



Standard 1.P.2: The student will demonstrate an understanding of the properties of light and how shadows are formed.

1.P.2A. Conceptual Understanding: Objects can only be seen when light shines on them. Some materials allow light to pass through them; others allow only some light to pass through; and some do not allow any light to pass through and will create a shadow of the object. Technology such as mirrors can change the direction of a beam of light.

Contents of this kit:

- 3 Flashlights
- 3 Penlights
- 4 D batteries (extras for flashlights)
- 1 roll Aluminum foil
- 1 roll wax paper
- 3 plastic baggies
- 5 Mirrors
- 4 Paper Plates
- 8 Toothpicks
- 4 Straws
- 2 sheets of Cardboard
- 4 clothespins

Additional items teachers may need to supply:

- Candle (battery-operated candles are an option)
- Large paper
- Crayons or Markers
- Scissors
- Rulers
- Plastic Wrap
- Brown paper bags

GRADE ONE

PHYSICAL SCIENCE: EXPLORING LIGHT AND SHADOWS KIT

Background Info:

Let there be light! We are all glad about this! For without light we would not be able to see. Of course we would still have eyes, but our eyes are useless in the absence of light. What do you see when you enter a dark room? Nothing! How much detail can you see in dim light conditions? Very little. Many people even have health conditions related to low light conditions. Have you heard of night-blindness? Some people have difficulty driving at night because they cannot gauge distances very well when it is dark outside^[a]. Other people suffer from Seasonal Affective Disorder (SAD). This is a form of depression that results from spending lots of time in low light conditions such as during the winter months when the sunlight is not as direct and shines for fewer hours^[b]. Doctors tell patients with this condition to brighten the lights in their home and sit in bright light. We have seen that light has an effect on the hormones our body produces, hence our mood.

Light is a form of energy. We define energy as the ability to cause change. What kinds of changes does light cause, you may be wondering. Well, light enters the eye through the pupil and the surrounding muscle, the iris, contracts to control the amount of light that enters. Too much light makes it difficult to see. This light then strikes the lens, which has muscles to change its shape. Its shape changes so it can focus on objects at various distances from our eyes. The image is then focused on the retina, but upside-down. Nerves from the retina travel to the brain to right the image and interpret its colors, distance, and other important information about what we are seeing [c].

Another change caused by light occurs in plants. Plants undergo a process called photosynthesis in order to make food. When light strikes the green parts of a plant it stimulates the plant to use water and carbon dioxide along with chlorophyll to make food.

We get light from flashlights, candles, lights in our ceilings, lamps, and other places. Some animals like fireflies can even give off light themselves, but our major source of light is the sun. The sun is about 93,000,000 miles away from the earth, but its energy, both light and heat, are so strong we feel it everyday. We depend on it everyday.

When light from any light source is blocked in a certain area, it creates a shadow. Objects that do not block the passage of light are called transparent. Windows are transparent. Some objects allow some light to pass through, but images cannot clearly be seen through those objects. These objects are called translucent. Wax paper is translucent, and sometimes a shower door is translucent for privacy. Objects that do not allow light to pass through are called opaque. We cannot see through opaque materials. Examples are wood, many plastics, walls, and metals.

[a] <http://www.webmd.com/eye-health/night-blindness>

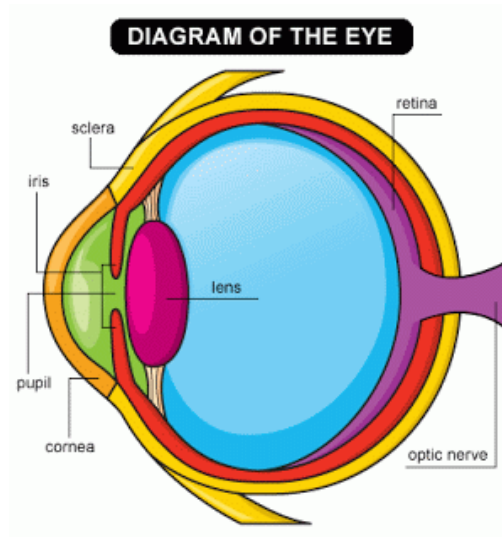
[b] <http://www.webmd.com/mental-health/tc/seasonal-affective-disorder-sad-topic-overview>

[c] <http://coopervision.com/eye-health-and-vision/how-do-we-see>

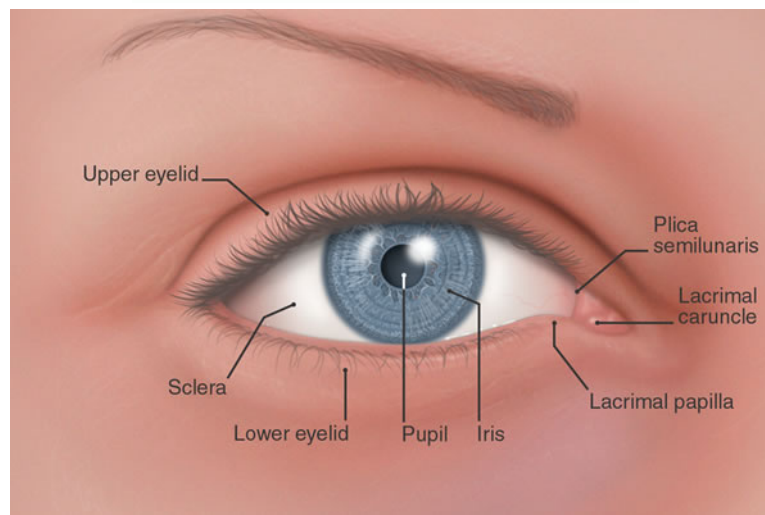
[d] <http://telcel2u.blogspot.com/2013/06/your-eyes-children-hospital-colorado.html>

[e] <http://1.bp.blogspot.com/-Y6u6VEvFWJ0/Ta5KtU8a6RI/AAAAAAAAALw/iw4JQf8KK0o/s1600/Eye%2BDiagram.jpg>

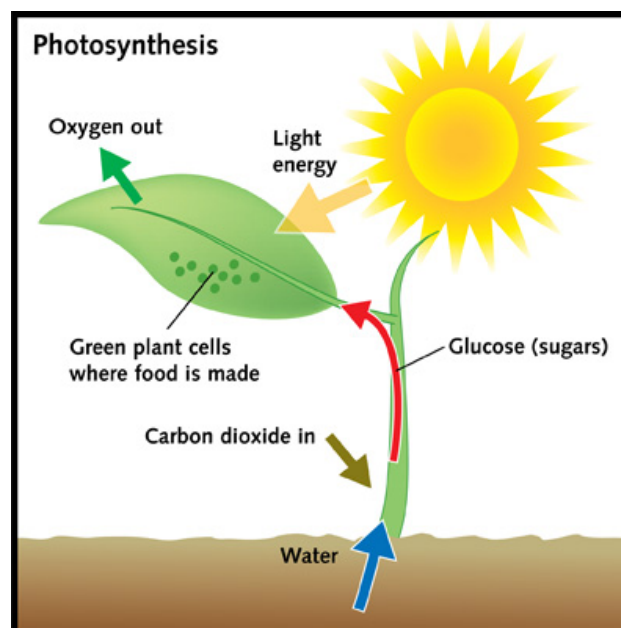
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1.P.2A.1 Obtain and communicate information to describe how light is required to make objects visible.

FOR DISCUSSION:

-Ask students how they feel when the light in their bedroom is turned on in the morning.

-Ask how many students sleep with a night light. Ask them what they can see in their bedroom when there is no light.

-Turn off the classroom lights and ask students to list things that they can no longer see or can no longer see as well as they can with the lights on.

-Ask students if they have ever taken a walk outside at night. Ask them what that was like. Ask if they saw much light from the moon. Was it enough to make a shadow?

-Turn the classroom lights off and tell students a story by candlelight. (Candle must be supplied by the teacher.) Ask students to notice how the shadows change with the flickering of the light.

-Teachers may choose to draw the silhouettes of a few students based on their shadow. The shadow should be drawn on black paper and cut out and pasted in the room. Students can try to guess their classmates based on their side profile drawn from their shadow.

-Shining a bright light, such as from the projector mounted in the room, allow students to check out how their shadows move with them. They may even choose to make some shadow puppets!



LESSON #1: FLASHLIGHT SCAVENGER HUNT

Give students a flashlight and have them go on a flashlight scavenger hunt to find items hidden in the classroom. The room should be dark. Once they find an item they must check it off the list, they must also use the flashlight to see the list. Items you hide may include: marbles, magic markers, special pencils, toy cars, wooden blocks, pieces of candy, Styrofoam cups, etc. Ask students what it was like finding objects in the dark? Ask them if turning the light on in the room would have made it easier. Discuss that light is needed to make objects visible.

LESSON #2: WHAT'S IN THE BAG

Various objects are placed in brown paper bags, students look in the bags to identify the objects with and without a flashlight. Discuss the fact that in order to see the objects, light is needed. Have students draw what they see before the light and after the light.

LESSON #3: KEEPING YOUR BALANCE

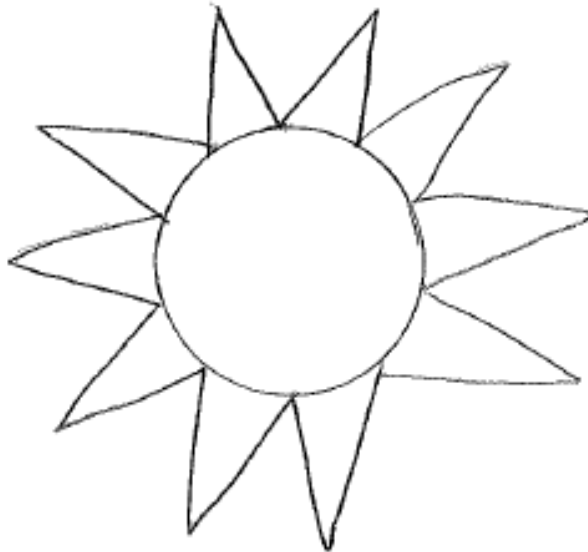
1. Ask students to stand up.
2. Ask students to stand on one foot (all 1st graders may or may not be able to do this very well...).
3. Ask students to close their eyes while they stand on one foot.
4. Once the fidgeting and wobbling stops, have everyone sit down.
5. Ask students if standing on one foot is easier with their eyes open or with their eyes closed. (All should say it is easier with eyes open.)
6. Demonstrate this for students.
7. Explain that with their eyes open, they can focus on something in the room to help them keep their balance, with their eyes closed, they can't see anything, so they lose their balance.

LESSON #4: WHICH IS A SOURCE OF LIGHT?

Discuss with students that in order to see objects, they must either give off light (be a source of light) or reflect light. Turn off the lights, ask students to identify which object are no longer visible. Those items that they can no longer see are objects that reflect light. Try this again, by setting some sources of light around the room. This may include battery-operated candles, glow sticks, something that glows in the dark. When the lights are turned off, these objects should become more visible because they give off light. Discuss that the sun gives off light, but the moon is only visible because it reflects the light of the sun.

LESSON #5: COLOR THE SUN AND THE MOON

The sun is a source of light. See its rays!



The moon reflects light. Without the sun, it is not visible.



1.P.2A.2 Analyze and interpret data from observations to compare how light behaves when it shines on different materials.

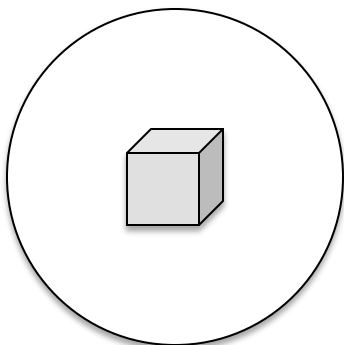
According to the Support Document the terms opaque, transparent and translucent, are Extended Knowledge. The concepts represented by these terms are Essential Knowledge.

- **Transparent:** Transparent materials allow light to pass through completely. Window glass, air, and water are examples.
- **Translucent:** Translucent materials cause materials to look blurry as light passes through. Wax paper and frosted glass are examples.
- **Opaque:** Opaque materials do not allow light to pass through. People cannot see through opaque materials. Wood, metals, and cardboard are opaque.

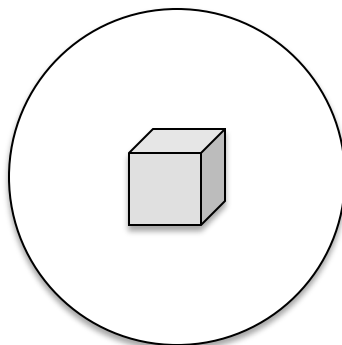
LESSON #6: LIGHT AND DIFFERENT MATERIALS

The teacher should lay the flashlight flat on a surface, turn it on, and aim it towards the class. The classroom lights could be on or off. The teacher should hold up an object such as a toy car or teddy bear in front of the light. Ask the kids if they can see it clearly. They can because air is transparent. Next the teacher should hold a sheet of wax paper in front of the toy and ask students if they can still see it—does it look clear or blurry? Next the teacher should hold a sheet of cardboard in front of the toy and ask if the students can see the toy—does it look clear, blurry, or can it be seen at all? Try this with various object held in front of the toy.

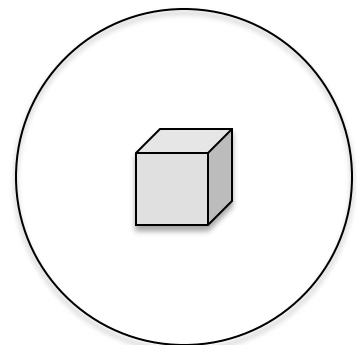
LESSON #7: COLOR THE CIRCLES



All light passes through.



Some light passes through.



No light passes through.

LESSON #8: LIGHT AND MATERIALS

Give students a flashlight. Assign them to test how the light shines through different materials and check (✓) whether they are transparent, translucent, or opaque.

Students may design their own chart, but an example chart is shown below.

	Transparent	Translucent	Opaque
Aluminum foil			
Plastic baggie			
Wax paper			
Typing Paper			
Construction Paper			
Cardboard			
Fabric			
Tissue			

1.P.2A.3 Conduct structured investigations to answer questions about how shadows change when the position of the light source changes.

LESSON #9: WHY IS THAT SHADOW MOVING?

For this activity you will need a doll or other figure that will stand upright. Shine the flashlight on the object and have students observe the location of the shadow. Move the flashlight and have students observe the movement of the shadow.

LESSON #10: I KNOW WHERE MY SHADOW IS

Take students outside into the sun. Each student should look for his shadow on the ground. Ask students to dance and see what their shadow does. Ask students to wave and see what their shadow does. Next ask students to close their eyes, and turn in a circle. They should open their eyes when they are facing the direction of their shadow.

LESSON 11: HAND ME MY SHADOW

1. Each pair of students needs a sheet of white typing paper, a black marker, a red marker, and a blue marker, and a flashlight.
2. One student places his hand down on the typing paper for his friend to trace with the black marker.
3. Holding the hand above the paper and the flashlight above the hand, they should try to get the shadow to fit inside the black outline.
4. Students should explore what happens to the hand shadow as the flashlight moves around—both side to side and up and down.
5. The flashlight should be held to the right (by the person's thumb) and the new shadow traced in red.
6. The flashlight should be held to the left (by the person's pinky) and the new shadow traced in blue.

*Your kit contains cardboard which can be cut into various shapes for a similar activity.

*In addition, there are 4 clothespins that could be used as a stand to hold objects for tracing the shadow.

Here you can find animal patterns to cut out and use with clothespins.
<http://tinyurl.com/nwgrlvk>



LESSON #12: TELLING TIME WITH SHADOWS

<http://www.nwf.org/kids/family-fun/crafts/sundial.aspx>

1. Prepare Paper Plate:

- Start this project on a sunny day just before noon.
- Use the pencil to poke a hole through the very center of the paper plate. Write the number 12 on the edge of the plate with a crayon. Using the ruler as a guide, draw a straight line from the number 12 to the hole in the center of the plate.

2. Take Plate Outside:

At noon, take the plate and the straw outside. Put the plate on the ground and poke the straw through the hole. Slant the straw toward the line you drew. Now carefully turn the plate so that the shadow of the straw falls along the line to the number 12.

3. Fasten Plate to Ground:

Fasten the plate to the ground with some toothpick. Have your child predict where he/she thinks that the shadow of the straw will be pointing in one hour.

4. Check Shadow Position Hourly:

One hour later, at one o'clock, check the position of the shadow along the edge of the plate and write the number 1 on that spot. Continue each hour predicting the position and then checking and marking the actual position and time on the edge of the plate.

5. Discuss Your Sun Clock:

At the end of the day you and your child will have a sun clock. On the next sunny afternoon you will be able to tell time by watching where the shadow of the straw falls on your clock.

Note: Observation, prediction and communication are all very important science skills. This activity helps to develop those skills. Be sure to discuss why students think the shadow is moving.

This activity is from: <http://www.nwf.org/kids/family-fun/crafts/sundial.aspx>

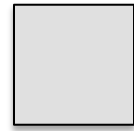
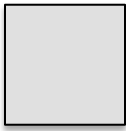


LESSON #13: SHADOWS FROM A DISTANCE

The student should set an object such as a small figurine in the box and lay the flashlight down in its outline. The student should trace the shadow of the object. Next the toy should be moved to the next box, and the flashlight moved to the next outline. The new shadow should be drawn.

Shadow:

Object:



Flashlight:



Flashlight:

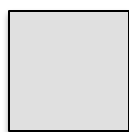
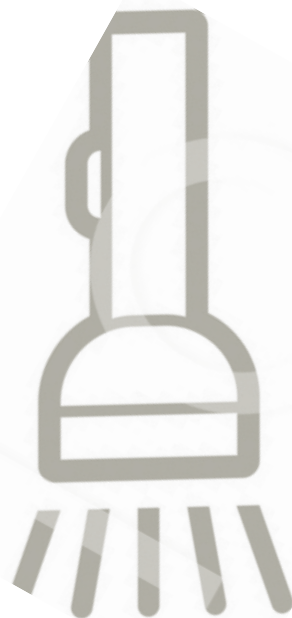


Flashlight:



LESSON #14: WHAT DOES THE ANGLE HAVE TO DO WITH IT?

The student should set an object such as a small figurine in the box and lay the flashlight down in its outline. The student should trace the shadow of the object. Next the flashlight should be moved to the next position. The new shadow should be drawn.



1.P.2A.4 Develop and use models to describe what happens when light shines on mirrors based on observations and data collected.

LESSON #15: SPIN THE LIGHT

(This is like Spin the Bottle, but without the kiss.)

Students should be seated in a circle. A penlight is turned on and placed in the middle of the circle on the floor. The teacher or a selected student spins the penlight in a circle and everyone watches to see where it stops. When it stops it should be pointing at a student seated in the circle. That student is now the winner. He/She gets to pick a prize sticker out of the bag and is allowed to be the next to spin the light.

Discuss with students that the light always shines in a straight line.

LESSON #16: BEND THE BEAM

Students sit in a circle. One student holds the flashlight. The mirrors are given to various other students in the circle. The student with the flashlight aims towards a mirror. That mirror is aimed towards another mirror, which is aimed towards another until all mirrors are reflecting the light around the circle.

Other seating configurations may be attempted. Different students will want to hold the mirrors and flashlight. This activity may work better with the classroom lights off.

Discuss with students that beams of light travel in a straight line, but mirrors reflect light and can bend it into another direction. In their science journal, have students draw what they observed.

LESSON #17: TARGET PRACTICE

One student holds a flashlight and shines it on a mirror held by another student. The student holding the mirror attempts to angle the mirror such that it shines on the target taped to the wall.

Discuss that light travels in a straight line and that mirrors reflect light and can bend it into a new direction.



