Physics Notes on Optics

➤LIGHT

• Light is a form of energy, which is propagated as an **electromagnetic wave**.

• It is the radiation which makes our eyes able to 'see the object. Its speed is **3 x 10^8 m/s**. It is the form of energy. It is a **transverse wave**.

• It takes **8 min 19s** to reach on the earth from the sun.

• When light falls on the surface of an object it can either be

1. Absorbed - If an object absorbs all the light falling on it, then it will appear perfectly black for example a blackboard

2. Transmitted - An object is said to transmit light if it allows light to pass through itself and such objects are transparent.

3. Reflected - If an object sends back light rays falling on its surface then it is said to have reflected the light

➤Reflection of Light

• When a ray of light falls on a boundary separating two media comes back into the same media, then this phenomenon is called the reflection of light.

➤Laws of Reflection of light

• The angle of incidence is equal to the angle of reflection, and

• The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

➤Reflection from Plane Mirror

• If an object moves towards a plane mirror **with speed v**, relative to the object the moves towards it with **a speed 2v**.

• To see his full image in a plane mirror, a person required a mirror of at least half of his height.

➤Refraction of Light

• The phenomenon of deviation of light rays from its path when it travels from one transparent medium to another medium is called refraction of light.

• The cause of refraction is due to the different speed of light in a different medium.

• When a ray of light enters from one medium to another medium, its frequency and phase do not change, but wavelength and velocity change.

• Due to refraction from Earth's atmosphere, the stars appear to twinkle.

➤Laws of Refraction:

• The incident ray, the refracted ray and the normal at the point of incidence all three lie in the **same plane.**

• The ratio of sine angle of incidence to the sine angle of refraction remains constant for a pair of media i.e.

Sin i/Sin r = constant = μ2/μ1, this law is known as Snell's law

➤Application of Refraction:

• When light travels through a denser medium towards a rarer medium it deviates away from the normal, therefore a pond appears shallower.

• A coin appears at **lesser depth** in water.

• Writing on a paper appears **lifted** when a glass slab is placed over the paper.

➤Critical Angle:

• The angle of incidence in a denser medium for which the angle of refraction in the rarer medium becomes 90°, is called the critical angle.

➤Total Internal Reflection:

• When a light ray travelling from a denser medium to the rarer medium, in this incident at the interface at an angle of incidence greater than the critical angle, then light rays reflected back into the denser medium, this phenomenon is known as **total internal reflection**

• Sparkling of diamond, mirage and looming, shinning of the air bubble in water and optical Fibre are examples of total internal reflection.

➤Spherical Mirror:

Type of Spherical Mirrors-

1. Concave mirror

• The image formed by a concave mirror is generally real and inverted.

2. Convex mirror

• The image formed by a convex mirror is always virtual, erect and diminished.

➤Uses of Concave Mirror

• As a shaving mirror

• As a reflector for the headlights of a vehicle, searchlight.

• In ophthalmoscope to examine the eye, ear, nose by doctors.

• In solar cookers.

➤Uses of Convex Mirror

• As a rear view mirror in the vehicle because it provides the maximum rear field of view and image formed is always erect.

• In sodium reflector lamp.

➤Important points related to spherical Mirrors:

(a) Centre of Curvature (c): The centre of the hollow glass sphere of which the mirror is a part.

(b) The radius of Curvature (R): The radius hollow sphere of which the mirror is a part.

(c) Pole (P): The mid-point of a spherical mirror is called pole.

(d) Focus (F): when a parallel beam of light rays is incident on a spherical mirror then after reflection it meets or appears to meet at a point on the principal axis, called focus of the

spherical mirror.

(e) Focal length (f):

Focal length d= R/2

➤Image formation by a concave mirror :

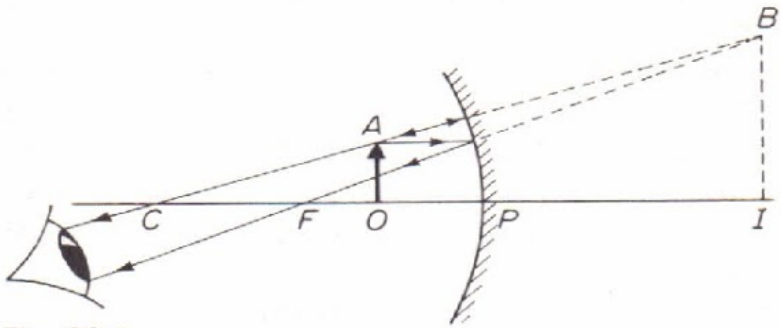


Fig. 22.4.

OBJECT BETWEEN *F* and *P*

the image is,

(1) Behind the mirror
(2) Virtual
(3) Erect
(4) Larger than object

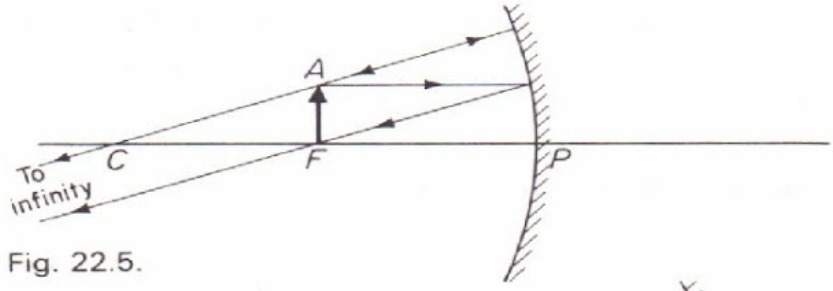


Fig. 22.5.

OBJECT AT *F*

the image is at infinity

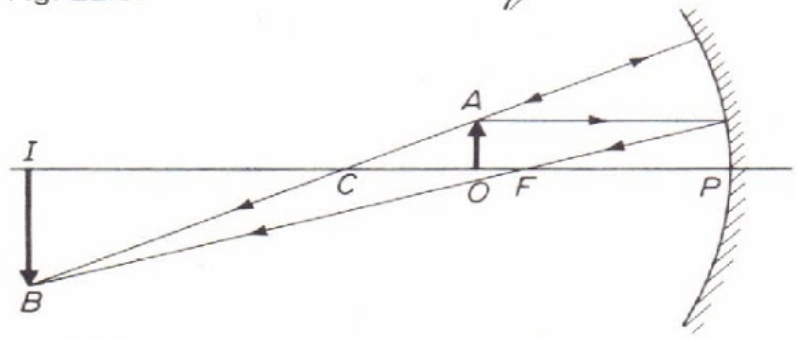


Fig. 22.6.

OBJECT BETWEEN *F* and *C*

the image is,

(1) Beyond *C*
(2) Real
(3) Inverted
(4) Larger than object

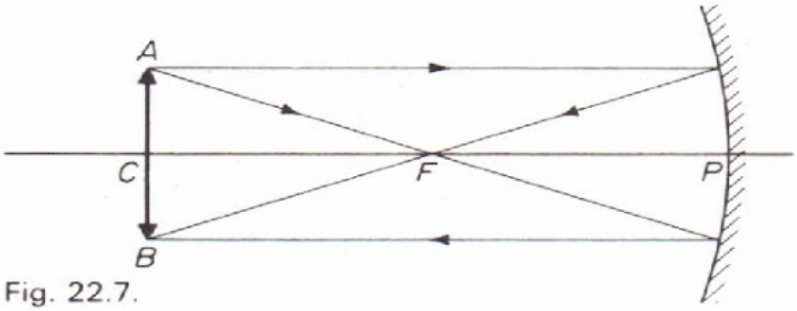


Fig. 22.7.

OBJECT AT *C*

the image is,

(1) At *C*
(2) Real
(3) Inverted
(4) Same size as object

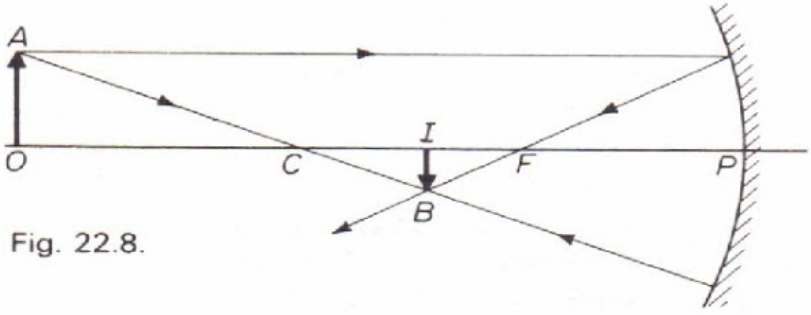
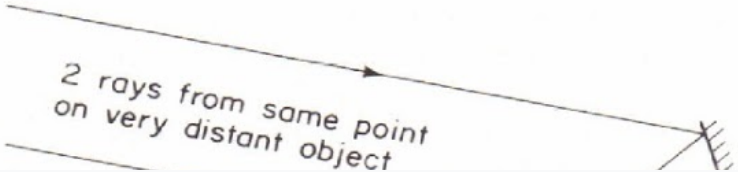


Fig. 22.8.

OBJECT BEYOND *C*

the image is,

(1) Between *C* and *F*
(2) Real
(3) Inverted
(4) Smaller than object



OBJECT AT INFINITY

➤**Image formation by convex Mirror :**

Image Formed by a Convex Mirror

Position of object	Position of image	Size of image with comparison to object	Nature of image
At infinity (∞)	At focus	Very small	Virtual and Erect
Any where except infinity (∞)	Between focus and optical centre	Small	Virtual and Erect

➤**Lenses:**

• A lens is a uniform refracting medium bounded by two spherical surface or one plane surface.

➤**Lenses are of two types:**

• Convex lens

• Concave lens

➤**Prism:**

• Prism is a uniform transparent refracting medium bounded by plane surfaces inclined at some angles forming a triangular shape.

➤**Dispersion of light:**

• When light is incident on a glass prism, it disperses into its seven colour components in the following sequence VIBGYOR, and this is known as the dispersion of white light.

• The refractive index of glass is maximum for violet colour and minimum for the red colour of light, therefore the violet colour of light deviated maximum and red colour of light deviated least.