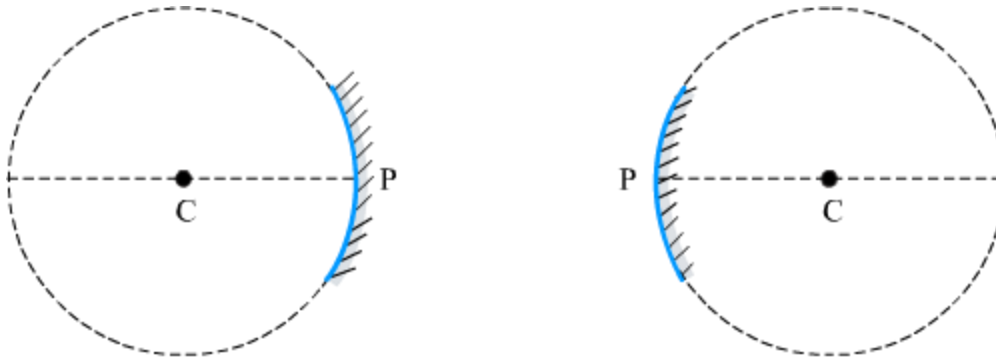


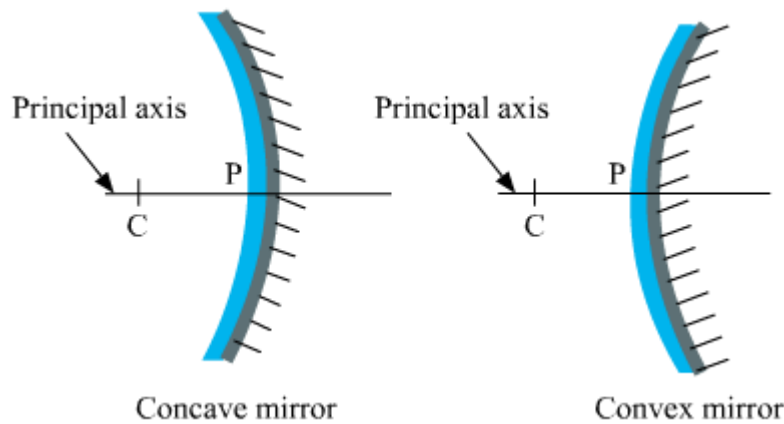
Light - Reflection And Refraction

Spherical Mirror

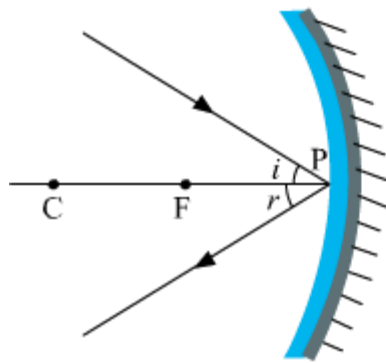
- Centre of curvature: Centre of the sphere of which the spherical mirror is a part



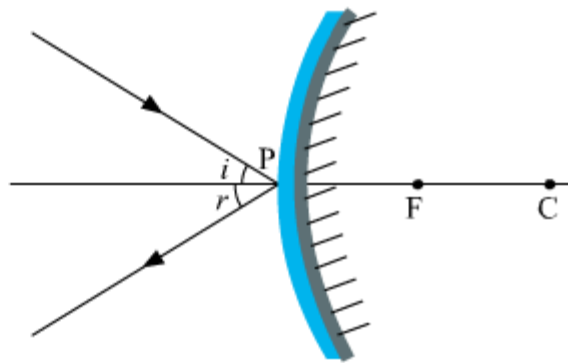
- Pole: It is the midpoint of the aperture of the spherical mirror or mirror centre.



- Focus: Where parallel rays (parallel to the principal axis) meet or appear to meet after reflection.
- Principal Axis: The imaginary line that runs through the pole and the center of curvature of a spherical mirror.
- Distance of focus from the pole is half the radius of curvature.

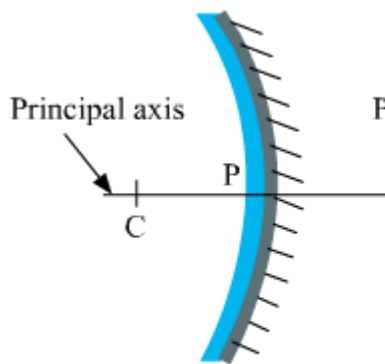


Concave mirror

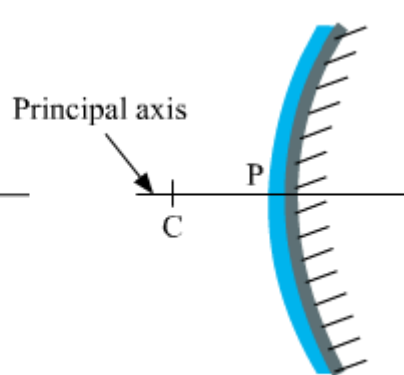


Convex mirror

Two types of spherical mirrors



Concave mirror



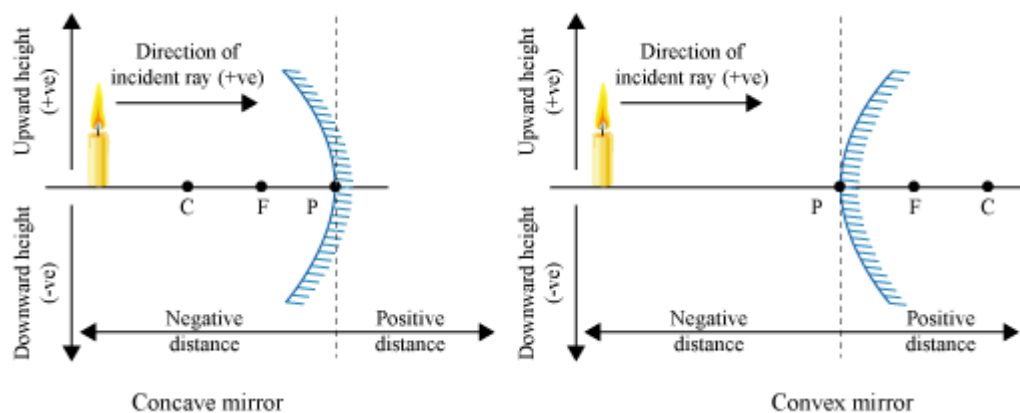
Convex mirror

1. The image formed by a convex mirror is **erect** and **diminished**. It is formed behind the mirror.
2. The image formed by a concave mirror can be **erect as well as inverted, diminished as well as magnified**, behind the mirror as well as in front of the mirror, depending on the distance of the object from the mirror.
3. The image that can be obtained on a screen is called **real** image. The image that cannot be obtained on a screen is called **virtual** image.
4. The image formed by a **convex** mirror is always **virtual**. The image formed by a **concave** mirror can be **real** as well as **virtual**.

1. Concave mirror is used as the reflector of a torch, dentist mirror, etc. It is also used in solar furnaces.

2. Convex mirror is used as a rear view mirror in vehicles. It also used road safety mirrors.

- **Sign Conventions for Spherical Mirrors:**



- Mirror formula**

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

For concave mirror, $f = -ve$ and for convex mirror, $f = +ve$

- Magnification**

$$\text{Magnification} = -\frac{v}{u}$$

For real image, $v = -ve$

Virtual image, $v = +ve$

- Refraction Laws**

<p>The diagram shows a horizontal interface between two media. A vertical dashed line MN represents the normal. An incident ray AO travels through medium 1 (top) towards point O on the interface. A refracted ray OB travels through medium 2 (bottom) away from point O. The angle of incidence is labeled 'i' and the angle of refraction is labeled 'r'.</p>	<p>AO, OB, and MON are co-planar</p> $\frac{\sin i}{\sin r} = \text{constant} \quad (\text{Snell's law})$	<p>Incident ray, refracted ray, and normal to the interface at incident point are co-planar</p>
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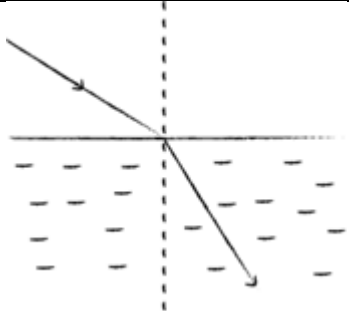
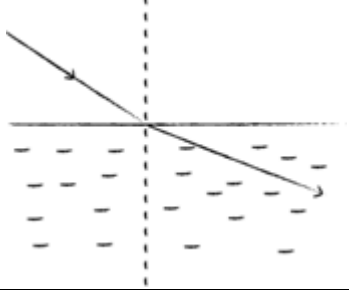
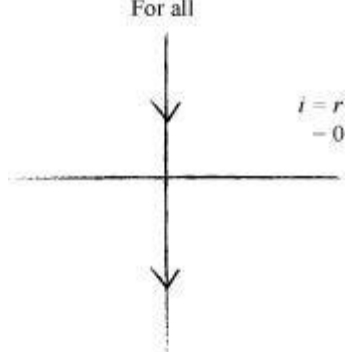
- Refractive index (RI)**

$$\mu_{21} \left(\mu \text{ of 2 w.r.t 1} \right) = \frac{\text{Velocity of light in medium 1}}{\text{Velocity of light in medium 2}} = \frac{v_1}{v_2}$$

$$\mu_{12} \left(\mu \text{ of 1 w.r.t 2} \right) = \frac{\text{Velocity of light in medium 2}}{\text{Velocity of light in medium 1}} = \frac{v_2}{v_1}$$

(Absolute RI when medium 1 = Vacuum)

(Light speed in vacuum is $= 3 \times 10^8 \text{ m/s}$)

	Medium (Optically denser) = $\mu > 1$
	Optically rarer = $\mu < 1$
	path of a ray when there is no change in medium.

- Differences between a spherical mirror and a lens:**

Spherical mirror	Spherical lens
Image is formed by reflection of light.	Image is formed by refraction of light.
A spherical mirror has only one focus.	A spherical lens has two foci.
The centre of the spherical mirror is termed as its pole.	The centre of the spherical lens is termed as its optical centre.

- Centre of curvature = Centre of the sphere of which the lens surfaces is a part of (Same as Spherical mirror)
- Optical centre is a point at the centre of the lens. It always lies inside the lens and not on the surface
- The straight line joining the two centers of curvature and the optical centre is called the principal axis of the lens.
- Focus = Where parallel rays meet after refraction (On principal axis = principal focus)
- Convex lens and Image**

- Virtual and erect images – when the object is placed between F_1 and the optical centre (Magnifying glass)
- Image size = object size when object at $2F$ (= Centre of curvature)

- **Concave lens and Image**

- Virtual and erect at all object positions

- **Lens Formula**

For concave lens $f = -ve$

convex lens $f = +ve$

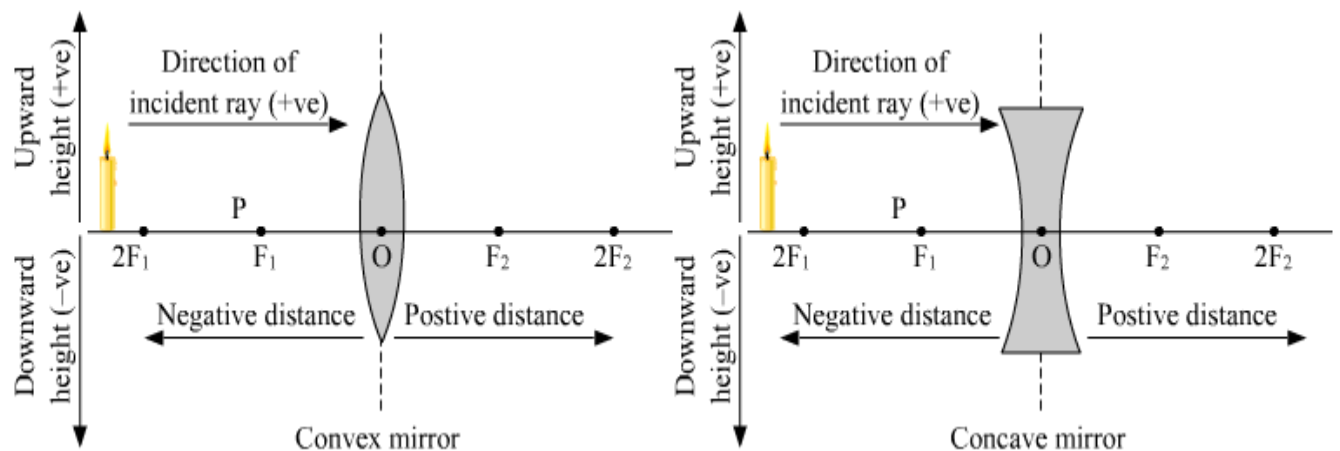
- **Magnification**

$$m = \frac{\text{Image height}}{\text{Object height}} = \frac{v}{u} \text{ (Same as mirror)}$$

- **Lens power**

$$P \text{ (Unit dioptre)} = \frac{1}{f \text{ (in m)}} f = -ve \text{ for concave}$$

- **Sign Convention for Lenses:**



- **Lens Formula**

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

For concave lens $f = -ve$

convex lens $f = +ve$

- **Magnification**

$$m = \frac{\text{Image height}}{\text{Object height}} = \frac{v}{u} \text{ (Same as mirror)}$$

- **Lens power:** Power of lens is the reciprocal of its focal length.

$$P \text{ (Unit dioptre)} = \frac{1}{f \text{ (in m)}} = \text{—ve for concave and +ve for convex lens.}$$