



Light travels in a straight line in a uniform transparent medium or in vacuum. This mode of propagation of light is called rectilinear propagation.

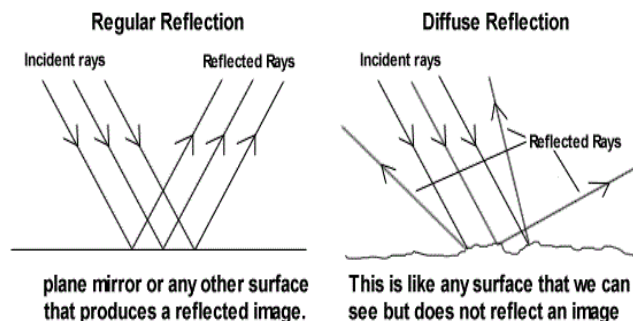
When you shine a torch in a dark room, you can see a beam of light. If you place a globe in front of a lit candle, a shadow can be seen on the wall. This shadow is formed when the globe blocks the light travelling in a straight line. This is possible because of rectilinear propagation of light.

### Reflection of light

When light falls on a surface, it bounces off the surface. This is called reflection.

### Reflecting surfaces

When light from the sun or any source falls on an object, we are able to see the object because the light reflected by the object reaches our eyes. Reflection by a regular surface is referred to as **regular reflection**. A rough surface reflects a parallel beam of light incident upon it in all directions. The small bumps and irregularities on a rough surface cause each of the light rays to reflect in different directions. This kind of reflection is called **irregular or diffused reflection**.



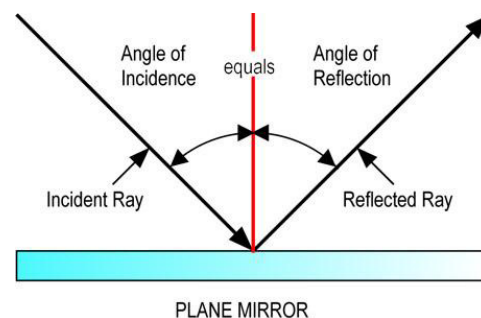
### Plane mirrors

Any smooth polished surface that can reflect the rays of light and form a clear image is called mirror. A virtual image cannot be formed on a screen. A reflecting surface produces an image with certain properties. The characteristics are:

1. A plane mirror produces an upright, virtual image
2. The image is of the same size as the object
3. The distance of the image formed on the mirror equals the distance of the object in front of the mirror.

**LAWS OF REFLECTION:** It is found that the reflection of light, from a Surface, always take place in a well defined manner according to the rules. We call these two rules as the two laws of reflection. We must, however, first know some terms to understand and explain the two laws of reflection.

- The 'Point of incidence' and the 'Normal':** The Point of incidence is that point on the Surface of the mirror where the incident ray falls. A line Perpendicular to the Surface, at the Point of incidence, is known as the 'Normal.'



- The incident ray and the Reflected ray:** The ray of light, coming towards the mirror, is called the incident ray. Similarly, the ray of light, which turns back after 'reflection' from the mirror Surface, is called the reflected ray.





(iii) **Angle of incidence and Angle of Reflection:** The angle between the incident ray and the normal at the point of incidence, is known as the angle of incidence. Similarly, the angle between the normal and the reflected ray, at the point of incidence, is called angle of Reflection.

(iv) **The Plane of incidence and the Plane of Reflection:** The Plane, defined by the incident ray and the normal, at the point of incidence, is called the **Plane of incidence**. Similarly, the plane defined by the reflected ray and the normal, at the point of incidence, is called the plane of reflection.

**First Law:** The incident ray, the normal at the point of incidence and the reflected ray, all lie in the same Plane.

**Second Law:** The angle of incidence and the angle of reflection are equal to each other.

**Convex and Concave Mirrors:** Curved mirrors produce images that are different from those formed by plane mirrors. These curved mirrors have two types of reflecting surfaces: one that bulges out to form a convex surface is called convex mirror, and one that curves inwards to form a concave surface is called concave mirror. The reflecting surfaces of curved mirrors are a part of a big sphere. Certain definitions regarding curved mirrors are:

- i. **Centre of curvature:** - the centre of the sphere of which the given (spherical) mirror is a part.
- ii. **Concave of mirror:** - a spherical mirror whose reflecting surface is curved inwards.
- iii. **Convex mirror:** - a spherical mirror whose reflecting surface is curved outwards.
- iv. **Focal length:** - the distance between the pole and the focus of the mirror.
- v. **Focus:** - the point, on the principal axis, where all the rays, incident parallel to the principal axis, actually meet, or appear to meet, after their reflection by the given spherical mirror.
- vi. **Principal axis:** - the line, joining the pole and the centre of curvature, of the spherical mirror.
- vii. **Radius of curvature:** - the radius of the sphere of which the given mirror is a part.

#### Types of Images:

**Real image:** - The images that can be formed on the screen are called real images. They are formed by actual intersection of light rays.

**Virtual image:** - The images that cannot be taken on the screen are called virtual images. They are formed by the apparent intersection of light rays.

1. A concave mirror usually forms a real and inverted image of a given object. However, when an object is placed very close to a concave mirror, the image formed is virtual, erect and magnified image.
2. The image, formed by a convex mirror, is always a virtual and erect image. The image is smaller in size than the object.



3. Concave mirrors are used by ENT doctors as 'head mirror'. They are also used by dentist and are also used as reflectors in torches and in many other optical instruments.
4. Convex mirror is used as a rear mirror in vehicles. This is because it gives a virtual erect and diminished image of the object and provides a wide range of view to the driver.

Type of Mirror	Nature of the image formed		
	Real/ Virtual	Upright/Inverted	Size
Plane Mirror	Virtual	Upright	Same size
Concave	Real Except when the object is very close	Inverted when real Erect when virtual	Enlarged
Convex	Virtual	Upright	Diminished

**Uses of curved mirrors:** Convex mirrors make things look smaller but you can see a lot more of the surroundings. In other words, they give you a wider range of view. Some uses of convex mirrors are given below.

- As car wing mirrors, to see through a wide angle behind the car.
- In supermarkets and big shops to look out for shoplifters.
- In buses, so that the driver can view the whole bus.

When objects are kept very close to a concave mirror, objects look larger. This makes concave mirrors useful for the following application:

1. as shaving mirrors or while putting on make-up
2. As a dentist mirror for examination

