

# SUNRISE SUNSET

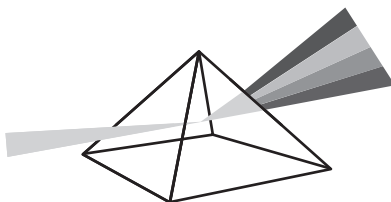
## Background Information for Activity Leaders

### Overview

Children will create a model of the atmosphere to explore how sunlight or visible light is absorbed and then scattered.

### Key Concepts

- The Sun's energy reaches the earth in many forms: **heat energy**, **ultraviolet radiation**, and **visible light** are just some examples.
- Even though visible light appears to have no color, it is a combination of every color of light. A prism can separate the visible light into each of the component wavelengths or colors.

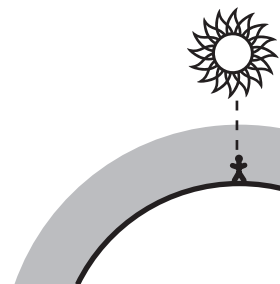


- Seven colors are represented by specific ranges in wavelength. The seven colors are easily memorized by using the mnemonic device ROY G. BIV (Red, Orange, Yellow, Green, Blue, Indigo, Violet).
- Water droplets in the air can act as a prism and separate visible light into a rainbow.
- The **atmosphere** is the air that surrounds the Earth like a big blanket. It is made mostly of gases. It also has a lot of water (in the form of vapor, droplets and ice crystals) and small solid particles (like dust, soot and ashes, pollen, and salt from the oceans).
- When light hits a gas molecule, some of the light gets absorbed. After a while, the molecule radiates (releases, or gives off) the light in all directions.
- All the different colors of light are affected differently. Blues are absorbed and scattered more often than reds. The molecules of gas absorb and then scatter blue light in all directions but let more of the red light straight through untouched. More blue light bounces around in the atmosphere compared to red, and the sky appears blue.

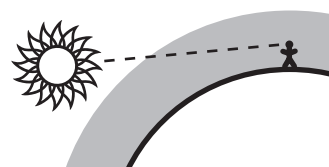
# SUNRISE SUNSET

## Background Information for Activity Leaders

- During the day, when the Sun is overhead, light travels a much shorter distance through the atmosphere. When light travels a shorter distance there is less scattering of blue light, so the sky appears blue.
- When the sun is setting or rising the light has to travel a greater distance through the atmosphere and more blue light is scattered, so the colors we are more likely to see are yellow, orange and red.
- If the air is polluted with small particles, natural or not, the sunset will be redder. The sunsets over the sea may also be orange, due to salt particles in the air.



**Midday Sun**  
(blue sky)



**Sunset or Sunrise**  
(red or yellow sky)

## What to Expect

- In this lesson children will use a model to explore the appearance of the sky at different times of the day. Milk particles mixed into the water are used to scatter blue light, just as air molecules do in the atmosphere. When light from the flashlight passes through the milk and water mixture, blue light is scattered and can be seen throughout the glass.
- Children should notice that as they add each drop of milk the color of the light from the flashlight will appear to change. When the light is viewed through fewer molecules the transmitted light actually looks yellow-orange like a noonday Sun. When the light is viewed through more molecules the transmitted light actually looks red-orange like a setting Sun.

## Common Misconceptions

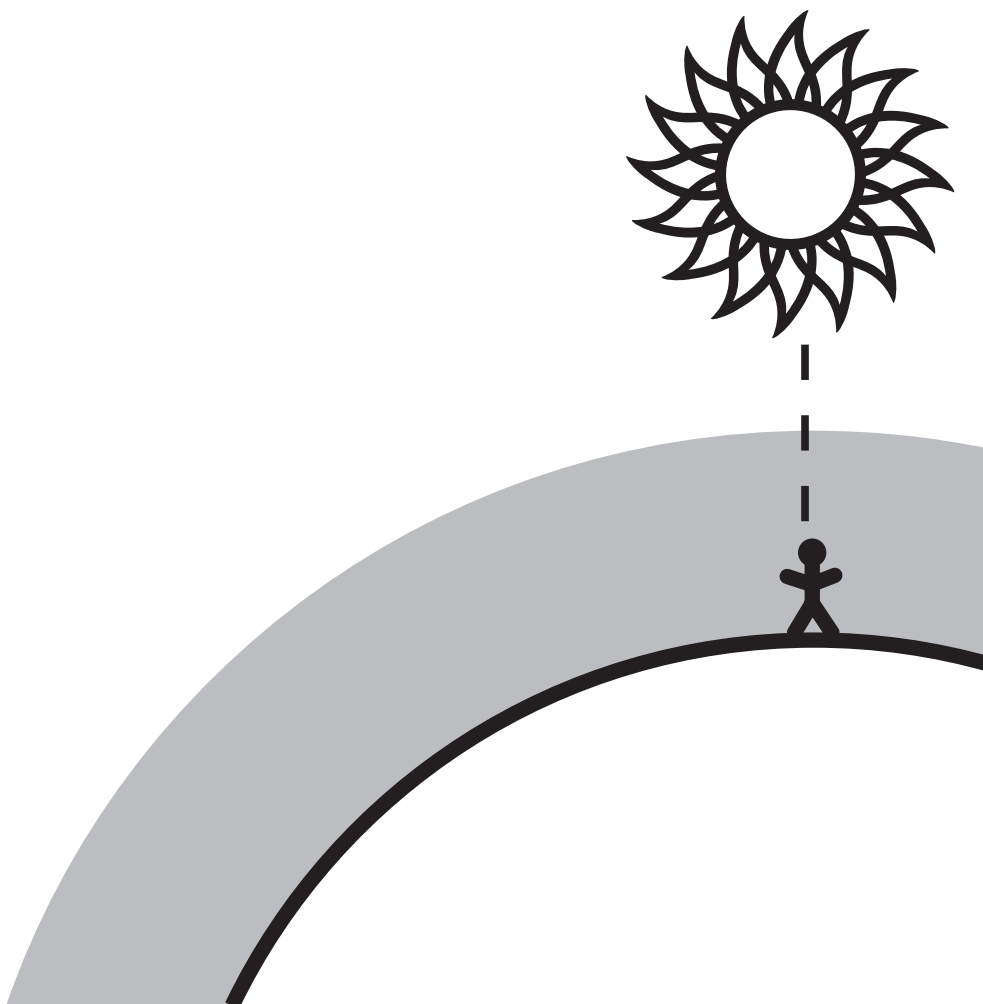
- *Children may think "The sky is blue because it reflects light from the oceans."*

So actually, it may be the other way around. The ocean may reflect the blue sky. Blue wavelengths are absorbed the least by the deep ocean water and are scattered and reflected back to the observer's eye. Particles in the water may help to reflect blue light.

If this were true the color of the sky over the red sea would be red and the color of the sky over the black sea would be black. Also, there would be a noticeable variation in the color of the sky over the ocean and over land masses.

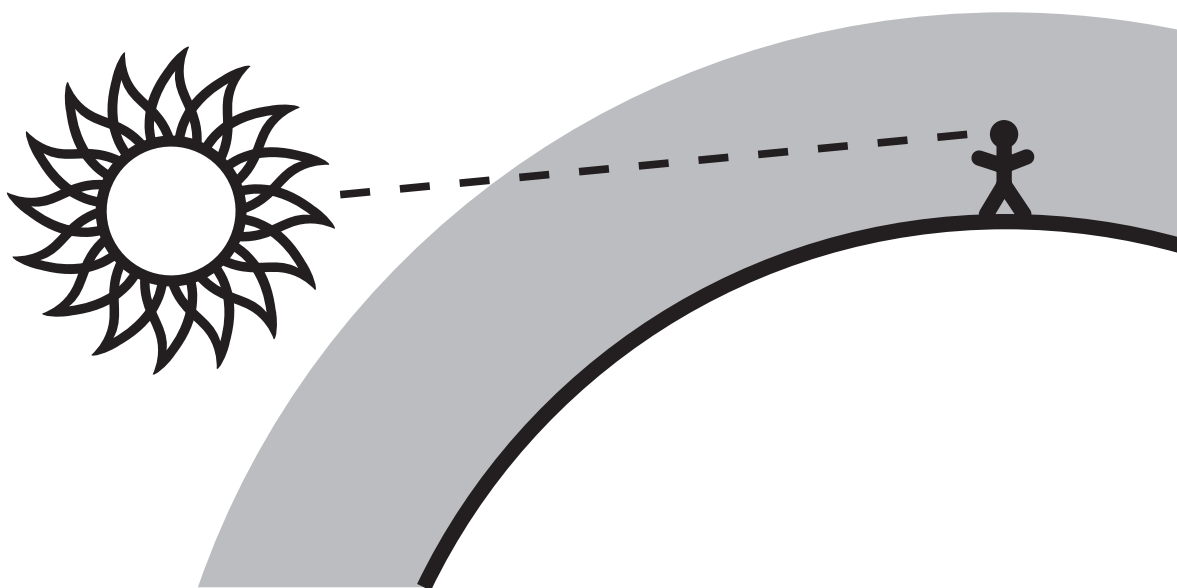
# SUNRISE SUNSET

.....  
**Sunlight and the Atmosphere at Midday Illustration**



# SUNRISE SUNSET

.....  
**Sunlight and the Atmosphere at Sunrise or Sunset Illustration**



# SUNRISE SUNSET

.....

## Data Collection Sheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**WONDER** Why does the color of the sky appear different during different times of the day?

.....

**RECORD** What did you discover from your research?

amount of milk added	observations
none	
1 drop	
2 drops	
3 drops	
4 drops	
5 drops	

**CONCLUDE** What did you discover about the way particles in the atmosphere affect the colors you see in the sky?

.....

.....

**EXPAND** When you add some milk to the water, what color or colors disappear from the rainbow?

.....

.....

## Set Up the Expedition

### Materials

#### For the activity leader:

- (1) Sunlight and the Atmosphere at Midday illustration
- (1) Sunlight and the Atmosphere at Sunrise or Sunset illustration

#### For each group:

- **Sunrise Sunset** Learning Cards
- (1) pocket flashlight
- (1) spoon or stirrer
- (1) ml of whole milk in a small cup
- (1) dropper
- (1) clear glass filled with water
- (1) sheet of letter sized white poster board
- sunny area

#### For each child:

- (1) **Sunrise Sunset** Data Collection Sheet

#### Prepare the demonstration:

1. Find an area where you can conduct the ENGAGE part of the activity. The area should receive direct sunlight through an open window or you should arrange to conduct the activity outside.
2. Practice producing the rainbow on the white poster board before you do it with the children. Hold up a glass filled with water and place it on the corner of a table. Place a white poster board next to the bottom of the glass so that rays of sunlight shine through the cup onto the white poster board. Adjust the angle and height of the poster board so that a rainbow is visible on the white surface. It helps to start with the poster board flat next to the glass, and then gradually move it down and adjust it until a clear image or a rainbow appears.
3. Fill a clear glass cup with water.

#### Prepare the exploration:

1. Provide each group with one clean glass of water, white poster board, and a small cup with 1ml of milk.

## SUNRISE SUNSET

### Activity Leader's Guide

**Group Size:** 2-4 children

**Time:** 30 minutes

## Engage

- 1 Gather the children together. Ask the children to sit in a circle around you in a sunny area. Display the image of the rainbow.

#### Ask:

**“What do you see on this white poster board?”**

Children will see a rainbow. Children may also see shadows. Children may also see a shadow being cast by nearby objects. Explain that the rainbow is what you were intending for them to see.

#### Ask:

**“What is making the rainbow?”**

Allow children time to make some suggestions. The rainbow is created when light shines through the cup of water.

- 2

#### Say:

**“The sunlight, which is white light, is made up of all the colors of the rainbow. In the sky, when the sunlight shines through water droplets, white light is separated into seven colors which appear as a beautiful rainbow. We can remember the seven colors by saying ROY G. BIV (red, orange, yellow, green, blue, indigo, violet).”**

**“Air molecules can also cause some colors to be scattered or sent in different directions. When this happens the sky appears to have a color. What colors do you see when you look at the sky?”** Most children have seen a blue sky at midday and a red, orange, or pink sky at sunset or sunrise.



# SUNRISE SUNSET

## Activity Leader's Guide

### Explore

- 3 Separate the children into groups. Give each group a flashlight, a cup of water and a white poster board.

**Say:**

*“The white light from the flashlight represents sunlight. Use the flashlight, the water and the white poster board to make your own rainbow.”*

- 4 Distribute the Data Collection Sheet and the Learning Cards

**Say:**

*“Follow the directions on the Learning Card to discover how scattering affects the color of the sky.”*

### Conclude

- 5 **Ask:**  
*“How were we able to model the atmosphere?”*

We modeled the atmosphere by using water and milk. Each additional drop of milk we added increased the number of particles the light had to travel through to reach our eyes.

*“Look at these two pictures, in which one does the light have to travel through a greater number of gas molecules?”* Explain that when the glass has fewer milk particles, it represents the atmosphere at midday, and when the glass has more milk particle in it, it represents the sky at sunrise or sunset.

*“What color did the light appear before you added the milk?”* When the light from the flashlight is observed head-on the light appears white.

*“What color did the light appear after you added each additional drop of milk?”* As milk is added, the light from the flashlight will appear yellow and then become more orange and then red, while the surrounding water may begin to appear blue if the beam of light is observed from the side, along the beam of light, instead of head-on.

- 6 Using the illustrations provided, help children to understand that when the glass has fewer milk particles, it represents the atmosphere at midday, when sunlight has to travel through fewer particles. When the glass has more milk, it represents the sky at sunrise or sunset when sunlight has to travel through a greater distance and therefore a greater number of particles.

### Expand

- 7 Ask the children to follow the EXPAND instructions on their Learning Card.

**Ask:**

*“When children added the milk which color or colors disappeared from the rainbow?”*


- 8 **Say:**  
*“Congratulations! You are ready to tell people about light from the Sun. You have earned your ‘Ask Me About The Sun’ stamp.”*

# SUNRISE SUNSET

## Expedition Learning Card

? Why does the color of the sky change?

 **atmosphere visible light scattering**

 Explore how the Earth's atmosphere affects the way we perceive sunlight.

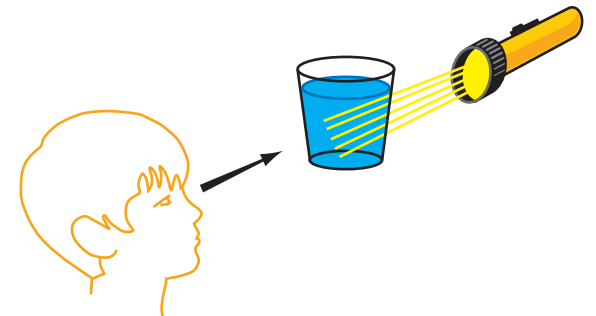
**1 WONDER** Why does the color of the sky appear different during different times of the day?

 Record your ideas on your Data Collection Sheet.

**2 EXPLORE** The water in the glass is a model of the Earth's atmosphere. The milk represents particles in the atmosphere.

**1.** Fill the glass with water.

**2.** Shine the light of the flashlight into the glass of water, while your partner observes on the opposite side of the glass and then observes along the beam of light. **Do not insert the flashlight into the water!**



**3.** Explore how the light of the flashlight appears from different positions as you shine the light thru the water. Draw or write down what you see.

**4.** Stir one drop of milk into the water.

**5.** Observe what happens to the white light of the flashlight as each drop of milk is added.

**6.** Repeat steps 2-5 until you have added 5 drops of milk.



# SUNRISE SUNSET

## Expedition Learning Card

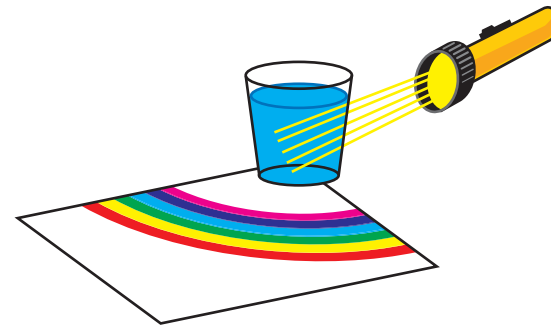
- 3 RECORD** What did you notice when you pointed the light through the water? What happened to the color of the light as you added each drop of milk?

 Draw or write on your Data Collection Sheet what you observe.

- 4 CONCLUDE** What did you discover about the way particles in the atmosphere affect the colors you see in the sky?

- 5 EXPAND** Using a glass of water, project a rainbow on a sheet of poster board, then add 3 drops of milk to the water. What color or colors disappear from the rainbow?

 Draw or write what you observe.



## Discovery

### Why did we do that?

- Sunlight is white light. It is made up of all the colors of light.
- When white light is separated by a prism or by water droplets a rainbow appears.
- The atmosphere absorbs and then scatters blue light most.

## Congratulations!

You have earned your "Ask Me About the Sun" stamp! Now you are ready to tell people about the Sun!

