Chapter Twelve

Light Energy:

Introduction:

- This is the form of energy which enables us to see.
- We see objects because light energy from these objects travel into our eyes.
- Light travels in a straight line.
- Objects such as the sun, which can produce and give off their own light are called luminous objects.
- But those which cannot produce and give off their own light, are referred to as non-luminous objects.
- A material is said to be transparent if light can pass through it, and a material through which light cannot pass through is said to be opaque.
- A material through which light can pass through, even though we cannot see through it is said to be translucent.

Sources of light:

- The sources of light can be divided into two main groups and these are:
  (I) Natural sources.
  (II) Artificial sources.

Natural sources of light:

- The sun is the main as well as the most important source of natural light.-
Another source of natural light are the stars. -
There are also certain living things such as the firefly, which also serve as a source of natural light.

Artificial sources of light:

- These are those sources which enable us to see and do things we cannot do, when natural light is not available -
Common examples of artificial light include the electric bulb, the candle and fluorescent light tube.

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Properties of light:

- It travels in straight line.
-It has a speed of 3 x 10^8m/s.
-- It undergoes reflection, refraction and diffraction.

Rectilinear propagation of light:

- A ray is the direction of path along which light travels and it is represented by any of the following:

- A beam refers to a group of rays, and can be represented by a number of rays such as

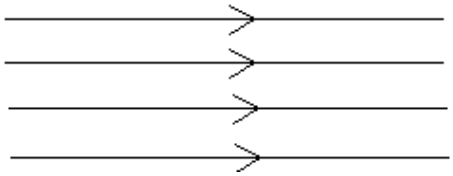
or

- Light always travels in a straight line, and the ability of light to travel in a straight line is known as the rectilinear propagation.
- Because light travels in straight line, images of objects have sharp or well defined edges..

Types of beams:

- There are three types of beams and these are:

1. Parallel beam:



- This is the type of beam in which the rays move parallel to each other and never meet.

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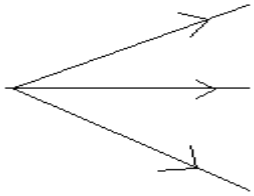
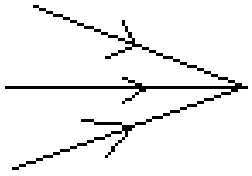
2. **Diverging beam:**



This is the type in which the rays spread out or diverge from a point.

3. **Converging beam:**



In this type, the rays of the beam seem to meet or converge at a point.

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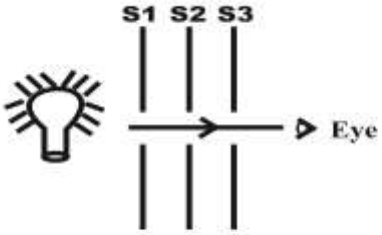
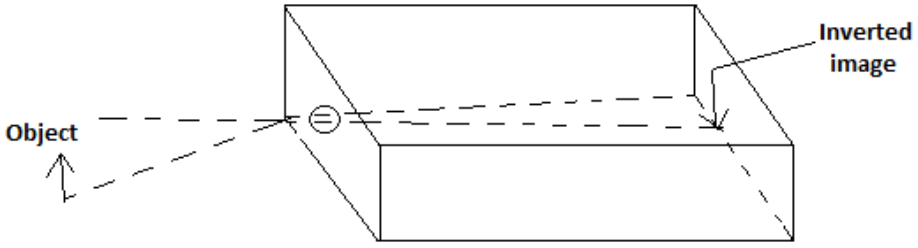
Experiment to show that light travels in straight line:



- Three cardboard screens S1, S2 and S3 with small holes in each are arranged in such a way that their holes fall or are in a straight line.
- A source of light is then placed in front of the first cardboard, and it will be noticed that the light can be seen by the eye, at the other side after passing these holes.
- If any one of these screens is moved slightly out of line, the eye can no longer see the light.
- This shows that the light can only be seen when the holes are in a straight line.
- This shows that light travels in straight line.

The pinhole camera:



- This type of camera can be constructed by taking a cardboard box, and removing one of its sides.
- The removed side is then replaced with a transparent material.
- A small hole which is about the size of a pin head is made in the middle of the side of the box, which is opposite to the transparent material.
- When an object is placed before he hole, it inverted image will be seen on the screen or the transparent material.
- In order to see the image clearly, all the external light must be removed by covering the box with a black cloth.

The nature of the image formed:

- The image is inverted or turned upside down.
- This is due to the fact that light rays from the upper and the lower parts of the object cross each other in the pin hole, before forming the image on the screen.

The size of the image formed:

- The size of the image formed, depends on the location of the object from the pin hole.
- The further the pin hole from the object, the smaller becomes the size of the image formed.
- Also the closer the object to the pin hole, the larger becomes the size of the image formed.

The diameter of the pin (the focus):

- If the diameter of the pin of the camera is small in size, then only a few rays of light will be able to pass through it, and the image formed will not be bright even though it will be shaper.
- An increase in the size or the diameter of the pin hole, will allow more light rays in.
- This will give rise to a brighter image which is also blurr.

Shadows:

- A shadow is formed when an opaque object is placed in the path of light.
- The two types of shadows which can be formed are the umbra and the penumbra.

- The umbra which is made up of a dark region, receives no light at all from the source of light but the penumbra receives a certain amount of light.
- It is formed when the source of light in which the opaque object is placed, is smaller than the object.
- When the source of light is moved further away, the umbra becomes smaller.
- The penumbra is formed when the shadow formed is made up of a dark region, and a semi dark region.
- In this case, when the source of light is moved further away from the object, the penumbra diminishes and the umbra enlarges.
- When the source of light is moved away from the object, the image formed becomes larger and when it is brought near the object, the image becomes smaller.
- Penumbra or partial shadow is brighter and larger while umbra or full shadow is smaller and darker.