Refraction of Light

Purpose Of The Activity:

To explore the types of mirrors.
To use the placement and angles of plane mirrors to direct light to a target. To discover the principles of light refraction and reflection.

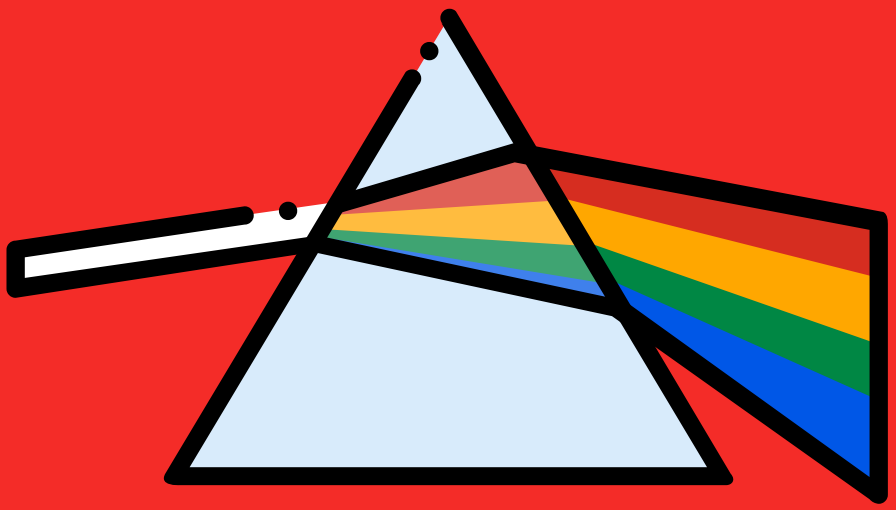
Theme/Unit:

Reflection/Refraction

What Do You Know?

- Do all mirrors produce the same image?
- If we didn't put any windows in a room, could we bring light inside using only mirrors?
- Why doesn't our image in a mirror flip completely, but only swaps left and right?

Explain what you know!



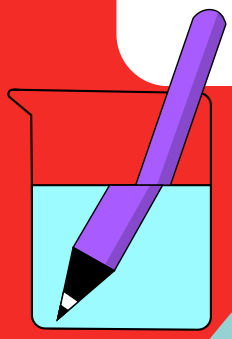
CURIOUS BOX

Let's Spark Curiosity!

Let's start exploring!

““It is necessary to have windows for light to enter a house. In the same way, we need mirrors to direct light properly. Imagine you have a light source and want to get that light to a target. We know that light travels in a straight line, but sometimes we need to change or redirect its path. That’s where mirrors come in! By placing mirrors at different angles, we can change the direction of light and make it reach the point we want. But are all mirrors the same? Does light reflect the same way from every mirror? Let’s discover different types of mirrors and witness the journey of light together!” is said, and the activity materials are brought out.

The activity video is watched, pausing to check the set content. All steps of opening covers and packages are performed simultaneously with the students.Set Contents Watch the Video by Pausing!



Content Of The Set

- [ ] Ray tracing paper .....
- [ ] Laser .....
- [ ] Convex lens (thin lens) .....
- [ ] Concave lens (thick lens) .....
- [ ] Gloves .....
- [ ] Refraction of Light Activity Sheet .....

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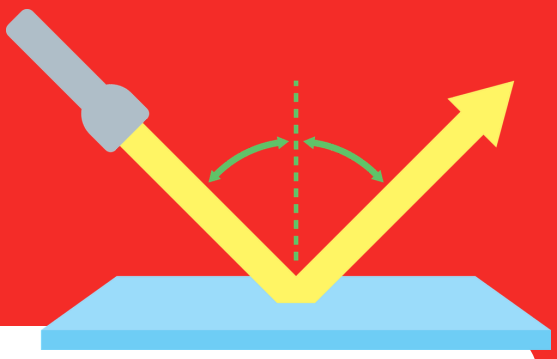
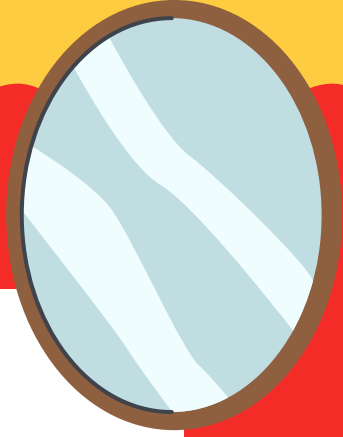
CURIOUS BOX



How Do We Do It?

1. Wear gloves for safety.
2. Examine the convex and concave lenses and observe their similarities and differences.
3. Place the concave (thick) lens on the ray tracing paper, shine parallel laser beams through it, observe how the rays spread and refract, and make a drawing.
4. Place the convex (thin) lens on the ray tracing paper, shine parallel laser beams through it, observe how the rays converge at a point, and make a drawing.

What Should Future Scientists Explore?



The following questions are posed to the students:

- Why do you observe changes in your image when looking at a mirror from different angles? How does this affect the behavior of light?
- Why doesn't our image flip upside down in a plane mirror, but does when we look into a spoon?
- Is anyone curious about the difference between reflection and refraction of light?

Types of Mirrors

- Glass with a reflective backing is called a mirror. Mirrors reflect light and show objects. There are three main types of mirrors: plane mirrors, concave mirrors, and convex mirrors. Concave and convex mirrors are also called spherical mirrors.

Plane Mirrors

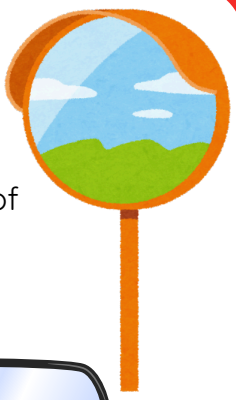
- Their reflective surface is flat, and the image has the same properties as the real object. They are used in hair salons, stores, periscopes, and projection devices.

Did You Know?

The writings on the front of ambulances and fire trucks are written in reverse so that they appear correctly in a mirror. Why? This design ensures that their reflections in rearview mirrors are readable. As a result, drivers behind can quickly recognize emergency vehicles and give way. So, these words are not just signs — they are life-saving symmetry!

CURIOUS BOX

Convex Mirrors



They reduce the size of images and show a wider area. Because of this feature, they are used at intersections, in vehicle side and rearview mirrors, and in store and market security systems. The back surface of a metal spoon acts like a convex mirror.

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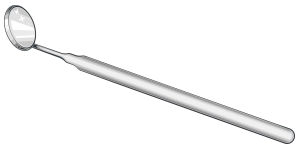
Concave Mirrors

They focus light at a single point and magnify images. They are used in car headlights, solar energy systems, dental examinations, telescopes, and makeup mirrors. The inner surface of a spoon acts like a concave mirror.

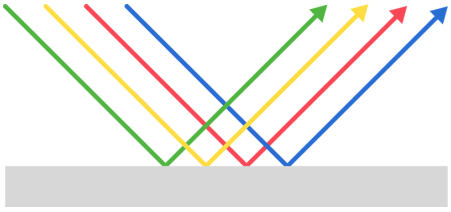


Reflection of Light

Reflection is when light strikes a surface and bounces back. As a result of reflection, the direction of light changes, but its color and speed remain the same. When light strikes a surface, a perpendicular line called the normal is drawn. The part of the light that reaches the surface is called the incident ray, and the part that bounces back is called the reflected ray. Reflection can vary depending on whether the surface is smooth or rough, and it occurs in two ways: regular reflection and diffuse reflection.

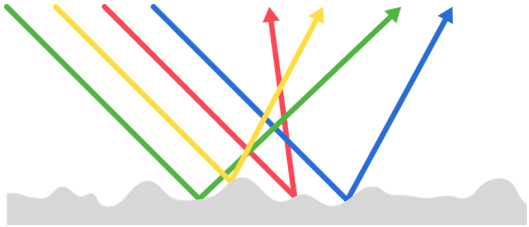
Regular Reflection

Light rays that come from smooth and flat surfaces are reflected parallel, creating clear images. This is observed in plane mirrors, metal surfaces, and calm water. Objects appear in the same shape and size.



Diffuse Reflection

Light rays coming from rough surfaces are reflected in different directions, and no clear image is formed. This occurs on surfaces like wavy water or crumpled foil. Objects appear in different shapes and sizes.



Refraction of Light

When light passes from one medium to another, such as from air to water or from glass to air, it bends slightly, changing its direction. This phenomenon is called refraction. The degree to which different transparent materials bend light varies!

For example, when you put a pencil in a glass of water, the part of the pencil in the water appears bent. It seems as though the pencil is crooked! This is due to the change in the speed of light when it enters the water, making the pencil look as if it is coming from a different position.

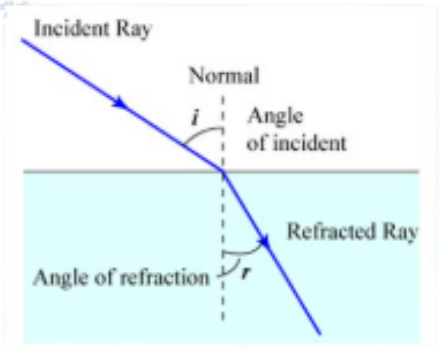
Why Does Light Bend?

Light travels quickly in the air. However, when it enters substances like water or glass, it begins to slow down. This change in speed causes the light's path to bend. The speed of light is different in various materials (glass, water, air), which is why light bends to different extents in each.

1. Refraction of Light Passing from a Less Dense to a Denser Medium

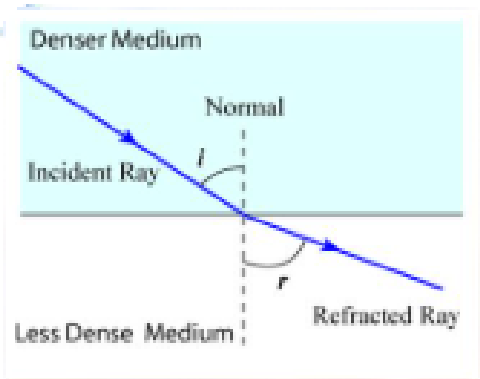
In refraction, the line drawn perpendicular to the surface separating the two mediums is called the normal. The angle between the incoming light and the normal is called the angle of incidence, while the angle between the refracted light and the normal is called the angle of refraction.

When light passes from a less dense medium to a denser medium, it bends toward the normal.



2. Refraction of Light Passing from a Denser to a Less Dense Medium

When light passes from a denser medium to a less dense medium, it bends away from the normal.



Curious Scientific Explanation

The following questions are posed to the students:

- Do the glasses we use in daily life reflect light like mirrors and high amounts of light towards our eyes?
- What property of light causes the image formed in magnifying glasses?
- What is the difference between the image formed in a plane mirror and the image formed in a magnifying glass?

What is the difference between the image formed in a plane mirror and the image formed in a magnifying glass?

Light, when it enters different materials like water and oil, bends differently because each material slows light down by a different amount, which is called the refractive index. The refractive index shows how much light is slowed down in a material. The higher the refractive index, the more the light is slowed down and bent. For example, water's refractive index is about 1.33, while oil's refractive index is around 1.47. This means that light bends more in oil than in water. When you shine laser light at the same angle to both water and oil, the light will bend more in the oil (refract more) because oil slows light down more than water.

Lenses

- Glasses do not reflect light like mirrors, but rather bend light to form clear images and are designed to correct vision problems. The lenses of glasses allow light to pass through, helping to provide clear vision. Lenses are objects that have at least one spherical and transparent surface; they form images by bending light.
- In mirrors, the image forms as a result of light reflection, while in lenses, the image is formed by the bending (refraction) of light. Light bends twice as it passes through a lens: first when it enters the lens, and again as it exits.
- Lenses that are thinner at the edges than in the center are called concave lenses, and they form a larger image of objects. They are also called converging lenses.

Lenses that are thicker at the center than at the edges are called convex lenses, and they form smaller images of objects. They are also called diverging lenses.

What Did We Discover?

"Today, as we observed the different types of mirrors, we discovered how light reflects in plane, concave, and convex mirrors. We also gained a lot of information by examining how light refracts in different environments. So, how did you feel during this activity?"

What Else Can We Do?

Come on, you try too!

Dear Teacher,

You can observe the reflection and refraction of light using the activity page. You can perform the following activity with your students.

Question of the Day?

How is a rainbow formed?

CURIOUS BOX

Materials
How to Perform

Pen Refraction Experiment

Materials:

- A glass of water
- A pen or straw
- A transparent glass

How to Perform the Experiment:

1. Fill the transparent glass about halfway with water.
2. Immerse the pen (or straw) into the glass. Position it so that half of the pen is submerged in the water and half is outside.
3. Look at the pen from eye level from outside the water. You will notice that the part of the pen submerged in the water appears bent, as if it has changed direction.
4. Why does this happen? This happens because of light refraction. When you look at the pen, the light bends as it passes through the water, meaning its direction changes. Because light moves more slowly in water and changes direction, the part of the pen in the water looks like it's coming from a different location. This is why the pen looks bent!
5. You can perform the same experiment with a glass of oil. Since light refracts more in oil, you will notice that the pen changes direction even more.

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