . The teacher will then cover the golf ball with aluminum foil-this will represent the “Moon.” The apple will represent the “Earth”, and the flashlight will represent the “Sun.” Place the Earth and the Moon on the table with the sun at arms length away. Next, move the moon around the Earth. Stay in the same place while you do this. The students will then see that the different lighted parts (the phases) come in and out of view.
 3. Ask students if they have ever been to the beach. Have they ever noticed how the level of the ocean rises and falls over time? Using the tide graph sheets (page 18 from Magic School Bus literature unit), assign each date from the tide table (page 17). The teacher will give instructions from page 14, and then the students will plot this information on their graphs. As the students finish plotting their data, connect the graphs together as instructed on page 15. The students will then answer the questions from page 16. Using pages 19-21, explain the results of their graphs of the tides. Explain to the students that tides are primarily influenced by the moon, but the sun has some effect. The relative positions of the sun and moon to each other cause variations in the tides. Explain how the phases of the moon indicate the position of the moon to the sun.
 4. In their journals, the students will illustrate the phases of the moon.
- E. *Evaluation/Assessment*
1. The teacher will assess the students’ verbal responses and participation in activities regarding the moon.
 2. The teacher will evaluate the graph for correct plotting of data and grade the questions for accurate answers.

Lesson Five: The Twinkling Twilights

- A. *Daily Objectives*
1. Concept Objective

- a. Students will explore, demonstrate, apply, and evaluate knowledge of the properties of asteroids and the celestial bodies.
 - 2. Lesson Content
 - a. Asteroids and celestial bodies
 - 3. Skill Objective
 - a. The students will analyze and identify the features of asteroids and celestial bodies.
- B. *Materials*
 - 1. Planet model (Lesson 2)
 - 2. Tootsie Roll Pops
 - 3. Foil
 - 4. Crepe paper (any color)
 - 5. Appendix E--Twinkling Star
 - 6. Appendix F--Day Star
- C. *Key Vocabulary*
 - 1. Star- a ball of exploding gases that gives off light and heat
 - 2. Asteroid- small rocky object orbiting the sun
 - 3. Constellation- a group of stars that can be seen as a pattern from Earth
 - 4. Comet- a bright body that orbits the sun in an oval shaped path
 - 5. Meteor- chunks of rock or metal flying through space
 - 6. Asteroid Belt- asteroids that orbit the sun between Mars and Jupiter
- D. *Procedures/Activities*
 - 1. Read the book, *Discovering the Stars*, to introduce stars and constellations. Go over vocabulary words star and constellation. To better understand how a star makes its light, the student will make a twinkling star. Please refer to Appendix E for instruction.
 - 2. Ask the students if they have ever seen a constellation. Tell them we are going to make a constellation of their own. Please refer to Appendix F for instructions.
 - 3. Discuss asteroid and asteroid belt to insure understanding for the following activity. For this activity, the students will need to have the model of the planets to add the asteroid belt. The students will then go outside to collect “asteroids” which need to be rocks. The teacher needs to specify the size of the rocks to be around the size of a tooth being no bigger than a quarter. Due to weight on the construction paper, the students need to have no more than 8 rocks.
 - 4. Discuss the vocabulary words comet and meteor to prepare for the lesson. Read the book *Comets and Meteors* to better inform students about the celestial bodies. The students will create their own comet based on the book about comets and meteors. The students should have the materials on their desk with the foil and the crepe paper already being cut to size. The first step is to wrap the foil around the Tootsie roll pop, not making it too tight. The foil should go about an inch past the Tootsie roll stick. Then attach crepe paper pieces to the end of the foil with glue to make the tail. Students will hold the end of the stick, making sure the foil is loose enough to come off when the student throws it like a dart holding on to the stick.
 - 5. The students will write one fact about each of the celestial bodies and the asteroid in their journal.
- E. *Evaluation/Assessment*

1. The teacher will take up students' journals and evaluate them.
2. The teacher will collect the students' planet models and evaluate them for the correct placing of the asteroid belt and location to the planets.
3. The teacher will also gather comet models and evaluate them for structure, creativity, and comet flying capability.

VI. CULMINATING ACTIVITY (Optional)

To bring this unit to a close, the students, along with their parents, will participate in a star watch party. If this activity is not convenient, then as a class, you can make planet visors. To make a planet visor, please follow these instructions. Please note this will not be to actual scale size or distance. For materials, you will need 5 yellow strips (1 inch by 18 inches), 6 blue strips (1 inch by 18 inches), and 1 black strip (1 inch by 18 inches). The procedure is as follows: First, staple the 5 yellow and 6 blue strips together. Next, staple a black strip to one side. Then, start with the SECOND blue strip, cut 1 inch off. Going from the second blue one, make each strip 1 inch shorter than the one before. When you are done, you will have a stair step effect with the yellow ones being the shortest. Measure your head, and then staple the black strip to the other side of the fan shape. Using planet stickers, start with Mercury on the first yellow one and go out from there. Make sure you place the planets so they can be seen by people looking at you. On the last yellow one, write the word asteroid, and then put Jupiter on the first blue one after the yellow. Comets will be the last one or the first one when you look at the fan shape. Presto, one neat visor for you to wear!

VII. HANDOUTS/WORKSHEETS

Appendix A--Sun Camera
 Appendix B--Heat
 Appendix C--Sun Stumpers
 Appendix D--Planet Worksheet
 Appendix E--Twinkling Star
 Appendix F--Day Star

VIII. BIBLIOGRAPHY

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Appendix A

Sun Camera

Materials: 1 sheet of paper
 yardstick
 masking tape
 pencil
 1 index card
 straight pin

1. Draw two parallel lines on the sheet of paper about the thickness of the pencil lead apart.
2. Punch a hole in the center of the index card with the straight pin.
3. Fold one edge of the card and tape the folded edge to the zero end of the yardstick.
4. Hold the paper at the 8 1/2-in. mark.
5. Stand so that the shadow of the card falls on the paper.
6. Look carefully at the paper and locate the small circle of light. Caution: Never look directly into the sun because it can damage you eyes.
7. Move the paper so that the circle of light fills the space between the lines on the sheet.

Result :The image of the Sun fits between the parallel lines on the paper.

Appendix B

Heat

Materials: baseball cap

1. Stand outside in the direct sunlight.
2. Face the direction of the sun for 5 seconds. Caution: NEVER look directly into the sun because it can damage you eyes
3. Position the cap on your head so that it shades your face.
4. Stand with the cap on for 5 seconds.
5. Remove the cap, but remain in the same position for another 5 seconds.

Result: The skin on your face feels warmer without the cap.

Appendix C

Sun Stumpers

1. Our nearest star is the sun. It is only 93 million miles away. That may seem far, but the nearest star is trillions of miles away.

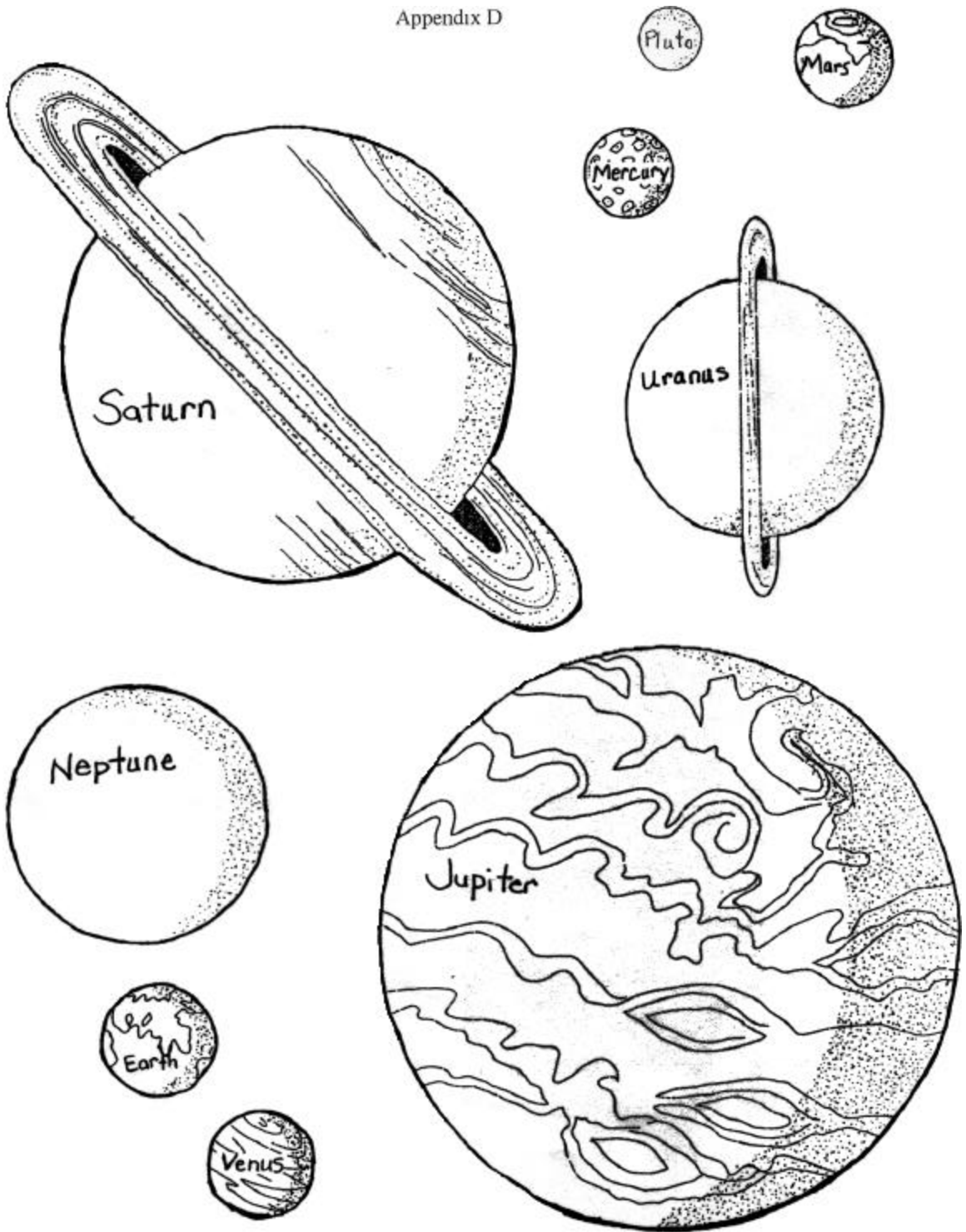
2. If you could drive to the sun in a car, the trip would take more than 175 years! Lucky for us, light travels much faster, 186 thousand miles per second- so light from the sun takes only about 8 minutes to reach the Earth.

3. Our sun is medium-size star. There are many stars smaller than our sun and many much larger. How large is the sun? If it were hollow, it could hold more than a million Earths.

4. Unlike the planets which move in orbits, the sun is stationary. But that does not mean it is inactive. Violent explosions of hot gases, or flares, erupt on the sun's surface and can be thousands of miles high!

5. Eruptions of hot gases on the sun's surface are called flares.

Appendix D



Appendix E

Twinkling Star

Materials: flashlight
 aluminum foil
 glass bowl, 2 qt.
 pencil

Procedure:

1. Cut a piece of aluminum foil large enough to fit under the bowl. Wrinkle this piece of foil with your hands.
2. Fill the bowl half full with water and place it on top of the wrinkled piece of aluminum foil.
3. In a darkened room, hold the flashlight about 12 inches from the top of the bowl.
4. Observe the foil and take note of how it appears when viewed through the undisturbed water.
5. Continue to shine the light through the water as you gently tap the surface of the water with a pencil.
6. Observe the foil as it appears when viewed through moving water.

Results: The moving water causes the light reflecting from the aluminum foil

Appendix F

Day Star

Materials : hole punch
 index card
 1 white letter envelope
 flashlight

Procedure:

1. Cut several holes depending on the constellation you are wanting to create. These holes will be punched in the index card.
2. Insert the index card in the envelope.
3. In a well-lighted room, hold the envelope in front of you with the flashlight about 2 inches from the front of the envelope and over the index card.
4. Move the flashlight behind the envelope.
5. Hold the flashlight about 2 inches from the back of the envelope.

Results: The holes in the index card are not seen when the light shines on the front side of the envelope, but are easily seen when the light comes from behind the envelope and toward you.

Appendix G-Background Information

Lesson 4

Pgs. 311-312 in *What Your Third Grader Needs to Know*.

The moon does not give off its own light. The light comes from the sun's light reflecting off the moon. As it rotates, the part of the moon facing the sun reflects sunlight. The other part of the moon is dark. From the Earth, only the lighted part of the moon faces the Earth. As the moon revolves, different amounts of its lighted part are visible. The moon's phases are visible as the moon makes one revolution around the Earth. During the new moon phase, the lighted part of the moon faces away from the Earth and is invisible. About one week after the new moon, the moon looks like a half circle. It is sometimes called a half moon. As the moon continues to revolve, more and more of its lighted part is visible. About a week after the half moon, the moon is a complete circle. This phase is called a full moon. After the full moon, less and less of the moon is seen each night. About two weeks after the full moon the new moon phase comes again. Sometimes the moon is seen during the daytime. A full moon is only seen at night. All other phases of the moon can be seen during the day as well as at night.

Lesson 5

Pages 320-322 in *What Your Third Grader Needs to Know*

Page 360 in *What Your Third Grader Need to Know*