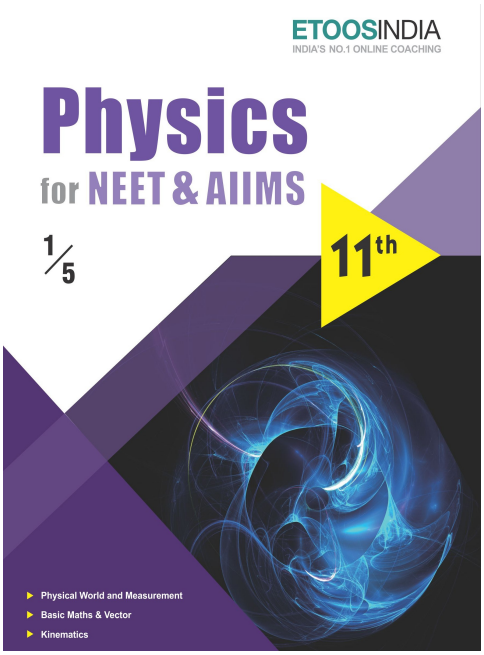
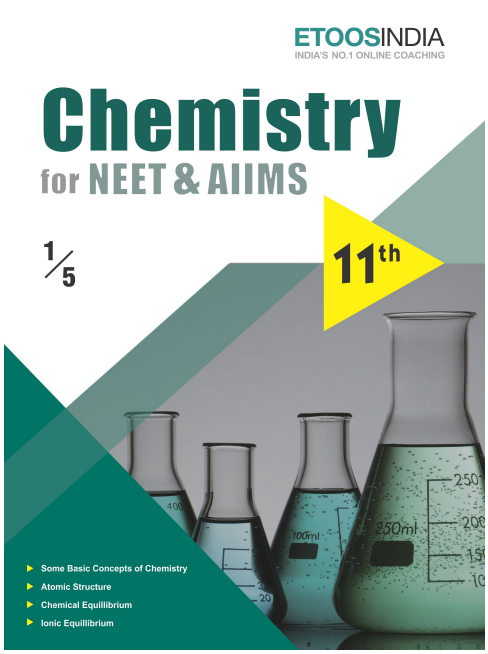
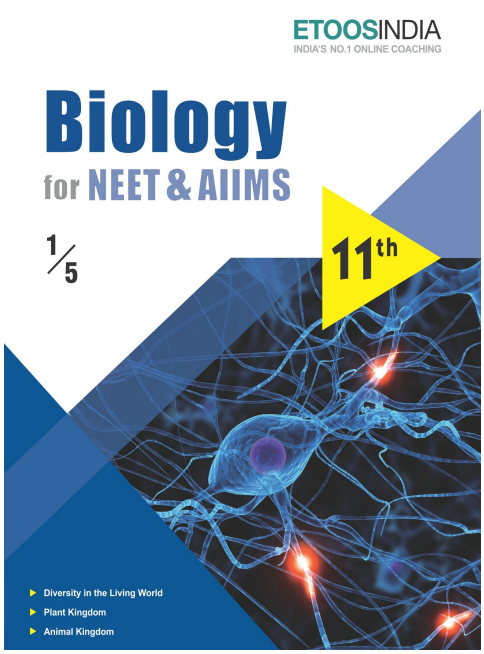
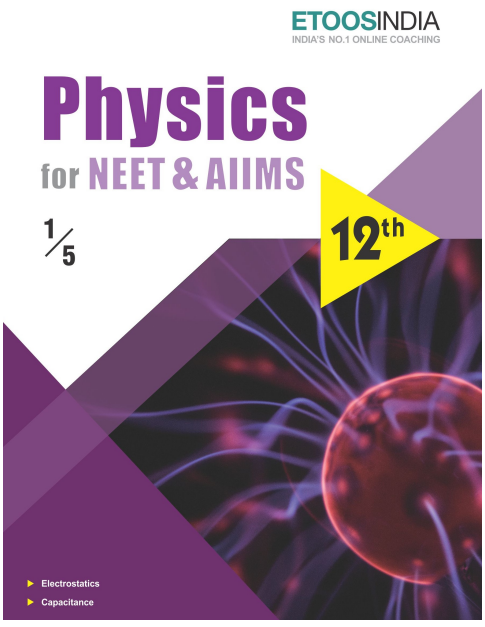
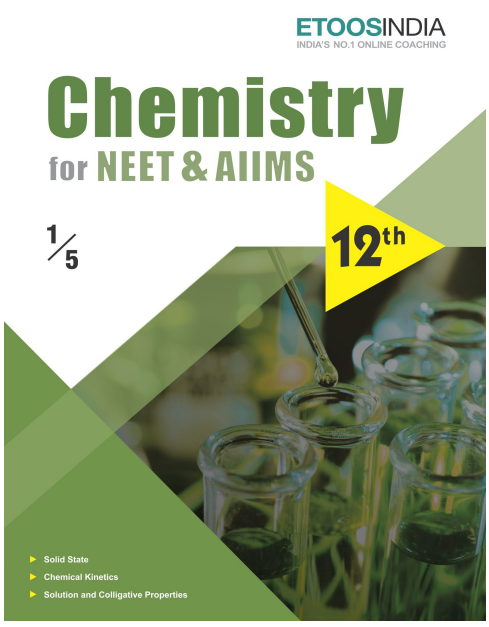
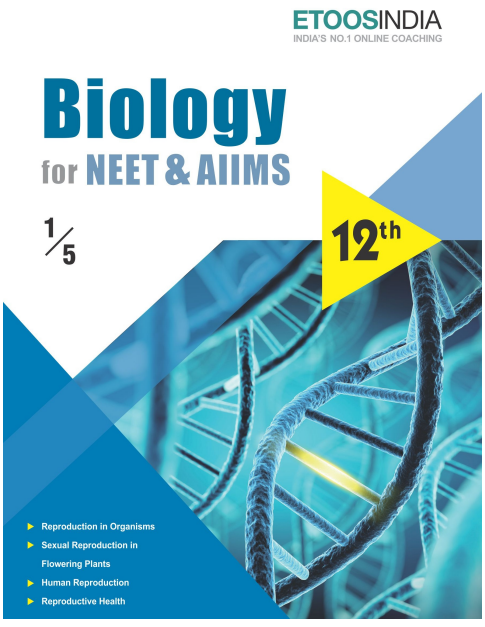












CHAPTER 07

GEOMETRICAL OPTICS

Light Brings us the news of the universe

"SIR WILLIAM BRAGG"

INTRODUCTION

Light form of radiant energy, that is energy emitted by excited atoms or molecules which can cause the sensation of vision in a normal human eye.

The branch of Physics which deals with the phenomena concerning light is called Optics. There are two branches of Optics :

(a) Geometrical Optics :

This consists the study of light in which light is considered as moving along a straight line as a ray. A ray of light gives the direction of propagation of light. When light meets a surface which separates two media, reflection and refraction take place. An image or an array of images may be formed due to this.

(b) Physical Optics :

It deals with the theories regarding the nature of light and provides an explanation for the different phenomena in light, such as reflection, refraction, interference, diffraction, polarisation and rectilinear propagation.

Ex. An extended object is placed perpendicular to the principal axis of a concave mirror of radius of curvature 20 cm at a distance of 15 cm from pole. Find the lateral magnification produced.

Sol. $u = -15$ cm $\quad f = -10$ cm

Using $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ we get, $v = -30$ cm

$\therefore \quad m = -\frac{v}{u} = -2.$

Aliter : $m = \frac{f}{f-u} = \frac{-10}{-10-(-15)} = -2$

Ex. A person looks into a spherical mirror. The size of image of his face is twice the actual size of his face. If the face is at a distance 20 cm then find the nature and radius of curvature of the mirror.

Sol. Person will see his face only when the image is virtual. Virtual image of real object is erect.

Hence $m = 2$

$\therefore \frac{-v}{u} = 2 \Rightarrow v = 40$ cm

Applying $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$; $f = -40$ cm or $R = -80$ cm (concave) $\therefore$ R.O.C. = 80 cm

Alter : $m = \frac{f}{f-u} \Rightarrow 2 = \frac{f}{f-(-20)}$

$\Rightarrow \quad f = -40$ cm or $R = -80$cm (concave) $\therefore$ R.O.C. = 80 cm

Ex. An image of a candle on a screen is found to be double its size. When the candle is shifted by a distance 5 cm then the image become triple its size. Find the nature and ROC of the mirror.

Sol. Since the images formed on screen it is real. Real object and real image implies concave mirror.

Applying $m = \frac{f}{f-u}$ or $-2 = \frac{f}{f-(u)}$ .....**(1)**

After shifting $-3 = \frac{f}{f-(u+5)}$ .....**(2)**

[Why u + 5 ? , why not u – 5 : In a concave mirror, the size of real image will increase, only when the real object is brought closer to the mirror. In doing so, its x coordinate will increase]

From **(1)** & **(2)** we get,

$f = -30$ cm or $R = -60$ cm (concave) and R.O.C. = 60cm

Ex. A point object is placed 60 cm from pole of a concave mirror of focal length 10 cm on the principle axis. Find

(a) the position of image

(b) If object is shifted 1 mm towards the mirror along principle axis find the shift in image. Explain the result.

Sol. **(a)** $u = -60$ cm

$f = -10$cm

$v = \frac{fu}{u-f} = \frac{-10(-60)}{-60-(-10)} = \frac{600}{-50} = -12$ cm.

ETOOS KEY POINTS

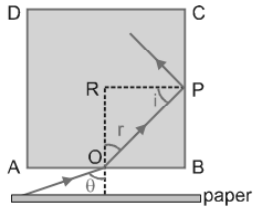
(i) A diver in water at a depth d sees the world outside through a horizontal circle of radius. $r = d \tan \theta_c$.

(ii) In case of total internal reflection, as all (i.e. 100%) incident light is reflected back into the same medium there is no loss of intensity while in case of reflection from mirror or refraction from lenses there is some loss of intensity as all light can never be reflected or refracted. This is why images formed by TIR are much brighter than formed by mirrors or lenses.

Ex. A rectangular block of glass is placed on a printed page laying on a horizontal surface. Find the minimum value of the refractive index of glass for which the letters on the page are not visible from any of the vertical faces of the block.

Sol. The situation is depicted in figure. Light will not emerge out from the vertical face BC if at it

$$i > \theta_C \quad \text{or} \quad \sin i > \sin \theta_C \Rightarrow \sin i > \frac{1}{\mu}\left[\text{as } \sin \theta_C = \frac{1}{\mu}\right] \ldots \textbf{(i)}$$



But from Snell's law at O $\quad 1 \times \sin\theta = \mu \sin r$

And in Δ OPR, $r + 90 + i = 180 \Rightarrow r + i = 90° \Rightarrow r = 90 - i$

So $\sin\theta = \mu \sin(90 - i) = \mu \cos i \Rightarrow \cos i = \dfrac{\sin\theta}{\mu}$

So $\sin i = \sqrt{1 - \cos^2 i} = \sqrt{1 - \left[\dfrac{\sin\theta}{\mu}\right]^2}$ $\quad \ldots \textbf{(ii)}$

so substituting the value of sin i from equation **(ii)** in **(i)**,

$$\sqrt{1 - \frac{\sin^2\theta}{\mu^2}} > \frac{1}{\mu} \text{ i.e., } \mu^2 > 1 + \sin^2\theta \quad \because (\sin^2\theta)_{max} = 1 \quad \therefore \mu^2 > 2 \Rightarrow \mu > \sqrt{2} \quad \therefore \mu_{min} = \sqrt{2}$$

Ex. Find the maximum angle that can be made in glass medium ($\mu = 1.5$) if a light ray is refracted from glass to vacuum.

Sol. $1.5 \sin C = 1 \sin 90°$, where C = critical angle.

$\sin C = 2/3$

$C = \sin^{-1} 2/3$

Ex. Find the angle of refraction in a medium ($\mu = 2$) if light is incident in vacuum, making angle equal to twice the critical angle.

Sol. Since the incident light is in rarer medium. Total Internal Reflection can not take place.

$$C = \sin^{-1}\frac{1}{\mu} = 30° \quad \Rightarrow \quad \therefore \quad i = 2C = 60°$$

Applying Snell's Law. $\quad 1 \sin 60° = 2 \sin r$

$$\sin r = \frac{\sqrt{3}}{4} \quad \Rightarrow \quad r = \sin^{-1}\left(\frac{\sqrt{3}}{4}\right).$$

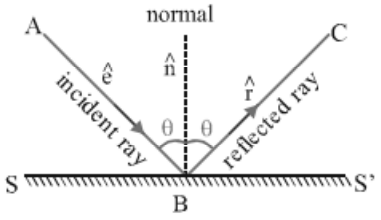
Etoos Tips & Formulas

REFLECTION

1. Law of Reflection :

The incident ray (AB), the reflected ray (BC) and normal (NB) to the surface (SS') of reflection at the point of incidence **(B)** lie in the same plane. This plane is called the plane of incidence (also plane of reflection).

The angle of incidence (the angle between normal and the incident ray) and the angle of reflection (the angle between the reflected ray and the normal) are equal $\boxed{\angle i = \angle r}$



In vector form $\boxed{\hat{r} = \hat{e} - 2(\hat{e}.\hat{n})\hat{n}}$

2. Object :

Real : Point from which rays actually diverge.

Virtual : Point towards which rays appear to converge

3. Image :

Image is decided by reflected or refracted rays only. The point image for a mirror is that point towards which the rays reflected from the mirror, actually converge (real image).

OR

From which the reflected rays appear to diverge (virtual image).

4. Characteristic of Reflection by a Plane Mirror :

The size of the image is the same as that of the object.

For a real object the image is virtual and for a virtual object the image is real.

For a fixed incident light ray, if the mirror be rotated through an angle θ the reflected ray turns through an angle 2θ in the same sense.

5. Number of images (n) in inclined mirror Find $\frac{360}{\theta} = m$

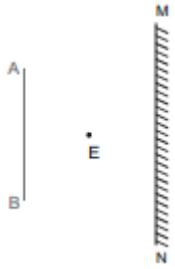
(i) If m even, then $n = m - 1$, for all position of object.

(ii) If m odd, then $n = m$, If object not on bisector and $n = m - 1$, If object at bisector

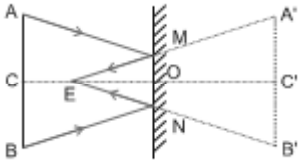
(iii) If m fraction then n = nearest even number

SOLVED EXAMPLE

Ex.1 Figure shows an object AB and a plane mirror MN placed parallel to object. Indicate the mirror length required to see the image of object if observer's eye is at E.



Sol. Required length of mirror = MN.

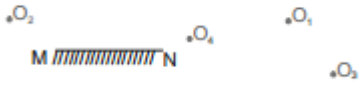


Δ MNE & ΔA'B'E are similar

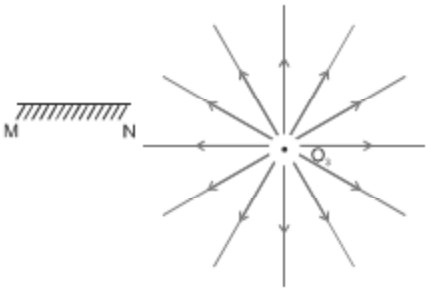
$$\frac{MN}{OE} = \frac{A'B'}{C'E}$$

$$\Rightarrow MN = \frac{A'B'}{2} = \frac{AB}{2}.$$

Ex.2 See the following figure. Which of the objects shown in figure will not form its image in the mirror.



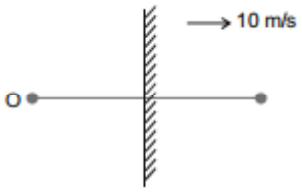
Sol.



No ray from O_3 is incident on reflecting surface of the mirror, so its image is not formed.

Ex.3 An object is kept fixed in front of a plane mirror which is moved by 10 m/s away from the object, find the velocity of the image.

Sol. $\vec{V}_{IM} = -\vec{V}_{OM}$

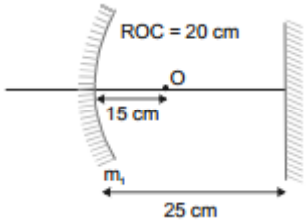


$$\vec{V}_{I,G} - \vec{V}_{M,G} = -\vec{V}_{O,G} + \vec{V}_{M,G}$$

$$\Rightarrow \vec{V}_{M,G} = \frac{\vec{V}_{I,G} + \vec{V}_{O,G}}{2} = \frac{\vec{V}_{I,G}}{2} \quad (\because \vec{V}_{O,G} = 0)$$

$$\frac{\vec{V}_{I,G}}{2} = 10\hat{i}\ \text{m/s} \Rightarrow \vec{V}_{I,G} = 20\hat{i}\ \text{m/s}$$

Ex.4 Find the position of final image after three successive reflections taking first reflection on m_1



Sol. **1st reflection at m_1**

u = – 15cm

f = –10 cm

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} = \frac{-3+2}{30} = -\frac{1}{30}$$

v = – 30 cm

2nd reflection at plane mirror :

u = 5 cm

v = – 5 cm

For III reflection on curved mirror again :

u = – 20 cm

Exercise # 1 SINGLE OBJECTIVE NEET LEVEL

1. Two vertical plane mirrors are inclined at an angle of 60° with each other. A ray of light travelling horizontally is reflected first from one mirror and then from the other. The resultant deviation is
(A) 60° (B) 120°
(C) 180° (D) 240°

2. A plane mirror reflects a pencil of light to form a real image. Then the pencil of light incident on the mirror is
(A) Parallel (B) Convergent
(C) Divergent (D) None of the above

3. What should be the angle between two plane mirrors so that whatever be the angle of incidence, the incident ray and the reflected ray from the two mirrors be parallel to each other
(A) 60° (B) 90°
(C) 120° (D) 175°

4. A plane mirror reflecting a ray of incident light is rotated through an angle θ about an axis through the point of incidence in the plane of the mirror perpendicular to the plane of incidence, then
(A) The reflected ray does not rotate
(B) The reflected ray rotates through an angle θ
(C) The reflected ray rotates through an angle 2θ
(D) The incident ray is fixed

5. A plane mirror is approaching you at a speed of 10cm/sec You can see your image in it. At what speed will your image approach you
(A) 10cm / sec (B) 5cm / sec
(C) 20cm / sec (D) 15cm / sec

6. A light bulb is placed between two plane mirrors inclined at an angle of 60°. The number of images formed are
(A) 6 (B) 2
(C) 5 (D) 4

7. It is desired to photograph the image of an object placed at a distance of 3m from the plane mirror. The camera which is at a distance of 4.5m from the mirror should be focussed for a distance of
(A) 3m (B) 4.5m
(C) 6m (D) 7.5m

8. A thick plane mirror shows a number of images of the filament of an electric bulb. Of these, the brightest image is the
(A) First (B) Second
(C) Fourth (D) Last

9. A man is 180cm tall and his eyes are 10 cm below the top of his head. In order to see his entire height right from toe to head, he uses a plane mirror kept at a distance of 1m from him. The minimum length of the plane mirror required is
(A) 180cm (B) 90cm
(C) 85cm (D) 170cm

10. A person is in a room whose ceiling and two adjacent walls are mirrors. How many images are formed
(A) 5 (B) 6
(C) 7 (D) 8

11. 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) $\left(\frac{n-1}{n}\right)f$
(C) $\left(\frac{n+1}{n}\right)f$ (D) $(n+1)f$

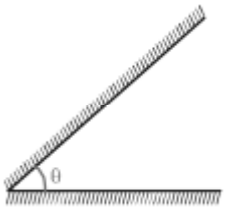
12. A diminished virtual image can be formed only in
(A) Plane mirror (B) A concave mirror
(C) A convex mirror
(D) Concave-parabolic mirror

13. Which of the following could not produce a virtual image
(A) Plane mirror
(B) Convex mirror
(C) Concave mirror
(D) All the above can produce a virtual image

14. An object $5cm$ tall is placed $1m$ from a concave spherical mirror which has a radius of curvature of $20\,cm$ The size of the image is
(A) $0.11cm$ (B) $0.50\,cm$
(C) $0.55\,cm$ (D) $0.60\,cm$

Exercise # 2 SINGLE OBJECTIVE AIIMS LEVEL

1. Two mirrors are inclined at an angle θ as shown in the figure. Light ray is incident parallel to one of the mirrors. Light will start retracing its path after third reflection if :



(A) $\theta = 45°$ (B) $\theta = 30°$

(C) $\theta = 60°$ (D) all three

2. Two plane mirrors are inclined to each other at an angle 60^0. If a ray of light incident on the first mirror is parallel to the second mirror, it is reflected from the second mirror

(A) Perpendicular to the first mirror

(B) Parallel to the first mirror

(C) Parallel to the second mirror

(D) Perpendicular to the second mirror

3. A point object is kept in front of a plane mirror. The plane mirror is performing SHM of amplitude 2 cm. The plane mirror moves along the x-axis and x- axis is normal to the mirror. The amplitude of the mirror is such that the object is always infront of the mirror. The amplitude of SHM of the image is

(A) zero (B) 2 cm

(C) 4 cm (D) 1 cm

4. An unnumbered wall clock shows time 04: 25: 37, where 1st term represents hours, 2nd represents minutes and the last term represents seconds. What time will its image in a plane mirror show.

(A) 08: 35: 23 (B) 07: 35: 23

(C) 07: 34: 23 (D) none of these

5. A person's eye is at a height of 1.5 m. He stands infront of a 0.3m long plane mirror which is 0.8 m above the ground. The length of the image he sees of himself is:

(A) 1.5m (B) 1.0m

(C) 0.8m (D) 0.6m

6. An object of height 1 cm is kept perpendicular to the principal axis of a convex mirror of radius of curvature 20 cm. If the distance of the object from the mirror is 20 cm then the distance (in cm) between heads of the image and the object will be:

(A) $\sqrt{\frac{6404}{9}}$ (B) $\sqrt{\frac{6414}{9}}$

(C) $\frac{40}{3}$ (D) none of these

7. Two plane mirrors are parallel to each other and spaced 20 cm apart. An object is kept in between them at 15 cm from A. Out of the following at which point(s) image(s) is/are not formed in mirror A (distance measured from mirror A):

(A) 15 cm (B) 25 cm

(C) 45 cm (D) 55 cm

8. A plane mirror is moving with velocity $4\hat{i} + 5\hat{j} + 8\hat{k}$. A point object in front of the mirror moves with a velocity $3\hat{i} + 4\hat{j} + 5\hat{k}$. Here $\hat{k}$ is along the normal to the plane mirror and facing towards the object. The velocity of the image is :

(A) $-3\hat{i} - 4\hat{j} + 5\hat{k}$ (B) $3\hat{i} + 4\hat{j} + 11\hat{k}$

(C) $-3\hat{i} - 4\hat{j} + 11\hat{k}$ (D) $7\hat{i} + 9\hat{j} + 11\hat{k}$

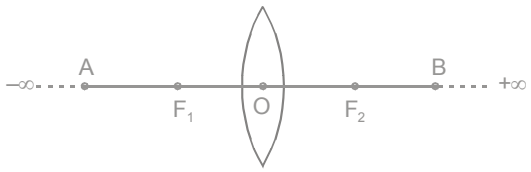
9. A point object is kept between a plane mirror and a concave mirror facing each other. The distance between the mirrors is 22.5 cm. Plane mirror is placed perpendicular to principal axis of concave mirror. The radius of curvature of the concave mirror is 20 cm. What should be the distance of the object from the concave mirror so that after two successive reflections the final image is formed on the object itself ? (Consider first reflection from concave mirror)

(A) 5 cm (B) 15 cm

(C) 10 cm (D) 7.5 cm

Exercise # 3 PART - 1 MATRIX MATCH COLUMN

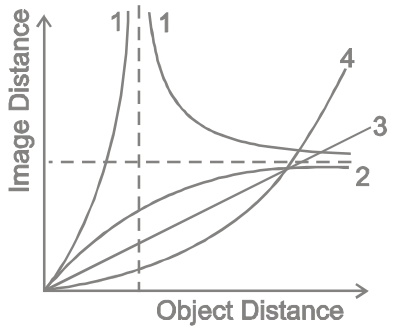
1. Consider the converging lens shown in figure :



Here O is the optic center, F_1 the first principal focus and F_2 the second 0principal focus.
($AF_1 = F_1O$ & $OF_2 = F_2B$)

(A) Object lies between $-\infty$ & F_1	**(J)** Image size is magnified	**(P)** Image lies between O & B
(B) Object lies between A and O	**(K)** Image size is diminished	**(Q)** Image does not lie between O & B
(C) Object lies between F_1 & $+\infty$	**(L)** Image is inverted	**(R)** Image lies between $-\infty$ & F_2
(D) Object does not lie between A and O	**(M)** Image is erect	**(S)** Image lies between F_2 & $+\infty$

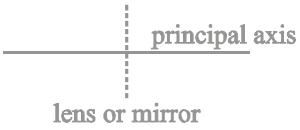
2. A small particle is placed at the pole of a concave mirror and then moved along the principal axis to a large distance. During the motion, the distance between the pole of the mirror and the image is measured. The procedure is then repeated with a convex mirror, a concave lens and a convex lens. The graph is plotted between image distance versus object distance. Match the curves shown in the graph with the mirror or lens that is corresponding to it. (Curve 1 has two segments)



Lens/Mirror	Curve
(A) Converging lens	**(P)** 1
(B) Converging Mirror	**(Q)** 2
(C) Diverging Lens	**(R)** 3
(D) Diverging Mirror	**(S)** 4

3. Column-I gives certain situations regarding a point object and its image formed by an optical instrument. The possible optical instruments are diverging and converging mirrors or lenses as given in Column-II. Same side of principal axis means both image and object should either be above the principal axis or both should be below the principal axis as shown in figure. Same side of optical instrument means both image and object should be either left of the optical instrument or both should be on right of the optical instrument as shown in figure. Match the statements in column-I with the corresponding statements in column-II .

Column I	Column II
(A) If point object and its image are on same side of principal axis and opposite sides of the optical instrument then the optical instrument is	**(P)** Concave mirror
(B) If point object and its image are on opposite side of principal axis and same sides of the optical instrument then the optical instrument is	**(Q)** Convex mirror
(C) If point object and its image are on same side of principal axis and same sides of the optical instrument then the optical instrument is	**(R)** Diverging lens
(D) If point object and its image are on opposite side of principal axis and opposite sides of the optical instrument then the optical instrument is	**(S)** Converging lens



Exercise # 4 PART - 1 PREVIOUS YEAR (NEET/AIPMT)

1. Rainbows are formed by [CBSE AIPMT 2000]
(A) reflection and diffraction
(B) refraction and scattering
(C) dispersio and total internal reflection
(D) interference only

2. A man is 6 ft tall. In order to see his entire image, he requires a plane mirror of minimum length equal to [CBSE AIPMT 2000]
(A) 6 ft (B) 12 ft
(C) 2 ft (D) 3 ft

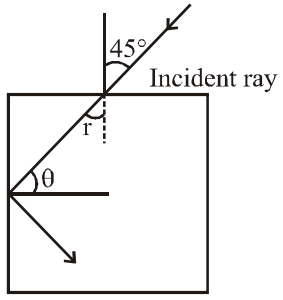
3. A planoconvex lens is made of a material of refractive index $\mu = 1.5$. The radius of curvature fo curved surface of the lens is 20 cm. If its plane surface is silvered, the focal length of the silvered lens will be [CBSE AIPMT 2000]
(A) 10 cm (B) 20 cm
(C) 40 cm (D) 80 cm

4. A transparent cube contains a small air bubble. Its apparent distance is 2 cm when seen through one face and 5 cm when seen through other face. If the refractive index of the material of the cube is 1.5, the real length of the edge of cube must be [CBSE AIPMT 2000]
(A) 7 cm (B) 7.5 cm
(C) 10.5 cm (D) $\frac{14}{3}$ cm

5. Diameter of human eye lens is 2 mm. What will be the minimum distance between two points to resolve them, which are situated at a distance of 50 m from eye? [The wavelength of light is 5000 Å] [CBSE AIPMT 2002]
(A) 2.32 m (B) 4.28 mm
(C) 1.25 cm (D) 12.48 cm

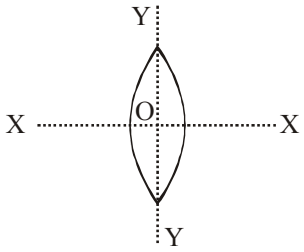
6. A body is located on a wall. Its image of equal size is to be obtained on a parallel wall with the help of a convex lens. The lens is placed at a distance d ahead of second wall, then the required focal length will be
(A) only $\frac{d}{4}$ [CBSE AIPMT 2002]
(B) only $\frac{d}{2}$
(C) more than $\frac{d}{4}$ but less than $\frac{d}{2}$
(D) less than $\frac{d}{4}$

7. For the given incident ray as shown in figure, the condition of total internal reflection of the ray will be satisfied if the refractive index of block will be [CBSE AIPMT 2002]



(A) $\frac{\sqrt{3}+1}{2}$ (B) $\frac{\sqrt{2}+1}{2}$
(C) $\sqrt{\frac{3}{2}}$ (D) $\sqrt{\frac{7}{6}}$

8. An equiconvex lens is cut into two halves along (i) XOX′ and (ii) YOY′ as shown in the figure. Let f, f′, f″ be the focal lengths of the complete lens, of each half in case (i), and of each half in case (ii), respectively.



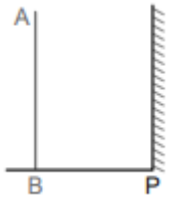
Choose the correct statement from the following [CBSE AIPMT 2003]
(A) f′ = f, f″ = f (B) f′ = 2f, f″ = 2f
(C) f′ = f, f″ = 2f (D) f′ = 2f, f″ = f

9. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will [CBSE AIPMT 2003]
(A) become small, but non-zero
(B) remain unchanged
(C) become zero
(D) become infinite

MOCK TEST

STRAIGHT OBJECTIVE TYPE

1. In the figure shown a person AB of height 170 cm is standing infront of a plane mirror. His eyes are at height 164 cm. At what distance from P should a hole be made in the mirror so that he cannot see the top of his head.



(A) 167 cm **(B)** 161 cm

(C) 163 cm **(D)** none of these

2. I is the image of a point object O formed by spherical mirror, then which of the following statement is incorrect:

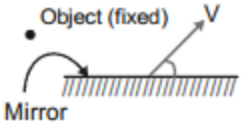
(A) If O and I are on same side of the principal axis, then they have to be on opposite sides of the mirror.

(B) If O and I are on opposite side of the principal axis, then they have to be on same side of the mirror.

(C) If O and I are on opposite side of the principal axis, then they can be on opposite side of the mirror as well.

(D) If O is on principal axis then I has to lie on principal axis only.

3. An object and a plane mirror are shown in figure. Mirror is moved with velocity V as shown. The velocity of image is :



(A) $2\ V \sin\theta$ **(B)** $2\ V$

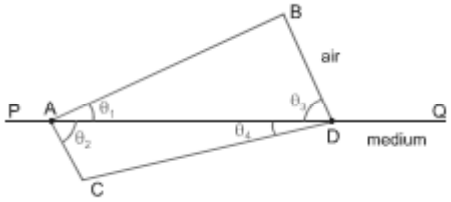
(C) $2V \cos\theta$ **(D)** none of these

4. Two plane mirrors are joined together as shown in the figure. Two point objects O_1 and O_2 are placed symmetrically such that $AO_1 = AO_2$. The image of the two objects is common if :

(A) $\theta = 60°$ **(B)** $\theta = 90°$

(C) $\theta = 30°$ **(D)** $\theta = 45°$

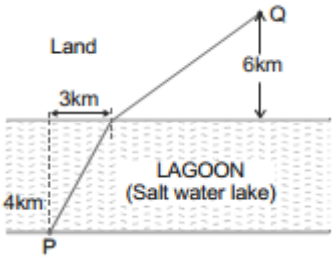
5. The following figure represents a wave front AB which passes from air to another transparent medium and produces a new wave front CD after refraction. The refractive index of the medium is (PQ is the boundary between air and the medium).



(A) $\frac{\cos\theta_1}{\cos\theta_4}$ **(B)** $\frac{\cos\theta_4}{\cos\theta_1}$

(C) $\frac{\sin\theta_1}{\sin\theta_4}$ **(D)** $\frac{\sin\theta_2}{\sin\theta_3}$

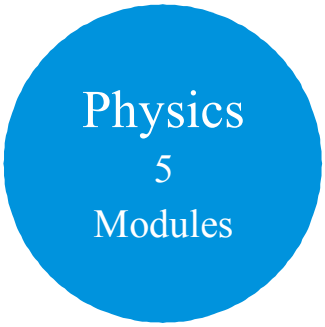
6. A man starting from point P crosses a 4 km wide lagoon and reaches point Q in the shortest possible time by the path shown in the figure. If the person swims at a speed of 3 km/hr and walks at a speed of 4 km/hr, then his time of journey is ($\mu_{\text{salt water}} = 4/3$) :

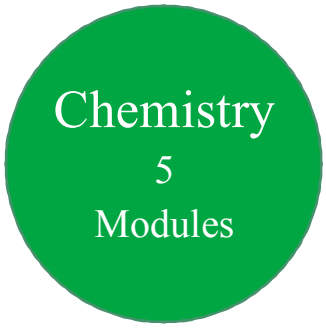


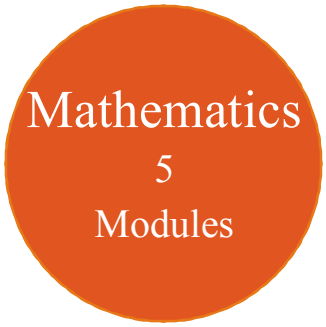
(A) 4hr, 10 min. **(B)** 4 hr and 30 min.

(C) 3 hr and 50 min **(D)** 5 hr and 10 min.

11th Class Modules Chapter Details

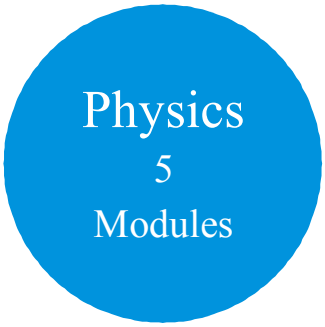


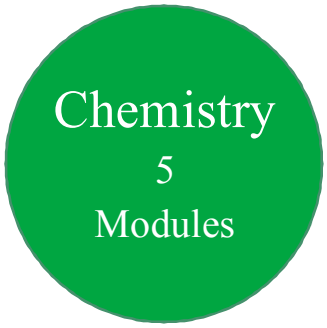


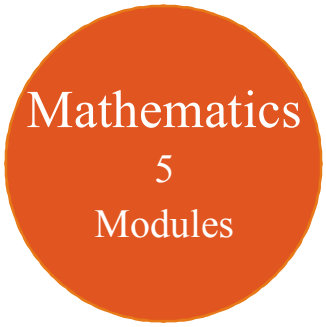


PHYSICS	CHEMISTRY	BIOLOGY
Module-1 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Motion of system of particles & Rigid Body 2. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Oscillations 2. Waves	**Module-1(PC)** 1. Some Basic Conceps of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-2(PC)** 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) **Module-3(IC)** 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds	**Module-1** 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom **Module-2** 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals **Module-3** 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition **Module-4** 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases **Module-5** 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

12th Class Modules Chapter Details







PHYSICS

Module-1

1. Electrostatics
2. Capacitance

Module-2

1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3

1. Electromagnetic Induction
2. Alternating Current

Module-4

1. Geometrical Optics
2. Wave Optics

Module-5

1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

1. Solid State
2. Chemical Kinetics
3. Solutions and Colligative Properties

Module-2(PC)

1. Electrochemistry
2. Surface Chemistry

Module-3(IC)

1. P-Block Elements
2. Transition Elements (d & f block)
3. Co-ordination Compound
4. Metallurgy

Module-4(OC)

1. HaloAlkanes & HaloArenes
2. Alcohol, Phenol & Ether
3. Aldehyde, Ketone & Carboxylic Acid

Module-5(OC)

1. Nitrogen & Its Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

BIOLOGY

Module-1

1. Reproduction in Organisms
2. Sexual Reproduction in Flowering Plants
3. Human Reproduction
4. Reproductive Health

Module-2

1. Principles of Inheritance and Variation
2. Molecular Basis of Inheritance
3. Evolution

Module-3

1. Human Health and Disease
2. Strategies for Enhancement in Food Production
3. Microbes in Human Welfare

Module-4

1. Biotechnology: Principles and Processes
2. Biotechnology and Its Applications
3. Organisms and Populations

Module-5

1. Ecosystem
2. Biodiversity and Conservation
3. Environmental Issues