

1. EXPLORING LIGHT — CURVED MIRRORS AND LENSES

PROBE AND PONDER

- Have you ever looked at your reflection in a shiny spoon? It acts like a tiny magic mirror! When you peek into the inner scoop, your face appears upside down. But if you flip it to the outer bulge, your reflection stands upright, though it looks much smaller. This happens because the curved surface bends light in different ways.
- You might have noticed a similar trick in cars. Have you seen the warning on side-view mirrors that says, "Objects in mirror are closer than they appear"? These mirrors are curved outward to help drivers see a wider area of the road. However, this curve makes vehicles behind look smaller and farther away than they really are, which is why the warning is there to keep us safe.
- Finally, think about sunlight and glass. We know glass usually lets light pass through, but what if we use a curved piece of glass, like a magnifying lens? Can it focus scattered sunbeams into one tiny, super-hot spot? Surprisingly, yes! Under the right conditions, this focused light can become so intense that it can even make a piece of paper catch fire.



2. Spherical Mirrors: Curved Inward vs. Curved Outward

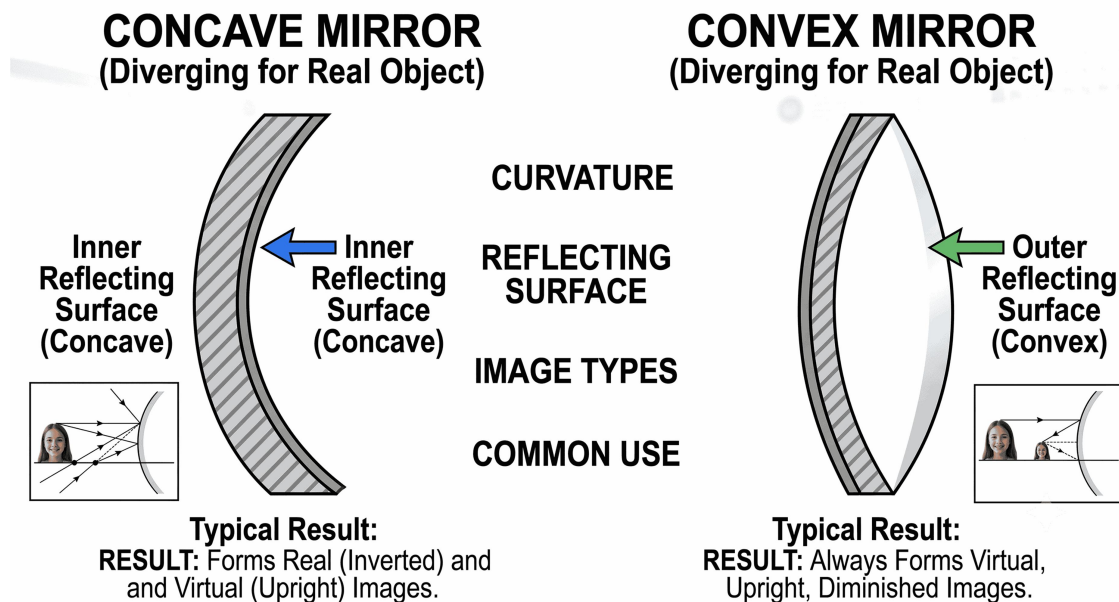
A flat dresser mirror is a plane mirror that reflects light to form an upright image of the exact same size as the object. However, when a reflecting surface forms part of an imaginary hollow sphere, it is called a Spherical Mirror. These mirrors come in two distinct types based on how their surfaces curve.

A. Concave Mirror

A Concave Mirror has a reflecting surface that curves inward toward the center of the sphere, much like the hollow inner entrance of a cave or the inner scoop of a spoon. Because of this shape, it acts as a converging mirror. When parallel rays of light strike it, they bounce inward and meet at a single focal point, allowing it to concentrate light.

B. Convex Mirror

In contrast, a Convex Mirror has a reflecting surface that bulges outward toward the incoming light, similar to the exterior surface of a dome or the back of a spoon. This shape makes it a diverging mirror. When parallel rays of light strike it, they bounce outward and scatter away from each other, which helps provide a wider field of view.



3. Real vs. Virtual Images

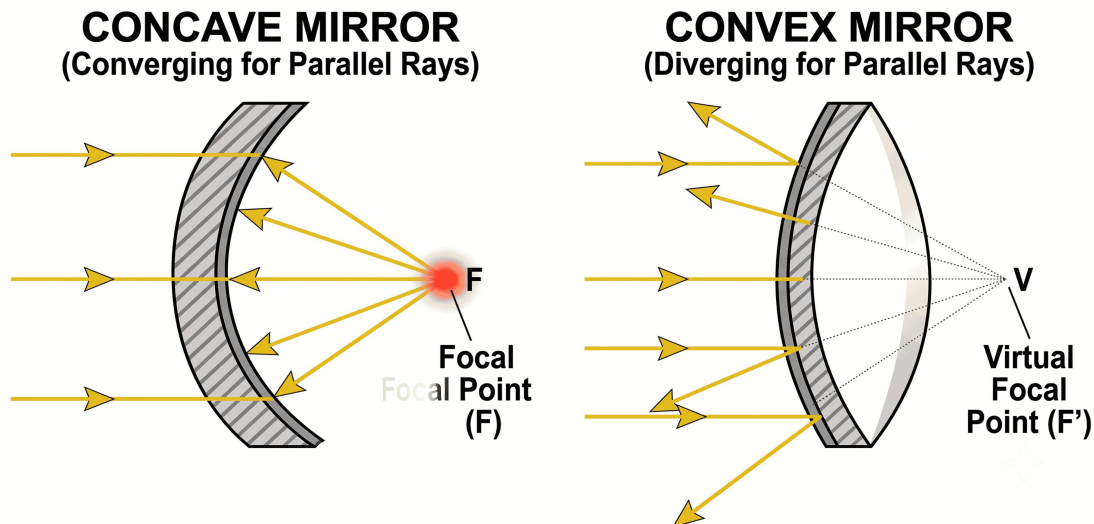
A **Real Image** is formed when light rays physically converge and intersect at a specific point in space. Because the light actually meets at this location, a real image can be captured and focused onto a physical screen, such as a piece of paper or a projector wall. In the context of spherical mirrors and lenses, real images are typically inverted, meaning they appear upside down compared to the original object.

In contrast, a **Virtual Image** is formed when light rays physically diverge or spread apart after reflection or refraction. Although the rays do not actually meet, they appear to originate from an imaginary point behind the mirror or lens when traced backward. Since the light does not physically converge at this point, a virtual image cannot be captured on a screen. Virtual images are always upright (erect), maintaining the same orientation as the object.

How Curved Mirrors Direct Light: Converging vs. Diverging

Reflection on curved surfaces strictly adheres to the two universal Laws of Reflection, just as it does on plane mirrors.

- First, the Angle of Incidence is always equal to the Angle of Reflection.
- Second, the incident ray, the reflected ray, and the normal (an imaginary line perpendicular to the surface at the point of incidence) all lie within the same geometric plane.



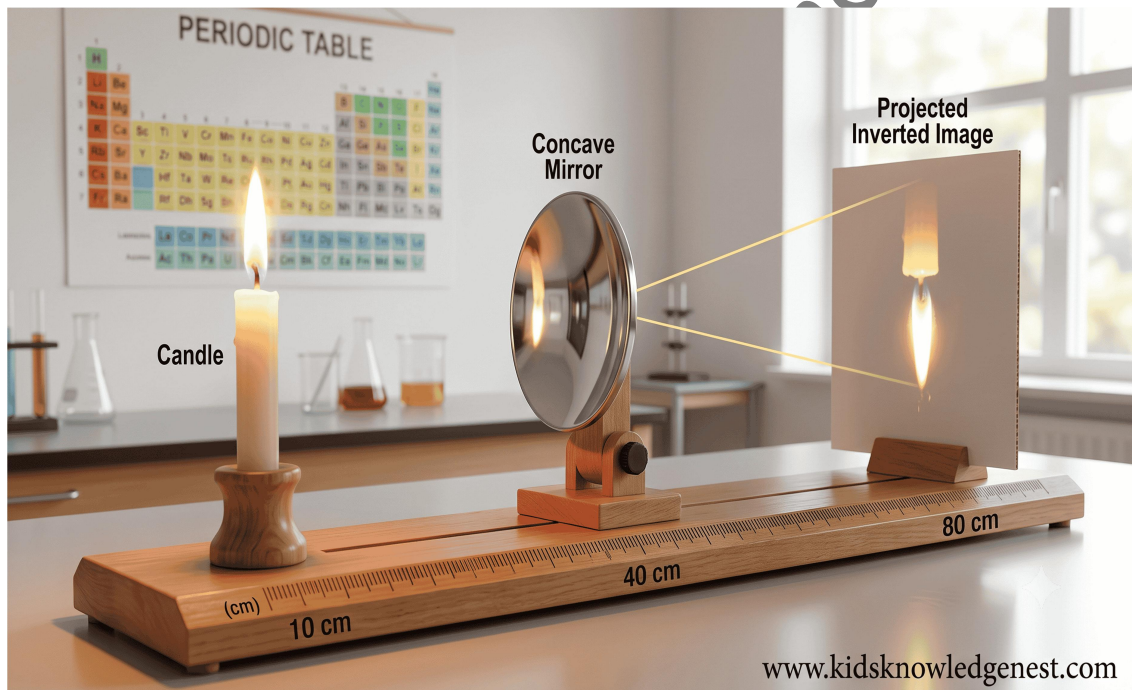
However, because the surface of a spherical mirror is curved, the orientation of the normal changes at every point along the mirror, tilting according to the curvature. This variation in the normal's direction causes parallel light beams to behave differently depending on the type of mirror.

- In a Concave Mirror, the inward curve directs incoming parallel beams inward, causing them to converge and cross at a specific real point known as the Principal Focus (F).
- In contrast, a Convex Mirror has an outward bulge that directs incoming parallel beams outward, causing them to diverge or spread apart. Although these reflected rays do not actually meet, if they are traced backward in straight lines, they appear to originate from a single imaginary point behind the mirror, known as the Virtual Focus.

www.kidsknowledgegenest.com

4. Classroom Activity: The Screen Test Experiment

- **Objective:** Demonstrate how a concave mirror transitions between a real image and a virtual image.
- **Materials:** A concave mirror on a stand, a lit candle, and a white cardboard sheet.
- **Procedure:**
 1. Place the lit candle approximately 50 cm away from the concave mirror.
 2. Move the cardboard sheet back and forth in front of the mirror until a sharp image of the flame appears on it. The flame is upside-down (inverted) and caught on the sheet—proving it is a **real image**.
 3. Now slide the candle very close to the mirror (about 5 cm). The image disappears from the cardboard completely. Look directly into the mirror surface: you see a giant, upright, magnified flame—a **virtual image**!



5. Real-World Applications

- **Concave Mirrors:**
 - **Dentist Diagnostic Mirrors:** Held close to teeth to create an enlarged, upright virtual image of cavities.
 - **Headlights and Search Torches:** Placing the bulb at the principal focus creates a strong, parallel forward beam.
 - **Solar Cookers:** Concentrates heat rays from the sun onto a cooking vessel at the focal point.
- **Convex Mirrors:**
 - **Vehicle Rear-view / Wing Mirrors:** Always forms an upright, reduced virtual image, giving the driver a wide panoramic field of view.
 - **Blind Turn Safety Mirrors:** Positioned at sharp road corners and parking ramps to reveal oncoming traffic.



www

6. What Is a Lens?

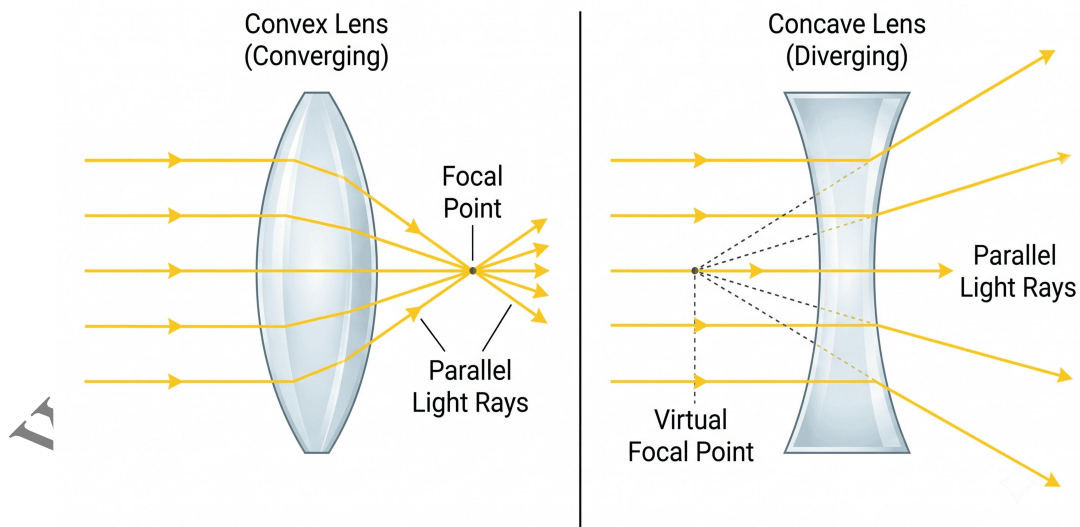
A **lens** is an optical component made of a transparent medium (such as optical glass or clear plastic) bounded by two spherical surfaces. Instead of bouncing light off, lenses allow light to pass through while **refracting** (bending) the rays:

A. Convex Lens (Converging Lens)

- **Profile:** Thicker across the center and thinner along the outer rim.
- **Action on Light:** Bends parallel rays inward toward a real focus point.
- **Image Characteristics:** Forms a real, inverted image on a screen at distance; acts as a **magnifying glass** (virtual, upright, magnified) when held very close to an object.

B. Concave Lens (Diverging Lens)

- **Profile:** Thinner across the centre and thicker at the rim.
- **Action on Light:** Bends parallel rays outward, scattering them apart.
- **Image Characteristics:** Always forms an **upright, virtual, and diminished (smaller)** image. It cannot cast an image onto a screen.



7. Summary Comparison Table

Optical Element	Physical Profile	Action on Rays	Resulting Image	Common Practical Uses
Concave Mirror	Curved inward	Converging	Real & inverted at distance; Virtual & magnified when held close	Dentist's mouth mirrors, torch and car headlamp reflectors, solar cookers
Convex Mirror	Bulged outward	Diverging	Always Virtual, Erect, and Diminished	Vehicle rear-view mirrors, blind-curve road mirrors, shop surveillance
Convex Lens	Thick center, thin edges	Converging	Real on screen; Virtual & magnified when held close	Handheld magnifying glasses, photographic cameras, microscopes, eye optics
Concave Lens	Thin center, thick edges	Diverging	Always Virtual, Erect, and Diminished	Eyeglasses for nearsightedness (myopia), door peepholes

8. Practice Worksheet & Questions

Section A: Fill in the Blanks

1. An image that can be captured and projected onto a physical screen is classified as a _____ image.
2. A _____ mirror is utilized by dental practitioners to view an enlarged, upright image of tooth cavities.
3. Parallel rays of natural sunlight entering a convex lens _____ at a common point called the principal focus.
4. A convex mirror consistently produces an image that is virtual, erect, and _____ in scale compared to the object.

Section B: True or False

1. A concave lens can be used to concentrate sunlight onto dry leaves to make them catch fire. *(True / False)*
2. A convex mirror provides a wider field of view than a flat plane mirror of the same surface area. *(True / False)*
3. An inverted image formed by a curved mirror is always a real image. *(True / False)*

Section C: Conceptual Questions

1. Why does an emergency ambulance vehicle have the word **"AMBULANCE"** painted in reversed lettering across its front hood?
2. If you are tasked with projecting a clear, sharp picture of an outdoor tree onto the classroom wall without using electronic projectors, which type of lens should you select and why?

9. Solutions & Answer Key

- **Section A:** 1. Real | 2. Concave | 3. Converge | 4. Diminished (smaller)
- **Section B:** 1. False (*Only a converging convex lens concentrates sunlight; a concave lens scatters it*) | 2. True | 3. True
- **Section C:**
 1. Drivers viewing the ambulance in their rear view mirrors experience **lateral inversion** (left-to-right reversal). The pre-reversed lettering reflects in standard order, allowing drivers to immediately read "AMBULANCE" and yield the right-of-way.
 2. A **convex lens** should be used. It is a converging lens capable of bending light rays from a distant object together to form a focused, real image on a screen or wall. A concave lens diverges light and cannot project an image onto a physical surface.

THANK YOU

If you like this lesson, Please share us on Social Media.