

Self-Assessment

Module 1 : Reflection from Plane and Spherical Surfaces

Q.9.1.1 A convex mirror of focal length f forms an image which is $\frac{1}{n}$ times the object. The distance of the object from the mirror is

- (A) $(n - 1)f$
- (B) $\frac{(n-1)}{n}f$
- (C) $\frac{(n+1)}{n}f$
- (D) $(n + 1)f$

Q.9.1.2 An object 5 cm tall is placed 1 m from a concave mirror of radius of curvature 20 cm. The size of image is

- (A) 0.11 cm
- (B) 0.5 cm
- (C) 0.55 cm
- (D) 0.6 cm

Q.9.1.3 The field of view is maximum for

- (A) Plane mirror
- (B) Concave mirror
- (C) Convex mirror
- (D) Cylindrical mirror

Q.9.1.4 When an object is placed at a distance d_1 from the focus of a concave mirror, the image is formed at a distance d_2 from the focus. The focal length of the mirror is

- (A) $\frac{2d_1d_2}{d_1+d_2}$
- (B) $\sqrt{d_1d_2}$
- (C) $\frac{d_1+d_2}{2}$

(D) $\frac{1}{2}\sqrt{d_1 d_2}$

Q.9.1.5 The lower half of the reflecting surface of a concave mirror is covered with an opaque material. Which of the following is true?

- (A) Image will show only half of the object with the same intensity
- (B) Image will show the full object with the same intensity
- (C) Image will show half of the object with reduced intensity
- (D) Image will show full object with reduced intensity

Q.9.1.6 An object is placed at a distance of 10 cm on the axis of a convex mirror of focal length 20 cm. The object is moved towards the mirror by 2 cm. The distance by which the image will move is

- (A) 2 cm
- (B) 20/21 cm
- (C) 1 cm
- (D) 8/9 cm

Q.9.1.7 An object of length 2 cm is placed along the axis of a concave mirror symmetrically around the center of curvature. The focal length of the concave mirror is 20 cm. The magnification produced by the mirror is

- (A) +1.05
- (B) -1.05
- (C) +0.95
- (D) -0.95

Q.9.1.8 An object is placed at a distance of 40 cm from a convex mirror of focal length 20 cm on the axis of the mirror. The mirror is now rotated by an angle $\Delta\theta$ about an axis passing through the center of curvature of the mirror. Now the image will be on the line normal to the mirror such that the normal makes an angle x with the axis of the mirror. The value of x is

- (A) 0
- (B) $\Delta\theta/2$
- (C) $\Delta\theta$
- (D) $2 \Delta\theta$

Q.9.1.9 A 2 cm diameter coin is placed at a distance of 25 cm from a convex mirror of focal length 12 cm.

The diameter of the coin will appear to be

- (A) 2 cm
- (B) 1 cm
- (C) 0.65 cm
- (D) 0.32 cm

Q.9.1.10 In a rear view mirror of automobiles a message printed says 'the objects in the mirror are closer than they appear to be'. This is because rear view mirror is

- (A) convex and has size of image less than size of the object
- (B) convex and has image distance less than object distance
- (C) concave and has image distance less than focal length
- (D) plane and has image distance equal to object distance

Module 2 : Refraction at Plane and Spherical Surfaces

Q 9.2.1 A short pulse of white light is incident from air to a glass slab at normal incidence. After traveling through the slab, the first color to emerge is

- (A) blue
- (B) green
- (C) violet

(D) red

Q 9.2.2 Kerosene has density 0.82 g/cm^3 and refractive index 1.44 . The same for water are 1.0 g/cm^3 and 1.33 respectively. Fig.Q.9.2.1 shows a container with water and kerosene above it. Out of the four path shows for an incident ray, the correct path is

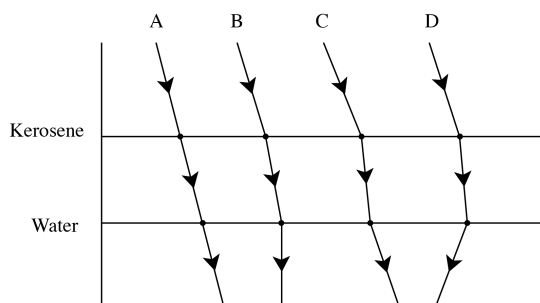
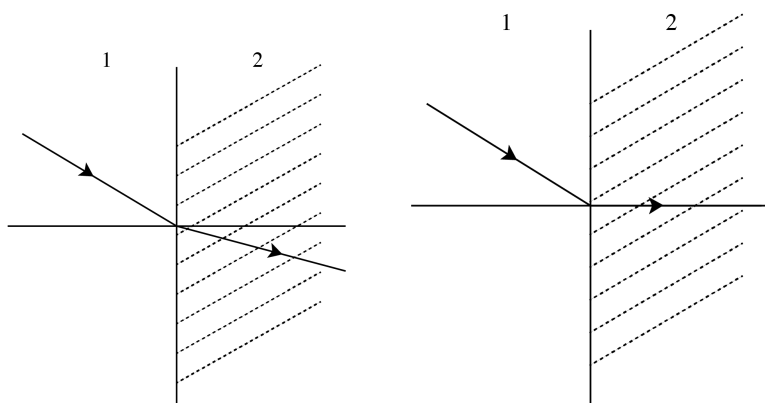


Fig.Q.9.2.1

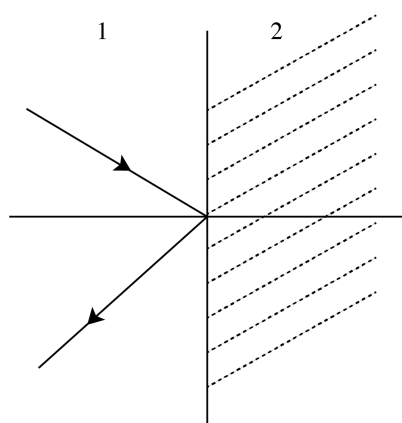
- (A) A
- (B) B
- (C) C
- (D) D

Q.9.2.3 Each figure below shows a ray of light traveling through a vertical interface separating two media. The figure in which the medium '2' has a negative refractive index is

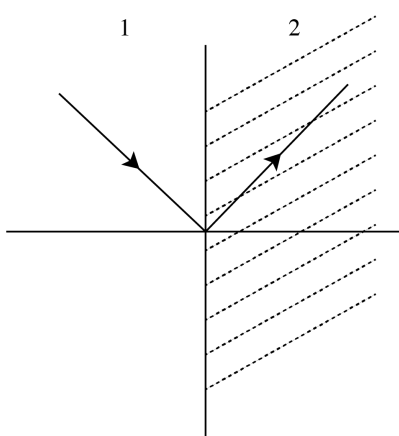


(A)

(B)



(C)



(D)

(A) A

(B) B

(C) C

(D) D

Q.9.2.4 A rectangular transparent block is kept on a piece of paper with some marking on it (Fig.Q.9.2.2) .

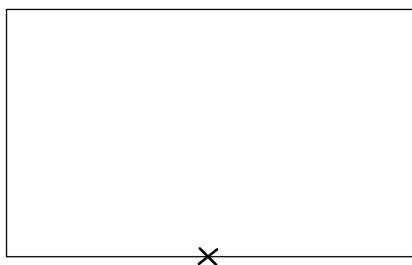


Fig.Q.9.2.2

The smallest refractive index for the material of the block for which mark on the paper will not be visible from side face is

(A) $4/3$

(B) $\sqrt{2}$

(C) $3/2$ (D) $\sqrt{3}$

Q.9.2.5 A small bulb is placed at the center at bottom of a tank containing water to a depth of 80 cm ($n_w = \frac{4}{3}$). Length and breadth of the water tank is 2 m each. What fraction of the surface area of water will be illuminated by the bulb?

(A) 100%

(B) 64.6%

(C) 60.5%

(D) 50%

Q.9.2.6 A cylindrical glass rod of diameter 2 cm is kept on a sheet of paper which has writing with letter size 0.5 cm. (Fig.Q.9.2.3) How big do these letters appear to be when seen through the rod? (Take the refractive index of glass as 1.5)

(A) $3/4$ cm

(B) 1 cm

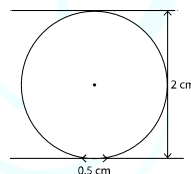
(C) $4/3$ cm(D) $3/2$ cm

Fig.Q.9.2.3

Q.9.2.7 A plane glass surface ($n_g = 1.5$) has a small spherical groove of radius 0.5 cm. A small dust grain appears to be trapped at a distance of 1.5 cm behind the groove (Fig.Q.9.2.4). What must be the actual position of the dust grain?

(A) 1 cm behind the groove

(B) 0.5 cm in front of the groove

(C) 0.5 cm behind the groove

(D) 2 cm behind the groove

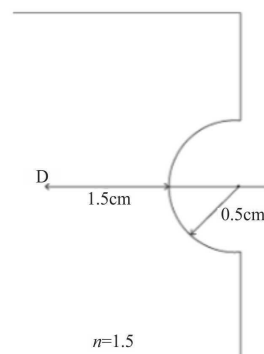


Fig.Q.9.2.4

Q.9.2.8 A glass sphere ($n_g = 1.5$) of diameter 4 cm, is to be used as a converging lens Fig.Q.9.2.5. Where will its focal point be?

- (A) 3 cm from the surface of incidence
- (B) 3 cm from the surface of emergence
- (C) 4 cm from the center of the sphere
- (D) 2 cm from the center of the sphere

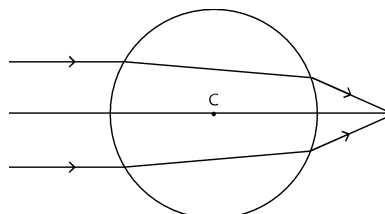


Fig.Q.9.2.5

Q.9.2.9 A glass slab ($n_g = 1.5$) has a spherical hollow sphere of diameter 4 cm inside as shown in the Fig.Q.9.2.6. Where will a parallel beam incident on the hollow sphere converge?

- (A) at a point 4 cm from the surface of incidence inside glass
- (B) at a point 4 cm from the opposite surface of the hollow sphere
- (C) the center of the hollow sphere
- (D) 1 cm from the surface of incidence of the hollow sphere

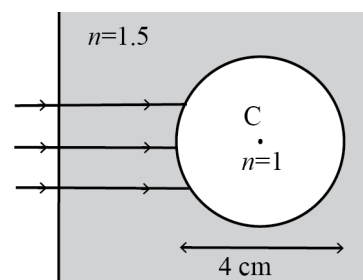


Fig.Q.9.2.6

Q.9.2.10 A cube made of thin glass walls and of the side of length h is tied inside a swimming pool such that it is completely immersed in water of refractive index n . The cube has something written on its side surfaces (Fig.Q.9.2.7). A swimmer on the other side of the cube is trying to read it. How far will this writing appear to be to the swimmer?

- (A) h/n
- (B) nh
- (C) $h/(n-1)$
- (D) $(n-1)h$

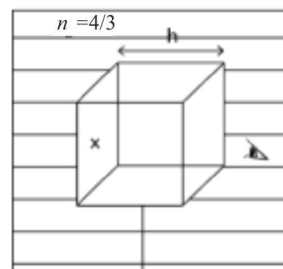


Fig.Q.9.2.7

Module 3 : Image Formation Due to Lenses

Q.9.3.1 An object is moving towards the focal point of a converging lens with uniform speed of 2m/s. As the instant when it passes through point $2F$, the image would be moving.

- (A) in the same direction on the other side of the lens with the same speed.
- (B) in the opposite direction on the other side of the lens with the same speed.
- (C) in the same direction on the same side of the lens with the greater speed.
- (D) in the opposite direction on the same side of the lens with the same speed.

Q.9.3.2 A converging and a diverging lens each having same focal length are kept separated by distance ($d \neq 0$). The resultant combination will be

- (A) Converging
- (B) Diverging
- (C) a focal
- (D) Converging or diverging depends on the distance d .

Q.9.3.3 In case of a converging lens of focal length f , focal length for violet colour is less than that of red colour. In case of diverging lens of focal length f and made of the same material

- (A) the focal length of violet colour will be less than that of red colour.
- (B) the focal length of the violet color will be more than that of red.
- (C) the focal length of the violet colour will be the same as that of the red color.
- (D) the relative value of focal length of violet colour and red colour depends on whether the lens is double concave, plano concave or concavo-convex.

Q.9.3.4 Two converging lenses of focal lengths f_1 and f_2 are kept separated by a distance d . The value of d for which this combination will be such that a (parallel beam incident on the pair will emerge as parallel beam) is

- (A) $d = f_1 - f_2$
- (B) $d = f_1 + f_2$
- (C) $d = \frac{f_1 + f_2}{2}$
- (D) it is not possible to have such a combination in this case

Q.9.3.5 One converging lens of focal length f_1 and other diverging lens of f_2 are kept separated by a distance d . The value of d for which this combination will be afocal (parallel beam incident on the pair will emerge as parallel beam) is

- (A) $d = f_1 - f_2$
- (B) $d = f_1 + f_2$
- (C) $d = \frac{f_1 + f_2}{2}$
- (D) it is not possible to have a focal combination in this case

Q.9.3.6 Two diverging lenses of focal lengths f_1 and f_2 are kept separated by a distance d . The value of d for which this combination will be afocal (parallel beam incident on the pair will emerge as parallel beam) is

- (A) $d = f_1 - f_2$
- (B) $d = f_1 + f_2$
- (C) $d = \sqrt{f_1 f_2}$
- (D) it is not possible to have afocal combination in this case

Q.9.3.7 A lens combination has a plano concave lens made by a hollow filled with water ($n_w = 4/3$) and an equiconcave lens made of glass ($n_g = 3/2$) of focal length 20 cm (Fig.Q.9.3.1). The focal length of the combination in cm will be

- (A) 10
- (B) 20
- (C) 30
- (D) 40

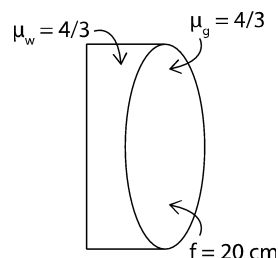


Fig.Q.9.3.1

Q.9.3.8 An object of size 2 cm is kept at a distance 40 cm from convex lens on its axis. The focal length of lens is 40 cm. The ratio of size of the image when object is kept parallel to the axis to the size of the image when object is kept perpendicular to the axis is

- (A) 0.9875
- (B) 1.0000
- (C) 1.0025
- (D) 1.9750

Q.9.3.9 A convex lens of focal length produces a magnification m of an object. The image distance is

- (A) $\frac{f}{m}$
- (B) mf
- (C) $(m - 1)f$
- (D) $(m + 1)f$

Q.9.3.10 A spherical marble is placed symmetrically at the axis of a convex lens of focal length f at a distance of $1.5f$. The image of the sphere appears

- (A) a sphere with a larger radius
- (B) a sphere with a smaller radius
- (C) elongated along the principal axis
- (D) non uniformly elongated perpendicular to the principal axis



Module 4 : Prism and Optical Instruments

Q.9.4.1 For small angle prism of angle 10° , a ray of light is incident normally. The emerging ray is found to be deviated by 5° . Then the angle of emergence is .

- (A) 5°
- (B) 10°
- (C) 15°
- (D) 30°

Q.9.4.2 In order to produce a real image in a refracting telescope or microscope, the distance between the objective lens and eyepiece should be

- (A) increased in the microscope as well as telescope
- (B) decreased in the microscope as well as telescope
- (C) increased in the microscope and decreased in the telescope
- (D) decreased in the microscope and increased in the telescope

Q.9.4.3 If the focal length of the objective lens in microscope and telescope is increased,

- (A) Magnifying power of microscope will increase but that of telescope will decrease
- (B) In both magnifying power will increase
- (C) In both magnifying power will decrease
- (D) The magnifying power of the microscope will decrease but that of the telescope will increase

Q.9.4.4 A ray of light is incident normally on a right angled prism having an angle of refraction of 30° and refractive index $\sqrt{3}$ (Fig.Q.9.4.1). What is the total deviation the ray suffers as it emerges out of the prism?

- (A) 30°
- (B) 45°
- (C) 60°
- (D) ray would internally get reflected at the second surface

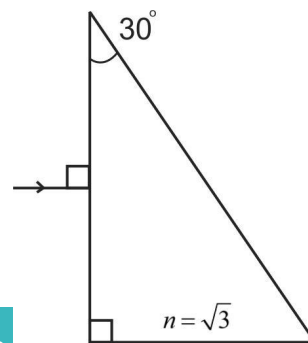


Fig.Q.9.4.1

Q.9.4.5 In an optical instrument we need to change the direction of a ray by 90° as shown in the Fig.Q.9.4.2. One method is to use a mirror and achieve it. Another is to place a right-angled isosceles prism as shown in the Fig.Q.9.4.2. For this we should choose a material of minimum refractive index

- (A) $4/3$
- (B) $\sqrt{2}$
- (C) $3/2$
- (D) $\sqrt{3}$

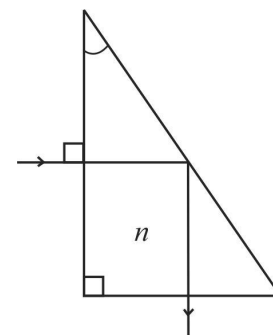


Fig.Q.9.4.2

Q.9.4.6 In a Galilean telescope the objective has a focal length 20 m and the eyepiece has a focal length of 4 cm. (more than one option may be correct)

- (A) The magnifying power is 500, tube length is 19.96 m
- (B) image is inverted
- (C) images is erect
- (D) The tube length is 20.04 m and magnifying power is 500.

Q.9.4.7 A ray of light incident normally on a small angled prism of angle A and refractive index n . Then it will emerge at an angle

- (A) A/n
- (B) $A(n-1)$
- (C) $A n$
- (D) $A(n+1)$

Q.9.4.8 A compound microscope has an objective of focal length 1 cm and an eyepiece of focal length 2.5 cm. The object to be viewed is placed at a distance of 1.2 cm from the objective and the final image is formed at the least distance of distinct vision. (more than one option may be correct)

- (A) length of the tube is 3.5 cm
- (B) length of the tube is 8.25 cm
- (C) magnifying power is 90.75
- (D) magnifying power is 82.5

Q.9.4.9 A convex mirror of focal length f forms an image which is $\frac{1}{n}$ times the object. The distance of the object from the mirror is

- (A) $(n - 1)f$
- (B) $\frac{(n-1)}{n}f$
- (C) $\frac{(n+1)}{n}f$
- (D) $(n + 1)f$

Q.9.4.10 An astronomical telescope forms an inverted image whereas to see a terrestrial object we need to form an erect image

For this we use a diverging lens as an eyepiece as shown in Fig.Q.9.4.3.

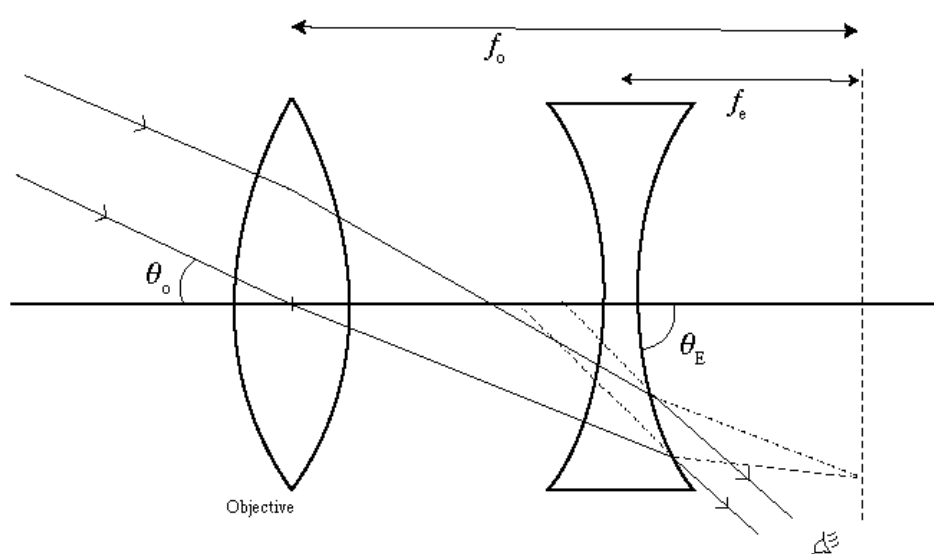
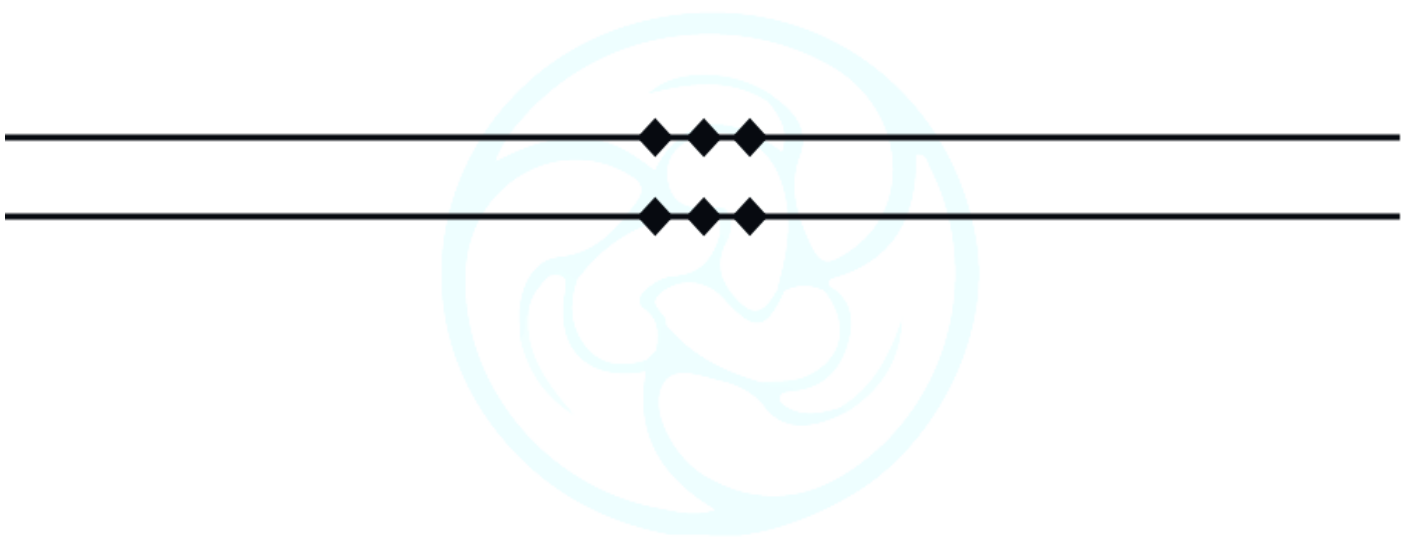


Fig.Q.9.4.3

In this case length of telescope and magnification produced are given by

- (A) $f_o - f_e$ and f_o/f_e
- (B) $f_o - f_e$ and $-f_o/f_e$
- (C) $f_o + f_e$ and $-f_o/f_e$
- (D) $f_o + f_e$ and f_o/f_e



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