# Light & Colours of Light

### **Introduction to Light**

Light is a form of energy that enables us to see objects.

It travels in the form of waves and exhibits properties of both waves and particles (wave-particle duality).

A beam of light entering a dark room through a hole illuminates the objects in its path.

Light appears to travel in a straight line under normal conditions.

## **Rectilinear Propagation of Light**

The property of light traveling in straight lines is called rectilinear propagation.

It can be observed in everyday life:

- The formation of shadows by opaque objects.
- Light passing through narrow openings.
- The working of a pinhole camera.

Experiment: Demonstrating Straight-Line Propagation of Light

Aim: To prove that light travels in a straight line.

Materials Required: A sheet of paper, a candle, and a matchstick.

#### **Procedure:**

- i. Roll the sheet into a straight pipe and light the candle.
- ii. Look at the flame through one end of the straight pipe.
- iii. Bend the pipe and try looking at the flame again.

**Observations:** The flame is visible through the straight pipe but not through the bent pipe.

**Conclusion:** Light travels in a straight line in a uniform medium like air.

## **Reflection of Light**

When light falls on a smooth surface, it bounces back. This phenomenon is called reflection.

Laws of Reflection:

- i. The incident ray, the reflected ray, and the normal lie in the same plane.
- ii. The angle of incidence is equal to the angle of reflection.

## **Terms Related to Reflection:**

**Incident Ray:** The incoming ray that strikes the surface.

**Normal:** A perpendicular line to the surface at the point of incidence.

**Reflected Ray:** The ray that bounces back from the surface.

Angle of Incidence: The angle between the incident ray and the normal.

Angle of Reflection: The angle between the reflected ray and the normal.

## **Colours of Light**

#### **Dispersion of Light**

When white light passes through a prism, it splits into a spectrum of seven colours.

- This phenomenon is called dispersion.
- The band of colours formed is called a spectrum.
- The seven colours of the spectrum are Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR).

#### Why Does White Light Split?

- White light consists of different colours, each with a different wavelength.
- When passing through a prism, each colour bends by a different amount due to refraction.

## Natural Example: Rainbow Formation

- A rainbow is formed when sunlight passes through water droplets in the air.
- The droplets act as tiny prisms, dispersing the sunlight into its component colours.

#### **Newton's Colour Disc**

- A disc painted with VIBGYOR colours appears white when rotated rapidly.
- This is due to persistence of vision the eye retains an image for a fraction of a second.
- The colours blend together because the brain cannot distinguish them at high speed.

## **Historical Contributions to Optics**

Isaac Newton: Demonstrated that white light is composed of different colours.

Alhazen (Ibn al-Haytham): Made significant contributions to optics, including reflection and refraction.

**Rene Descartes:** Developed the law of refraction (Snell's Law).

James Clerk Maxwell: Formulated the theory of electromagnetic waves, explaining the nature of light.

**Thomas Young:** Conducted the double-slit experiment, demonstrating the wave nature of light.

#### **Key Takeaways**

- Light travels in straight lines (rectilinear propagation).
- Reflection follows the law of equal angles.
- Dispersion of light through a prism creates a spectrum.
- A rainbow is a natural example of dispersion.
- White light is a mixture of multiple colours, which can be demonstrated using Newton's Colour Disc.
- Many scientists have contributed to our understanding of light and optics.