

**FORM 6 PHYSICS NOTE WEEK 1****PROPERTIES OF LIGHT****1. Propagation and Reflection****Learning Outcomes:**

- ❖ Explain the production of shadows in terms of rectilinear propagation (3)
- ❖ State the law of reflection (1)
- ❖ Apply the law of reflection on one plane mirror or two plane mirrors at right angle to each other (2)
- ❖ Define lateral inversion (1)
- ❖ Describe characteristics of images produced by plane mirror (2)
- ❖ Define:
  - a. Reflection. (1)
  - b. Regular reflection. (1)
  - c. Diffused reflection. (1)
- ❖ Construct ray diagrams to illustrate the formation of images of an object by curved mirrors. (3)
- ❖ Describe characteristics of images produced by plane and curved mirrors. (2)
- ❖ Apply the following relationships to determine the unknown variables:  $s_i s_0 = f^2$  or  $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$  (3)
- ❖ Predict the nature of the images of an object by curved mirrors either by using ray diagrams or by using the following relationships:  $s_i s_0 = f^2$  or  $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$  (4)
- ❖ Define the following:
  - a. Pole (1)
  - b. Focus (1)
  - c. Focal length (1)
  - d. Radius of Curvature (1)
- List the properties of:
  - a. Concave mirrors (1)
  - b. Convex mirrors (1)
- Differentiate between the uses of concave and convex mirrors. (3)

## Introduction to Rectilinear Propagation of Light

The word **rectilinear** literally means “**straight**” in Geometry and the **rectilinear propagation of light** means that **light travels from the source in a straight line**. Due to this property, light does not bend due to which we are unable to look around the corner of objects where the light ray falls upon.

There are two notable phenomenons related to the rectilinear propagation of light- **reflection** and **refraction**. Reflection can be demonstrated using a mirror and refraction can be explained when a person puts his hand inside a tub of water, the hand appears bent and smaller.

### Examples:

1. Sunrays entering a dark room through a small opening appear to travel in a straight line.
2. Light from torch, headlights of cars, etc. appears to travel in a straight line.
3. Light from a projector travels in a straight line in the form of light rays towards the screen.
4. Light emitted from a laser pointer appears to travel in a straight line.

### Propagation and Reflection.

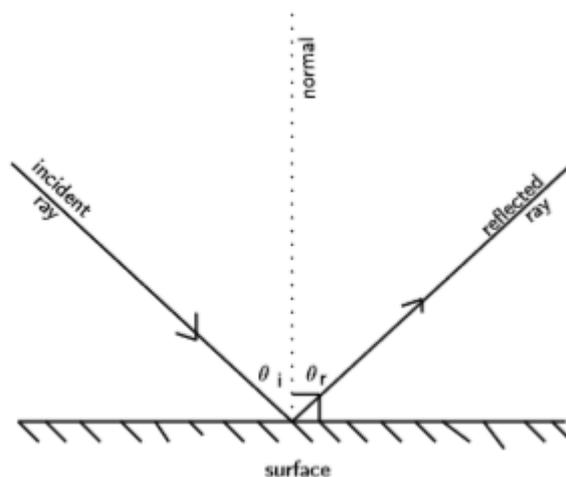
The incoming light ray is called the **incident ray**. The light ray moving away from the surface is the **reflected ray**. The most important characteristic of these rays is their angles in relation to the reflecting surface. These angles are measured with respect to the normal of the surface. The **normal** is an imaginary line perpendicular to the surface. The angle of incidence:

$\theta_i$  is measured between the incident ray and the surface normal.

The angle of reflection:

$\theta_r$  is measured between the reflected ray and the surface normal.

When a ray of light is reflected, the reflected ray lies in the same plane as the incident ray and the normal. This plane is called the **plane of incidence**.



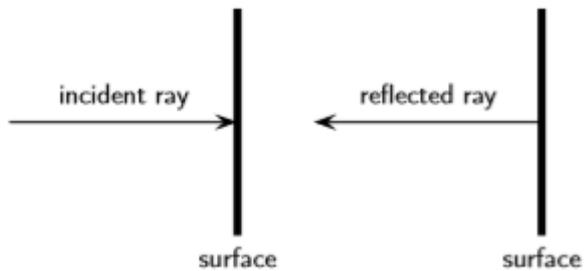
### The Law of Reflection

- states that the angles of incidence and reflection are always equal and that the reflected ray always lies in the plane of incidence.
- states that the angle of incidence is equal to the angle of reflection.

$$\theta_i = \theta_r$$

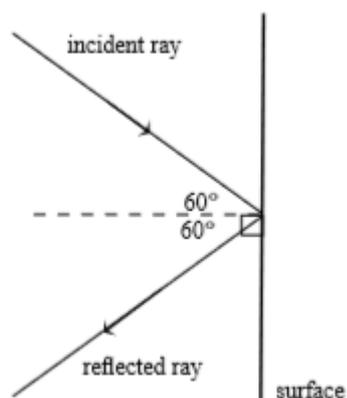
### Example

The simplest example of the law of incidence is if the angle of incidence is  $0^\circ$ . In this case, the angle of reflection is also  $0^\circ$ . You see this when you look straight into a mirror.



When a wave strikes a surface at right angles to the surface, then the wave is reflected directly back.

If the angle of incidence is not  $0^\circ$ , then the angle of reflection is also not  $0^\circ$ . For example, if a light strikes a surface at  $60^\circ$  to the surface normal, then the angle that the reflected ray makes with the surface normal is also  $60^\circ$ .

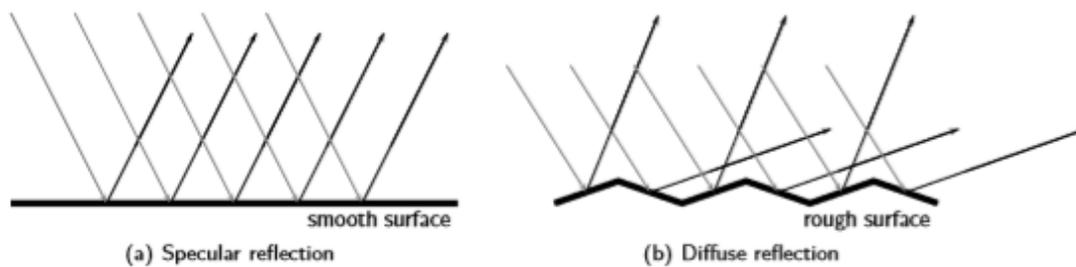


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Ray diagram showing angle of incidence and angle of reflection. The Law of Reflection states that when a light ray reflects off a surface, the angle of reflection  $\theta_r$  is the same as the angle of incidence  $\theta_i$ .

### Types of Reflection

The Law of Reflection is true for any surface. Does this mean that when parallel rays approach a surface, the reflected rays will also be parallel? This depends on the texture of the reflecting surface.



### Exercise:

1. Explain the production of shadows in terms of rectilinear propagation.
2. State the law of reflection.
3. Draw a diagram, label the appropriate angles and write a mathematical expression for the Law of Reflection.
4. An incident ray strikes a smooth reflective surface at an angle of  $33^\circ$  to the surface normal. Calculate the angle of reflection.
5. Apply the law of reflection on one plane mirror or two plane mirrors at right angle to each other.