FIRST GRADE
DECEMBER
LIGHT AND SHADOWS

TOTAL TIME: 60 Minutes.

ACTIVITY 1: Shadows need light (Read the book to the entire class)

Book: William And The Magic Ring. (A Shadow Casting Story)

- A lamp or projector

ACTIVITY 2: Playing with Shadows

Version 1: inside
Version 2: outside

Material: (you will need to chose one)

For inside you need:

- Scissors
- Pencil
- Tape
- Tracing paper
- Flashing light or the classroom projector

For outside you need:

- Sunny day
- Chalk

ACTIVITY 3: Playing with Light

Materials:

- A glass
- A Pen
- A coin
- A saucer
- A white piece of paper
- The light Crystal
- The rainbow glasses

ACTIVITY 4: Light box

Materials:

- box with the projector lamp and the prisms
- the transformer

ACTIVITY 1
SHADOWS NEED LIGHT

Material:

- Book: William And The Magic Ring. (A Shadow Casting Story)
- Use the class projector

Activity:

Read the book to the children.
Each page has a silhouette that can be projected as a shadow on a wall. You will need to use the classroom projector.

This book will show the children that shadows need light in order to exist.

ACTIVITY 2
PLAYING WITH SHADOWS

Depending on the weather you could either play inside or outside.

Materials for inside:

- Scissors
- Pencil
- Tape
- Card board
- Flashing light
- the classroom projector

Activity:

Explain to them that light comes from different sources. Shadows are created and changed by different light sources.

Ask: Can you find shadows inside the classroom?

Discuss the object and light source (i.e. external light, spotlight, the sun).

1. Use an overhead projector to investigate shadow making using hands and/or other objects, and with the light source coming from different angles. Can you make it bigger, smaller, different shape, clearer?
2. Give each child a piece of cardboard.
3. Let the children, trace patters of figures. They could invent their own. They could draw ghost, flowers, a car anything they are good at.
4. Let the children cut out the patterns and tape each one to the end of their pencil.
5. How can we make the shadows appear on a different wall?
6. Experiment using objects from the classroom and placing them in front of the projector.
7. Let the kids play with their own shadows. If you can, you can also trade the shadows of the kids on the board.

Where a room has more than one light, children may notice multiple shadows are formed.

Discuss how the position and number of light sources impacts on the shadow(s) formed.

Materials for outside:

- Sunny day
- Chalk

Activity:

This activity gives students a chance to experiment with different ways of making shadows. Shadows often tell as much about the light source as about the objects which cast them. Since light travels in straight lines, if we know where an object is and where its shadow is, we can determine where the light source is.

Shadows are formed when opaque objects come between a light source and the 'ground'. The relative position of the sun or light source affects the direction of the shadows it forms.

Students can investigate shadows outside. The discussion can be on the following:

- Can you make your shadow big or small?
- Can you hide your shadow?
- Can you make it disappear?
- Can you make your shadow touch another shadow without bodies touching?
- Can you make your shadow point different directions?
- Can you make your shadow not touch your feet?
- Can you step on your shadow?
- Work with a partner to make shadow monsters (2 heads, 4 arms, etc)
- Make one shadow. Working in groups of three or four students to make one large shadow. Try to create familiar shapes. A circle, a square, a triangle.
- Make sure they experiment with different angles.
- Draw the shadows' shapes with chalk
- Discuss why shadows change during the day.

While doing those games make them face the Sun. Explain and try to make them find their shadows. Ask questions such as:
Are they in front of us? They are behind us. Let's face our shadows. Where is the Sun? It is behind us now. So, where are shadows going to be when the Sun is over there (point to the left)? Let's face that way. Our shadows would be behind us again, on the other side.
So, where do shadows form? They form on the side of us away from the Sun. Is this true for any light? Yes. Can both the Sun and shadow ever be on the same side of us? No. Could we face the Sun and face our shadows at the same time? No.

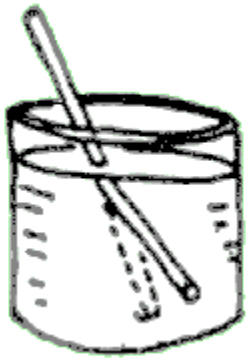
ACTIVITY 3
PLAYING WITH LIGHT

Materials:

- A glass
- A Pen
- A coin
- The light Crystal
- The rainbow glasses

Activity:
Explain that light makes it possible for us to see the world around us. Source of light, such as the Sun and the light bulbs, produce light rays. These bounce off object. The rays then enter in our eyes, and we see the objects. We use light to form "images" or pictures of things.

You will do several experiments with light.



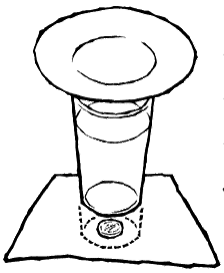
Experiment 1: Broken and Bent?
Use the glass and fill it with water. Then let the pen stand in it. The pen standing in the glass of water is in fact straight. It looks strange because water bend the light rays coming from the pen to your eyes. This is the reason why it is hard to spear fish.

Light is refracted, bent by water. The standard explanation of physics is that light passes more slowly through water than through air, and the "bending" is a side-effect of this slowing down.

When you put a pencil or some other straight object into a glass like this, you will see this sort of bending, but the same bending has a practical importance for anybody trying to spear fish from a rock, a river bank or a stream.

In the interests of the fish, I shall not reveal the secret, but it comes down to the problem that you are aiming a spear which is in the air at a fish which is in the water.

Experiment 2: Out of Sight



Place a coin on a white piece of paper. Put a clear glass filled with water on top of the coin. Can you see the coin? Where is the best place to see it? Now place a saucer on top of the water glass. Try to find the coin without looking straight down through the water glass. Can you do it?

How did the coin disappear?

We see objects because light rays reflect off them and into our eyes. But light bends each time it hits a substance of a different density. The light reflecting off the coin must pass through air, glass, and water (all with different densities) to get to your eye but the light bends so many times that by the time it gets to your eye, it looks like it's somewhere that it's not!

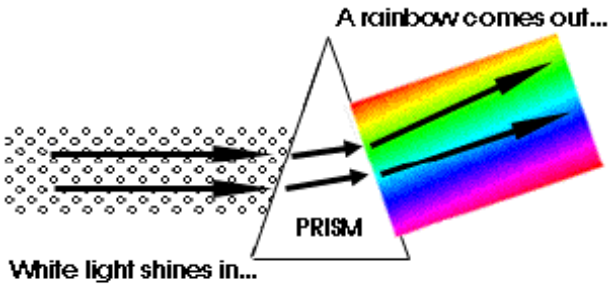
Experiment 3: The Light Crystal

Just like in water, light travels more slowly through the prism than through air. When a beam of light enters the prism at an angle, this slowing bends (refracts) the light. How much it bends depends on the wave length of the light.

Can light be broken into the different colors?

Yes white light is made of all the different colors.

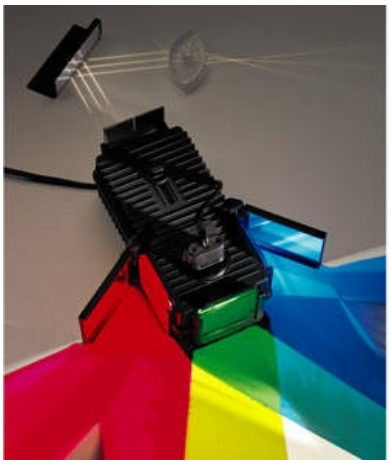
- Use the prism to show this.



- Use the triangular design cards to see how the prism acts like a kaleidoscope.
- Place the triangular designs cards into the top of the display base. Next place the Light Crystal into the base covering the design. Look down through the slanted top of the Light Crystal and notice that it acts just like a Kaleidoscope.
- Let the children wear the rainbow glasses.

ACTIVITY 4 THE LIGHT BOX:

Connect the lamp cable to the transformer.



Use the light box, the black masks and the mirror figures to show how light travels straight and how it can be reflected.

- Light travels straight and the path of light can be represented by rays. Use one single slit mask (black cards) and place it in the back slid to send a single ray. (notice that in the picture above, you see the colored light on the front. You will not be using that yet). Just close the mirrors and focus on the back part of the projector.
- Change the mask to a three slit mask. Now you will have three rays traveling in a straight line.
- Light can also be reflected by using a mirror. As you can see above, you change the direction of the light by using the mirror.
- Try predicting how light will be reflected when using a concave mirror.

Now see how light is refracted through a thick lens. Use the different lenses to refract the light. See on the picture above how the concave lens twisted the light. Try to do the same as shown in the picture at the back of the lamp but also try at the front:

- Make sure the side mirrors are closed.
- Project a big ray at the front.
- Place a lens in front of the ray. (without using any black slit). Try to predict what will happen to the light before the light passes through the lens.
- Check your predictions.
- Do the same with the different shapes.
- Ask questions such as which figure do you thing brings the light together, which figure brings the light apart, can you criss-cross the light?
- Use a two slit mask to produce two rays. What happens to the path of parallel rays of light as they enter and exit a lens?

BE CREATIVE FEEL FREE TO TRY AND DO EXPERIMENTS WITH THE BOX