



## LESSON PLAN

### 2

**Skills:** shape of a sphere, identifying geographical location, observation

**Materials:** globe; goose-necked lamps or flashlights for each pair of students, pin with large head

**Resources:** *What Makes Night and Day?* by Franklyn Mansfield Branley; *The Sun Is Always Shining Somewhere* by Allan Fowler

**Vocabulary:** poles, sphere, rotate, revolve

**Funsheets:** *Grade K: Science 002; Fact File 005*

# What Makes Day and Night?

Grade Preschool-K

SPACE • LESSON PLANS • 002

**Objective:** To learn that the earth we live on is a planet in space, orbiting a sun in a solar system, and to understand that the rotation of the planet causes night and day.

**Introduction:** Ask students where they live. They will probably offer the name of their street or city. Ask which state, province, or region they live in. Ask which country they live in. Then ask them if they know which continent they live on. Review that continents are big chunks of land surrounded by oceans. Use maps to show where each area is located inside the next.

Show students the globe. Have students point to their continent, and help them find their city or town. Push the pin into the globe at your location and tell students that this is a "you are here" pin.

### Procedure:

1. Explain that the earth moves. It rotates, or spins on an imaginary line that goes through the poles. Model how the earth rotates by turning the globe. Then model the motion by spinning your body, keeping your feet on the same spot. Have students stand up and rotate like the earth.
2. Bend the goose-necked lamp or place the flashlight so it shines horizontally (you may wish to place it in front of the sun in the Solar System Mural). Turn off the lights in the room and have students gather around. Hold the globe in the light so it is "day" for the "you are here" pin. Tell students that the light represents the sun. When part of the earth faces the sun, that part is in daylight. Ask students what the earth does (it spins). Turn the globe and show students how the pin moves from light to dark. Explain that this is why we have days and nights—the sun doesn't really "rise" or "set." Our "pin" (location) moves in and out of the sun's beam. Ask students whether it is night or day for a location opposite the pin. Tell them that when it is day for them, it is night somewhere else, and vice versa.
3. Have students pair up. One student will play the sun by holding the flashlight so that it shines on his or her partner's head. The other partner is the earth. Have the earths rotate very slowly, keeping their heads still, and tell as day moves into night and back to day again. Have pairs switch.

**Extension:** You may want to have students model an old way of thinking—that the sun revolves around the earth. Explain that while rotating is turning in one place, revolving is moving in a circle around something. Demonstrate by "revolving" around your desk. Have the suns hold up their flashlights while they revolve around the earths to show how this motion still makes "night" and "day." This is why people were mistaken for so many years.

# Identifying Space Objects: Field Trip

Grade Preschool-K

SPACE • LESSON PLANS • 003

## LESSON PLAN

### 3

**Skills:** observation, classification, cooperation

**Preparation:** Choose a relatively dark area near the school. Obtain parents' permission for a short, local, nighttime field trip. Arrange chaperones. Reproduce enough *Sky Finder* worksheets for each group of 3 or 4 students.

**Materials:** Telescope or binoculars, if available; blankets suitable for lying on the ground; star map; Sky Finder worksheet

**Resources:** *Stargazing for Beginners: A User-Friendly Guide . . .* by John Mosley; *Night Sky* by Carole Stott

**Funsheets:** *Fact Files 016, 013; Grade K: Science 019, 017*

**Objective:** Students will be able to identify stars, planets, the moon, meteors, comets, satellites, the galaxy, and other space objects by sight.

**Introduction:** Before leaving, check the links or consult your star map so you can help students find various space objects.

**Links:** *Sky and Telescope Magazine:* [www.skypub.com](http://www.skypub.com); *Astronomy Magazine:* [www.kalmbach.com/astro/astronomy.html](http://www.kalmbach.com/astro/astronomy.html); *Mount Wilson Observatory Online Stargazer Map:* [www.mtwilson.edu/services/starmap/html](http://www.mtwilson.edu/services/starmap/html)

### Procedure:

1. Bring students to a place with as little artificial light as possible on a clear, moonless or crescent-moon night. Allow everyone's eyes to adjust to the dark (about 20 minutes). Allow students to lie on their backs and get a feel for how the sky looks so that they can identify moving objects.
2. Divide the students into groups of 3 or 4 and have them search for the objects on the *Sky Finder*. Assist them in locating features such as prominent stars, constellations, planets, and any comets, meteors, or other objects that make appearances.



**Instructions:** Have students try to find and identify these space objects:

Space Object	What It Looks Like	I Saw It!
Star	a point of white light that twinkles	
Planet	a point of light that does not twinkle; it may be colored	
Mars	orange-red	
Venus	greenish; visible at sunset	
Jupiter	tan	
Saturn	has "ears" (rings) through telescope or binoculars	
<i>(other planets are not readily visible with the naked eye or small instruments)</i>		
Meteor	sudden streak or line of light	
Comet	fuzzy point, which may have a tail	
Moon	big, white, crescent or round shape	
Satellite	small white dot moving steadily across the sky. Satellites may flash or blink.	
Milky Way Galaxy	thick band of stars; band of whiteness across the sky	

## LESSON PLAN

### 4

**Skills:** compare and contrast, identify solid, liquid, and gas

**Materials:** ice, cup of water, hot water pot, Solar System Mural

**Preparation:** If possible, locate a diagram of a large gas planet that shows its interior structure. Post the diagram next to that planet on the Solar System Mural. Locate a photo of a shoreline on Earth and post it next to Earth.

**Resources:** *What Is the World Made of? All About Solids, Liquids, and Gasses* by Kathleen Weidner Zoehfeld; *Solids, Liquids, and Gasses* by Ontario Science Center, Adrienne Mason and Deborah Hodge

**Funsheets:**

*Fact Files 002-015*

# Solid, Liquid, and Gas: Ingredients of the Universe

Grade Preschool-K

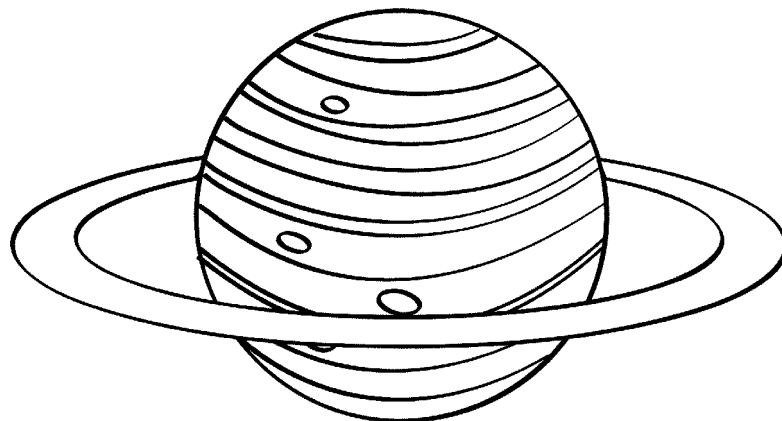
SPACE • LESSON PLANS • 004

**Objective:** Students will learn that matter (stuff) comes in three types: solid, liquid, and gas, and that the stars, planets, and all space objects are made of these things.

**Introduction:** Matter comes in three states—solid, liquid, and gas. While students normally think of big objects, such as planets, as being solid, objects in the universe are often made of gas and liquid, or all three states.

### Procedure:

1. Set the ice on the table. Ask students what it is. Then, set a cup of water on the table and ask what it is. Finally, turn on your hot water pot until steam and water vapor pour from the top. Ask students what is coming out of the top of the pot.
2. Ask students how the 3 things are alike (they are all made of water). Then, ask students how they are different. Encourage students to use adjectives such as *hard*, *wet*, *moving*, *clear*, and *floating* to help them clarify the visible and tactile differences between solids, liquids, and gasses.
3. Ask students to identify objects around them as solids, liquids, or gasses. Some examples are: a table, the contents of their juice boxes, bubbles in soda pop.
4. Show students the photograph of the seashore. How many states of matter do they see? Make sure to remind students that air is a gas. Earth has all three states of matter, but most of its surface is made of rock, which is solid. This is why it is a rocky planet.
5. Show students the diagram of the gas planet. Point to the gas layer, then the liquid layer, and then the solid core. Explain that gas planets also have all three states of matter. But unlike Earth, gas planets are mostly gas and liquid.
6. Have students sort the planets into the big and small planets. Explain that all of the large planets are gas and liquid planets, while all of the small planets are rocky, solid planets. In fact, if you could make a pool big enough to hold it, Saturn would float!



## LESSON PLAN

### 5

**Skills:** reading and writing vocabulary, compare and contrast, cause and effect

**Preparation:** Provide enough copies of the vocabulary worksheet for each student.

**Materials:** Book: *Sun: Our Nearest Star* by Franklyn Mansfield Branley; vocabulary worksheet

**Resources:** *Sun* by Paulette Bourgeois

**Funsheets:** *Fact File 002*; Grade K: *Language 001, 003*; *Science 001*

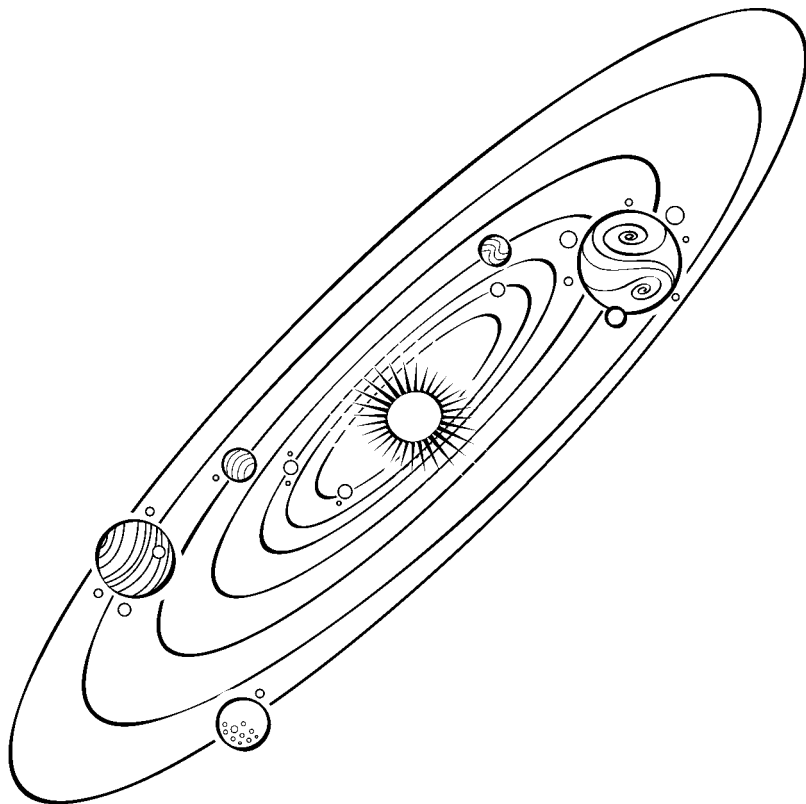
**Objective:** Students will learn that the sun is a star, just like the stars we see at night. Students will also learn what the sun is made of and how it provides energy for all life on Earth. Then they will fill in a vocabulary worksheet about the sun.

**Introduction:** Before any study of the sun, it is imperative that you remind students to never look directly at the sun—not through sunglasses, not during an eclipse, and especially not through binoculars or a telescope. Looking at the sun can cause immediate and permanent eye damage.

**Read:** Read to or have students read *Sun: Our Nearest Star* by Franklyn Mansfield Branley.

**Procedure:** Discuss the book and the facts that students learned.

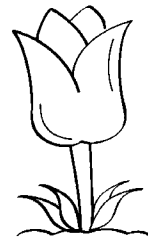
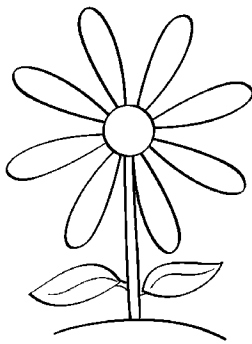
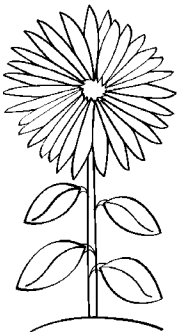
1. How is the sun like other stars? How is the sun not like other stars?
2. What does the sun provide for Earth?
3. In what ways do plants, animals, and humans use the sun's energy?
4. Distribute and help students complete the Vocabulary Worksheet.



light    gasses    star    plants    fuel    solar    heat



1. The sun is a \_\_\_\_\_.
2. It is made of hot \_\_\_\_\_.
3. The sun gives Earth \_\_\_\_\_ and \_\_\_\_\_.
4. \_\_\_\_\_ make food from sunlight.
5. Very old plants underground are used as \_\_\_\_\_.
6. \_\_\_\_\_ power is power from sunlight.





## LESSON PLAN

### 6

**Skills:** counting, comparing shapes

**Preparation:** Enlarge a copy of *Fact File 022* for students to model the shapes.

**Materials:** A flashlight or lamp and a large white ball for each group of 3 students. Large circle stencil, 5 pieces of white construction paper, 2 pieces of black construction paper, scissors, gray, white, black, and/or silver crayons for each student

**Resources:** *The Moon Book* by Gail Gibbons; *So That's How the Moon Changes Shape* by Allan Fowler

**Funsheets:** *Fact Files 012, 022; Fundamentals 023, 040; Grade K: Math 009; Language 012; Science 016, 020*

**Objective:** Students will learn how the positions of the earth, sun, and moon create the moon's changing phases.

**Introduction:** Ask students if they have ever noticed the shape of the moon and how it changes. Have students use scrap paper to draw different shapes of the moon they have seen. Tell students that we only see the parts of the moon that are lit by the sun. The moon revolves around the earth, so different parts are lit at different times.

### Procedure:

1. Divide students into groups of three, and distribute lights and balls. Have the first student play the sun (stand still and shine light at Earth), the second play the moon (hold ball at eye level and walk in circle around Earth) and the third play Earth (stand still facing the sun). Turn off the lights and cover the windows.
2. Have each moon hold the ball between its earth and sun, just to the earth's right to avoid an eclipse. Have the earths tell you how much of the lit moon they can see in this position. Have the moons take a step clockwise around the earths so that they are at a 45-degree angle. How much of the moon is lit now? Have the moons stand directly beside the earths, then behind them (just to their left, to avoid a lunar eclipse). How much of the moon is lit? Have moons continue the circle around Earths. Students may switch places.
3.
  - a. What was the shape of the lit moon when it was in front of the earth? Have students use their stencils to cut out a circle from the black paper. This is the new moon.
  - b. How much was visible when the moon was slightly off to one side? Model for students how to trace an arc (more than 1/2 circle) with the stencil on white paper, and then move the stencil over and trace another arc (less than 1/2 circle) to close off a crescent shape.
  - c. How much was visible when the moon was right beside you? Model how to fold the stencil to draw and cut out a half-moon on the white paper. The round edge should be on the right.
  - d. When the moon is behind Earth, it is full. Have students cut a white circle.
  - e. As the moon keeps going around, it becomes a half, and then a crescent again (with the rounded edge on the left). Students can either flip their half and crescent moons to use as stencils, or they can repeat steps b and c with their circle stencils.
  - f. At the end of the cycle, the moon is new again. Have students cut a second circle out of black paper.
4. Students can color craters on their moon. Have students display the moon phases in order, with the lit section moving from right to left.

**Extension:** Challenge students by mixing up the moon phases. Can students return the moon phases to the right order?



## LESSON PLAN

### 7

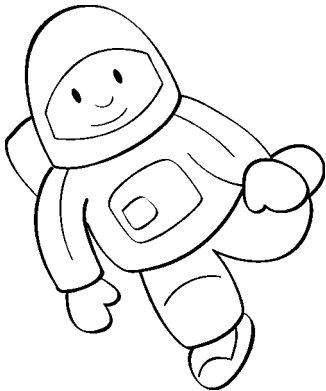
**Skills:** cause and effect, measuring temperature

**Preparation:** Download, print, and enlarge copy of *Tommy Tales Fact File 22, "Parts of a Space Suit."*

**Materials:** photos of astronauts in space (optional)

**Resources:** *Life in Space* by Sydelle A. Kramer; *To Space and Back* by Sally Ride

**Funsheets:** *Fact File 024, Grade K: Science 015; Math 003; Language 019, 020; Fundamentals 003*



**Objective:** Students will learn the extreme temperature, sun, and pressure conditions in space and what astronauts must do to cope with these conditions.

**Introduction:** Ask students what astronauts must wear when they go into space. Ask students if they know why astronauts must wear special suits and helmets. Explain that outer space is very different from Earth.

### Procedure:

1. Draw a compare-and-contrast chart on the board with 4 columns: "Earth," "What You Need," "Space," and "What Astronauts Need." Fill in the "Space" column as below.
2. Fill in the "Earth" column by asking students about the conditions around them. Ask students how hot and cold it gets in your area. Have students take deep breaths. Is there air on Earth? Inform students that the air around us has weight that presses down on us at all times. Our bodies are used to it, so we don't notice it. The weight of the air is about 15 pounds on every square inch (1 kg for every sq. cm) of our bodies. Finally, ask students how long it takes them to get sunburned on the sunniest day (depending on your area and skin tone, humans burn after 15 minutes to 3 hours). Write "sunburn in X minutes" on the chart.
3. Review students' safety needs for the conditions on Earth. What cools us off in the summer? What keeps us warm outside in the winter? How do we protect ourselves from sunlight? Write students' answers in the "What You Need" column.
4. Inform students that astronauts need all of the things we need to protect ourselves on Earth, but their protection must be much stronger. Astronauts' suits have built-in water tubes and air coolers to keep the astronauts cool, just as we have air conditioners, coolers, and swimming on Earth. They have many layers of insulation to keep them warm, just as we have coats and snowsuits on Earth. They carry tanks of air on their backs, and their suits are inflated tightly like balloons, to keep the air pressure up. Remind students of what it feels like when the air pressure changes—when they dive into deep water or gain altitude. Finally, space helmets have dark filters, like dark sunglasses, to protect the astronauts from the sun. If someone gets sunburned in 36 minutes on Earth, he or she would burn in 1 minute in space!

	Earth	What You Need	Space	What Astronauts Need
Hottest Temperature			250°F (121°C)	
Coldest Temperature			-250°F (-157°C)	
Air			None	
Air Pressure	15 ppsi		None	
Sunlight			36 times as bright as Earth	

## LESSON PLAN

### 8

**Skills:** measuring time and distance, learning the qualities necessary for life

**Preparation:** Have students read *Touchdown Mars!* by Peggy Wethered and Ken Edgett. Display photos of and taken by the Mars Pathfinder Rover.

**Materials:** paper, crayons, pencils, calendar

**Resources:** *The Adventures of Sojourner: The Mission to Mars that Thrilled the World* by Susi Trautmann Wunsch

**Funsheets:** *Fact Files 006*, *Grade K: Science 012*

**Objective:** Students will learn how long it takes to travel to Mars and what humans would need to bring in order to support life. Students will design an imaginary colony on Mars.

**Introduction:** Have students read *Touchdown Mars!* by Peggy Wethered and Ken Edgett. Ask students if they have ever seen the pictures taken by the Mars Pathfinder Rover. Display the pictures. Ask students if they have ever thought about what it would be like to live on Mars.

### Procedure:

1. Have students think back to the book. How long does a trip to Mars take? Show students the calendar. Point out the current date. It takes up to seven months to get to Mars. Flip the calendar seven months ahead—this may be into the next year. If your class started on a trip to Mars today, how many students would celebrate their next birthday before landing? How would it feel to miss two entire seasons on Earth? How would they feel about spending so much time on a small spaceship?
2. Have your students close their eyes and imagine that they are on Mars. It is very cold. The air is very thin. The only water on the planet is locked in ice on the poles or is underground. Their job is to create a living area on the planet that has the things humans need in order to live: air, water, warmth, shelter from the sun and dust storms, and food. Remind them to use what the planet has—water, soil, warmth from sunlight, and energy in the form of wind. Help students use resources such as oxygen from plants.
3. Have them use their imaginations to create new living spaces. Each student can share his or her colony with the class and explain how to supply the explorers with air, water, warmth, shelter, and food. Display the students' Mars colonies in your Space Learning Center.



## LESSON PLAN

### 9

**Skills:** recognizing shapes, categorizing, following instructions

**Materials:** 3 large sugar cookies for each student, packaged chocolate frosting, cleaned and sterilized paintbrushes (plastic rather than hair), star-shaped decorative candies or mini chocolate chips; cleanup materials; photos of the 3 shapes of galaxies

**Preparation:** Allow the frosting to warm and soften so that it is easy to work with. Set up a table so that students can use the frosting to paint their cookies. Display the photos of galaxies.

**Resources:** *Galaxies* by Seymour Simon; *Estreallas y Galaxias* by Miguel Perez

**Funsheets:** *Fact File 016*

**Objective:** Students will learn to identify and create the different shapes of galaxies.

**Introduction:** Introduce students to what a galaxy is—a clump of millions or billions of stars. Galaxies are held together by gravity, and like the solar system and the planets, they turn in space. Gravity and motion give galaxies different shapes. Our planet and solar system are part of a galaxy called the Milky Way.

### Procedure:

1. Have students gather around your activity table. Distribute three cookies to each student. Strongly encourage students not to eat the cookies before the activity is done.
2. Point to the photo of the spiral galaxy and tell students the name of the shape. This is the kind of galaxy that we live in—the Milky Way. Drop a dollop of frosting into the center of a cookie. Model how to use the paintbrush to draw arms out away from the center. Some spiral galaxy arms only stick out a bit, while others stretch out and loop all the way around the center. Have students make spiral galaxies on their cookies.
3. Point to the photo of the elliptical galaxy and say its name. An ellipse is an oval or football shape. Drop a blob of frosting on another cookie and use the paintbrush to make an elliptical shape. Have students make elliptical galaxy cookies.
4. Point to the photo of an irregular galaxy. Irregular galaxies can be almost any shape. They can have blobs, knobs, lumps, and bumps. Create an irregular galaxy and have students follow along.
5. Have students use star candies or mini chocolate chips to decorate their cookies. The candies or chips represent stars. Point to the photos to show students how the stars tend to clump in the center and get sparse near the edges.
6. Remind students that there are no mistakes, just irregular galaxies. Allow students to eat their galaxies.

## LESSON PLAN

### 10

**Skills:** creating shapes, reading, understanding story features, writing, drawing

**Materials:** Books: *Zoo in the Sky: A Book of Animal Constellations* by Jacqueline Mitton; *Stories of the Stars* by Tui T. Sutherland and Judith Moffatt; *Coyote Places the Stars* by Harriet Peck Taylor; star map; paper, pencils, crayons

**Preparation:** Scan through the above books and any other constellation myth and legend books you may have available. Choose your favorite tales, ensuring that students hear stories from a variety of cultures. Highlight or circle the chosen constellations on your star map.

**Funsheets:** *Fact Files 017, 018; Fundamentals 040; Grade K: Math 005; Science 010*

**Objective:** Students will identify constellations and learn the myths and legends of their origins. Then students will invent their own constellation and create a myth to go along with it.

**Introduction:** Tell students that people have been playing connect-the-dots with the stars for thousands of years. When people find a shape, they often make up a story to tell something about that shape and how it got in the sky.

### Procedure:

1. Read to students or have students read the constellation myths you chose. Point out the constellations on the star map during reading. You may wish to use the book's illustrations or a pencil to help students pick out the shape, since many constellations may seem incomplete or vague.
2. Help students come up with some of the features that all of the stories have in common. Constellation myths usually 1) tell something about the shape when it was on Earth, and 2) explain how the shape got into the sky.
3. Give students a homework assignment: on a clear night, they should take some time to look at the stars and try to make a shape out of them. Have the students draw their shape and bring it to class. Remind students that while many constellations are people and animals, they can pick out any sort of shape they wish (e.g., letters, objects, geometric shapes). If your students are able, they may complete the next step at home.
4. Help students compose a myth about the shape they found in the sky. Guide students to include the features of a constellation myth. Students can draw pictures to represent their stories and share their stories with the class.

