Exercise-1

ONLY ONE OPTION CORRECT TYPE

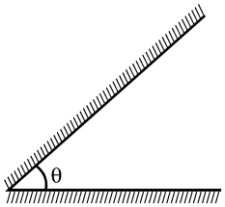
SECTION (A) : PLANE MIRROR

1. A clock hung on a wall has marks instead of numbers on its dial. On the opposite wall there is a mirror, and the image of the clock in the mirror if read, indicates the time as 8 : 20. What is the time in the clock-
(1) 3 : 40 (2) 4 : 40 (3) 5 : 20 (4) 4 : 20

2. A ray of light incident on a plane miror at an angle of incidence of 30º. The deviation produced by the mirror is-
(1) 30º (2) 60º (3) 90º (4) 120º

3. The image of a real object formed by a plane mirror is-
(1) Erect, real and of equal size (2) Erect, virtual and of equal size
(3) Inverted, real and of equal size (4) Inverted, virtual and of equal size

4. 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 :



(1) θ = 45° (2) θ = 30° (3) θ = 60° (4) all three

5. If an object is placed symmetrically between two plane mirrors, inclined at an angle of 72°, then the total number of images formed is-
(1) 5 (2) 4 (3) 2 (4) Infinite

6. A man 180 cm high stands in front of a plane mirror. His eyes are at a height of 170 cm from the floor. Then the minimum length of plane mirror for him to see his full length image is-
(1) 90 cm (2) 180 cm (3) 45 cm (4) 360 cm

7. A thick plane mirror shows a number of images of the filament of an electric bulb. Of these, the brightest image is the-
(1) First (2) Second (3) Last (4) Fourth

8. 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
(1) 60° (2) 100° (3) 180° (4) 240°

9. When a plane mirror is placed horizontally on a level ground at a distance of 60m from the foot of a tower, the top of the tower and its image in the mirror subtend an angle of 90° at the eye. The height of the tower will be
(1) 30 m (2) 60 m (3) 90 m (4) 120 m

10. An object is at a distance of 0.5 m in front of a plane mirror. Distance between the object and image is
(1) 0.5 m (2) 1 m (3) 0.25 m (4)1.5 m

11. The light reflected by a plane mirror may form a real image
(1) If the ray incident on the mirror are diverging
(2) If the rays incident on the mirror are converging
(3) If the object is placed very close to the mirror
(4) Under no circumstances

12. 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
(1) Perpendicular to the first mirror (2) Parallel to the first mirror
(3) Parallel to the second mirror (4) Perpendicular to the second mirror

13. It is desired to photograph the image of an object placed at a distance of 3 m from a plane mirror. The camera, which is at a distance of 4.5 m from the mirror should be focused for a distance of-
(1) 3 m (2) 4.5 m (3) 6 m (4) 7.5 m

14. 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.
(1) 08: 35: 23 (2) 07: 35: 23 (3) 07: 34: 23 (4) none of these

15. 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):
(1) 15 cm (2) 25 cm (3) 45 cm (4) 55 cm

16. A thick mirror produces a number of images of an object. The brightest images is
(1) first (2) second (3) third (4) last one

17. If two mirrors are kept at 60^o to each other, then the number of images formed by them is
(1) 5 (2) 6 (3) 7 (4) 8

18. To get three images of a single object, one should have two plane mirrors at an angle of
(1) 60^o (2) 90^o (3) 120^o (4) 30^o

19. A man is 6 feet tall. In order to see his entire image, he requires a plane mirror of minimum length equal to :
(1) 6 ft (2) 12 ft (3) 2 ft (4) 3 ft

SECTION (B) : SPHERICAL MIRROR

1. A convex mirror has a focal length f. A real object is placed at a distance f in front of it from the pole, then it produces an image at-
(1) Infinity (2) f (3) f/2 (4) 2f

2. The image formed by convex mirror of focal length 30 cm is a quarter of the size of the object. Then the distance of the object from the mirror, is-
(1) 30 cm (2) 90 cm (3) 120 cm (4) 60 cm

3. The largest distance of the image of a real object from a convex mirror of focal length 10 cm can be-
(1) 20 cm (2) Infinite
(3) 10 cm (4) Depends on the position of the object

4. In case of concave mirror, the minimum distance between a real object and its real image is-
(1) f (2) 2f (3) 4f (4) Zero

5. A luminous point object is moving along the principal axis of a concave mirror of focal length 12 cm towards it. When its distance from the mirror is 20 cm its velocity is 4 cm/s. The velocity of the image in cm/s at that instant is
(1) 6, towards the mirror (2) 6, away from the mirror
(3) 9, away from the mirror (4) 9, towards the mirror.

6. Which of the following can form erect, virtual, diminished image?
(1) plane mirror (2) concave mirror (3) convex mirror (4) none of these

7. The focal length of a concave mirror is 20 cm. Determine where an object must be placed to form an image magnified two times when the image is real-
(1) 30cm from the mirror (2) 10cm from the mirror
(3) 20cm from the mirror (4) 15cm from the mirror

8. A convex mirror of focal length f forms an image which is 1/n times the object. The distance of the object from the mirror is

(1) (n – 1)f (2) $\left(\frac{n-1}{n}\right)f$ (3) $\left(\frac{n+1}{n}\right)f$ (4) (n + 1)f

9. Which of the following could not produce a virtual image

(1) Plane mirror (2) Convex mirror
(3) Concave mirror (4) All the above can produce a vritual image

10. The field of view is maximum for

(1) Plane mirror (2) Concave mirror (3) Convex mirror (4) Cylindrical mirror

11. The focal length of a concave mirror is f and the distance from the object to the principle focus is x. The ratio of the size of the image to the size of the object is

(1) $\frac{f+x}{f}$ (2) $\frac{f}{x}$ (3) $\sqrt{\frac{f}{x}}$ (4) $\frac{f^2}{x^2}$

12. Image formed by a convex mirror is

(1) Virtual (2) Real (3) Enlarged (4) Inverted

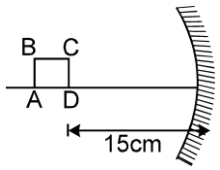
13. The image formed by a convex mirror of focal length 30 cm is a quarter of the size of the object. The distance of the object from the mirror is

(1) 30 cm (2) 90 cm (3) 120 cm (4) 60 cm

14. A person sees his virtual image by holding a mirror very close to the face. When he moves the mirror away from his face, the image becomes inverted. What type of mirror he is using

(1) Plane mirror (2) Convex mirror (3) Concave mirror (4) None of these

15. A square ABCD of side 1mm is kept at distance 15 cm infront of the concave mirror as shown in the figure. The focal length of the mirror is 10 cm. The length of the perimeter of its image will be(nearly):



(1) 8 mm (2) 2 mm (3) 12 mm (4) 6 mm

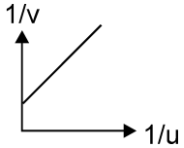
16. A particle is moving towards a fixed spherical mirror. The image:

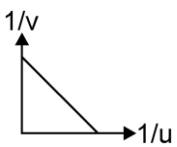
(1) must move away from the mirror
(2) must move towards the mirror
(3) may move towards the mirror
(4) will move towards the mirror, only if the mirror is convex.

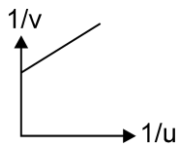
17. The distance of an object from the focus of a convex mirror of radius of curvature ' a ' is ' b '. Then the distance of the image from the focus is:

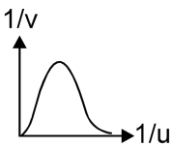
(1) $b^2 / 4a$ (2) a / b^2 (3) $a^2 / 4b$ (4) $4b / a^2$

18. An object is placed at a distance *u* from a concave mirror and its real image is received on a screen placed at a distance of *v* from the mirror. If *f* is the focal length of the mirror, then the graph between 1/*v* versus 1/*u* is

(1) 

(2*) 

(3) 

(4) 

SECTION (C) : REFRACTION IN GENERAL , REFRACTION AT PLANE SURFACE AND T.I.R.

1. Total internal reflection occurs in waves, when wave enters-
(1) Glass from air (2) Air from vaccum (3) Water from air (4) Air from water

2. An object is placed at 24 cm distance above the surface of a lake. If water has refractive index of 4/3, then at what distance from lake surface, a fish will sight the object-
(1) 32 cm above the surface of water (2) 18 cm over the surface of water
(3) 6 cm over the surface of water (4) 6 cm below the surface of water

3. Time taken to cross a 4 mm window glass of refractive index 1.5 will be-
(1) 2×10^{-8} sec (2) 2×10^{8} sec (3) 2×10^{-11} sec (4) 2×10^{11} sec

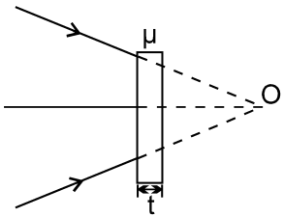
4. The total internal reflection of a beam of light occurs when beam of light enters-
[i_c = critical angle, i = angle of incidence]
(1) Rarer medium from a denser one and $i < i_c$ (2) Rarer medium from a denser $i > i_c$
(3) Denser medium from a rarer $i < i_c$ (4) Denser medium from a rarer $i > i_c$

5. A bubble in glass slab [$\mu = 1.5$] when viewed from one side appears at 5 cm and 2 cm from other side then thickness of slab is-
(1) 3.75 cm (2) 23 cm (3) 10.5 cm (4) 1.5 cm

6. A light wave travels from glass to water. The refractive index for glass and water are and $\frac{4}{3}$ respectively. The value of the critical angle will be:
(1) $\sin^{-1}\left(\frac{1}{2}\right)$ (2) $\sin^{-1}\left(\frac{9}{8}\right)$ (3) $\sin^{-1}\left(\frac{8}{9}\right)$ (4) $\sin^{-1}\left(\frac{5}{7}\right)$

7. The wavelength of light in vacuum is 6000 Å and in a medium it is 4000 Å. The refractive index of the medium is:
(1) 2.4 (2) 1.5 (3) 1.2 (4) 0.67

8. A beam of light is converging towards a point. A plane parallel plate of glass of thickness t, refractive index μ is introduced in the path of the beam. The convergent point is shifted by (assume near normal incidence):



(1) $t\left(1-\frac{1}{\mu}\right)$ away (2) $t\left(1+\frac{1}{\mu}\right)$ away (3) $t\left(1-\frac{1}{\mu}\right)$ nearer (4) $t\left(1+\frac{1}{\mu}\right)$ nearer

9. When a beam of light goes from denser medium (μ_d) to rarer medium (μ_r), then it is generally observed that magnitude of angle of incidence is half that of angle of refraction. Then magnitude of incident angle will be- (here $\mu = \mu_d/\mu_r$)
(1) $2\sin^{-1}\left(\frac{\mu}{2}\right)$ (2) $2\cos^{-1}\mu$ (3) $\cos^{-1}\left(\frac{\mu}{2}\right)$ (4) $2\cos^{-1}\left(\frac{\mu}{2}\right)$

10. To an observer on the earth the stars appears to twinkle. This can be ascribed to
(1) The fact that stars do not emit light continuosly
(2) Frequent absorption of star light by their own atmosphere
(3) Frequent absorption of star light by the earth's atmosphere

(4) The refractive index fluctuations in the earth's atmosphere

11. The refractive index of a certain glass is 1.5 for light whose wavelength in vacuum is 6000 Å. The wavelenghth of this light when it passes through glass is
(1) 4000 Å (2) 6000 Å (3) 9000 Å (4) 15000 Å

12. When light travels from one medium to the other of which the refractive index is different, then which of the following will change
(1) Frequency, wavelength and velocity (2) Frequency and wavelength
(3) Frequency and velocity (4) Wavelength and velcity

13. A monochromatic beam of light passes from a denser medium into a rarer medium. As a result
(1) Its velocity increases (2) Its velocity decreases
(3) Its frequency decreases (4) Its wavelength decreases

14. A rectangular tank of depth 8 meter is full of water ($\mu = 4/3$), the bottom is seen at the depth
(1) 6m (2) 8/3 m (3) 8 cm (4) 10 cm

15. If ${}_i\mu_j$ represents refractive index when a light ray goes from medium i to medium j, then the product ${}_2\mu_1 \times {}_3\mu_2 \times {}_4\mu_3$ is equal to
(1) ${}_3\mu_1$ (2) ${}_3\mu_2$ (3) $\frac{1}{{}_1\mu_4}$ (4) ${}_4\mu_2$

16. The wavelength of light diminishes μ times ($\mu = 1.33$ for water) in a medium. A driver from inside water looks at an object whose natural colour is green. He sees the object as
(1) Green (2) Blue (3) Yellow (4) Red

17. A diver in a swimming pool wants to signal his distress to a person lying on the edge of the pool by flashing his water proof flash light
(1) He must direct the beam vertically upwards
(2) He has to direct the beam horizontally
(3) He has to direct the beam at an angle to the vertical which is slightly less than the critical angle of incidence for total internal reflection
(4) He has to direct the beam at an angle to the vertical which is slightly more than the critical angle of incidence for the total internal reflection

18. The wavelength of light in two liquids 'x' and 'y' is 3500 Å and 7000 Å, then the critical angle of x relative to y will be
(1) 60° (2) 45° (3) 30° (4) 15°

19. Total internal reflection of a ray of light is possible when the (i_c = critical angle, i = angle of incidence)
(1) Ray goes from denser medium to rarer medium and $i < i_c$
(2) Ray goes from denser medium to rarer medium and $i > i_c$
(3) Ray goes from rarer medium to denser medium and $i > i_c$
(4) Ray goes from rarer medium to denser medium and $i < i_c$

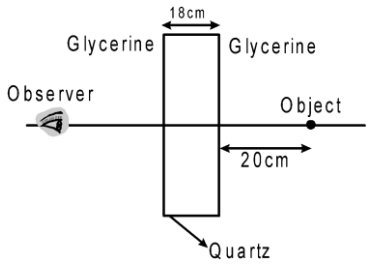
20. A diver at a depth of 12 m in water ($\mu = 4/3$) sees the sky in a cone of semi-vertical angle
(1) $\sin^{-1}(4/3)$ (2) $\tan^{-1}(4/3)$ (3) $\sin^{-1}(3/4)$ (4) 90°

21. The critical angle for diamond (refractive index = 2) is
(1) About 20° (2) 60° (3) 45° (4) 30°

22. The reason for shining of air bubble in water is
(1) Diffraction of light (2) Dispersion of light
(3) Scattering of light (4) Total internal reflection of light

23. 'Mirage' is a phenomenon due to
(1) Reflection of light (2) Refraction of light
(3) Total internal reflection of light (4) Diffraction of light

24. Given that velocity of light in quartz =1.5 × 10_8 m/s and velocity of light in glycerine = (9/4) × 10_8 m/s. Now a slab made of quartz is placed in glycerine as shown. The shift of the object produced by slab is

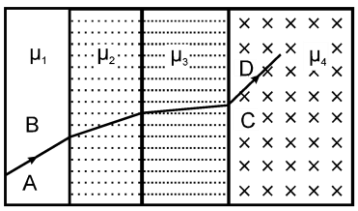


(1) 6 cm (2) 3.55 cm (3) 9 cm (4) 2 cm

25. A ray of light passes from vacuum into a medium of refractive index n. If the angle of incidence is twice the angle of refraction, then the angle of incidence is:
(1) $\cos^{-1}(n/2)$ (2) $\sin^{-1}(n/2)$ (3) $2\cos^{-1}(n/2)$ (4) $2\sin^{-1}(n/2)$

26. The critical angle of light going from medium A to medium B is θ. The speed of light in medium A is v. The speed of light in medium B is:
(1) $\frac{v}{\sin\theta}$ (2) v sin θ (3) v cot θ (4) v tan θ

27. A ray of light passes through four transparent media with refractive indices μ_1, μ_2, μ_3 & μ_4 as shown in the figure. The surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we must have:



(1) $\mu_1 = \mu_2$ (2) $\mu_2 = \mu_3$ (3) $\mu_3 = \mu_4$ (4) $\mu_4 = \mu_1$

28. If the critical angle for total internal reflection from a medium to vacuum is 30°, then the speed of light in the medium is
(1) 6 × 10_8 m/s (2) 3 × 10_8 m/s (3) 2 × 10_8 m/s (4) 1.5 × 10_8 m/s

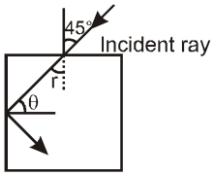
29. If a glass rod is immmersed in a liquid of same refractive index, then it will appear
(1) bent (2) longer (3) shorter (4) invisible

30. A metal coin is at the bottom of a beaker filled with a liquid of refractive index 4/3 to height of 6 cm. To an observer looking from above the surface of the liquid, coin will appear at a depth of :
(1) 7.5 cm (2) 6.75 cm (3) 4.5 cm (4) 1.5 cm

31. A transparent cube of 15 cm edge contains a small air bubble. Its apparent depth when viewed througth one face is 6 cm and when viewed through the opposite face is 4 cm. Then the refractive index of the material of the cube is :
(1) 2.0 (2) 2.5 (3) 1.6 (4) 1.5

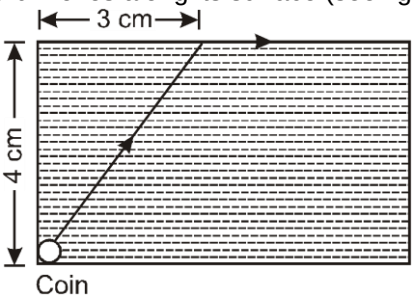
32. If the critical angle for total internal reflection from medium to vacuum is 30°, the velocity of light in medium is
(1) 3 × 10_8 m/s (2) 1.5 × 10_8 m/s (3) 6 × 10_8 m/s (4) × 10_8 m/s

33. 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 :



(1) $n > \frac{\sqrt{3}+1}{2}$ (2) $n < \frac{\sqrt{3}+1}{2}$ (3) $n > \sqrt{\frac{3}{2}}$ (4) $n < \sqrt{\frac{3}{2}}$

34. A small coin is resting on the bottom of a beaker filled with a liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface (see figure)



How fast is the light travelling in the liquid?

(1) $1.8 \times 10_8$ m/s (2) $2.4 \times 10_8$ m/s (3) $3.0 \times 10_8$ m/s (4) $1.2 \times 10_8$ m/s

35. Which of the following is used in optical fibers ?

(1) total internal reflection (2) scattering
(3) diffraction (4) refraction

36. Transmission of light in optical fibre is due to :

(1) Scattering (2) Diffraction
(3) Polarisation (4) Multiple total internal reflections

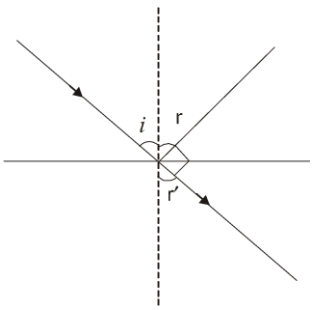
37. Which of the following will remain constant in the phenomenon of refraction of light ?

(1) Wavelength (2) Velocity (3) Frequency (4) None

38. The phenomena of total internal reflection is seen when angle of incidence is :

(1) 90° (2) greater than critical angle
(3) equal to critical angle (4) 0°

39. A ray of light from a denser medium strikes a rarer medium of an angle of incidence i. the reflected and refracted rays make an angle of 90_0 with each other. The angle of reflection and refraction are r and r'. The critical angle is-



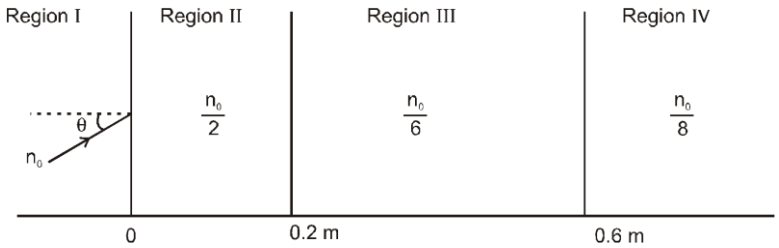
(1) $\sin^{-1}$ [tan r] (2) $\sin^{-1}$ [cot i] (3) $\sin^{-1}$ [tan r'] (4) $\sin^{-1}$ [sin r']

40. A ray of ligth travels from on optically denser to a rarer medium. The critical angle for the two media is c. The maximum possible deviation of the ray will be–

(1) 2c (2) $\frac{\pi}{2}$ – c (3) π – c (4) π – 2c

41. A ray of light traveling in water is incident on its surface open to air. The angle of incidence is θ, which is less than the critical angle. Then there will be :
(1) only a reflected ray and no refracted ray
(2) only a refracted ray and no reflected ray
(3) a reflected ray and a refracted ray and the angle between them would be less than 180º – 2θ
(4) a reflected ray and a refracted ray and the angle between them would be greater than 180º – 2θ.

42. A light beam is traveling from Region I to Region IV (Refer Figure). The refractive index in Regions I, II, III and IV are n_0, and, respectively. The angle of incidence θ for which the beam just misses entering Region IV is
Figure



(1) $\sin^{-1}\left(\frac{3}{4}\right)$ (2) $\sin^{-1}\left(\frac{1}{8}\right)$ (3) $\sin^{-1}\left(\frac{1}{4}\right)$ (4) $\sin^{-1}\left(\frac{1}{3}\right)$

43. The wavelength of light in two liquids x and y are 3500 Å and 7000 Å, then the critical angle of x relative to y will be
(1) 60° (2) 45° (3) 30° (4) 15°

44. The correct thickness of a glass having ${}_a\mu_g = 1.5$, which permits equal number of wavelengths as that of 18 cm long column of water is- $[{}_a\mu_g = 4/3]$
(1) 12 cm (2) 16 cm (3) 18 cm (4) 24 cm

45. Dimension of $\frac{1}{\mu_0\varepsilon_0}$ is (where symbols have usual meaning) :
(1) $[LT^{-1}]$ (2) $[L^{-1}T]$ (3) $[L^{-2}T^2]$ (4) $[L^2T^{-2}]$

46. When a ray of light is reflected from a denser medium interface, then the following changes-
(1) Wavelength (2) Phase (3) Frequency (4) Speed

47. If refractive index of a medium is 1.5, then velocity of light in that medium will be :
(1) 10×10^8 (2) 2×10^8 (3) 3×10^8 (4) 4×10^8

48. Light enters into glass from air then its :
(1) frequency increases (2) frequency decreases
(3) wavelength increases (4) wavelength decreases

49. The value of refractive index for any medium is-
(1) 1/ $\sqrt{\mu_r\varepsilon_r}$ (2) $\sqrt{\mu_r\varepsilon_r}$ (3) $\sqrt{\mu_r/\varepsilon_r}$ (4) $\sqrt{\varepsilon_r/\mu_r}$

SECTION (D) : REFRACTION BY PRISM

1. A ray of light is incident normally on one of the faces of a prism apex angle 30º and refractive index $\sqrt{2}$. The angle of deviation of the ray is:
(1) 15º (2) 22.5º (3) 0º (4) 12.5º

2. The refractive index of the material of prism of 60º angle is $\sqrt{2}$. At what angle the ray of light be incident on it so that minimum deviation takes place?
(1) 45º (2) 60º (3) 30º (4) 75º

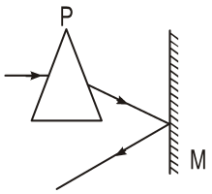
3. A ray of light is incident at angle of 60_0 on one face of a prism which has an apex angle of 30_0. The ray emerging out of the prism makes an angle of 30_0 with the incident ray. The refractive index of the material of the prism is -
(1) $\sqrt{2}$ (2) $\sqrt{3}$ (3) 1.5 (4) 1.6

4. If the critical angle for the medium of prism is C and the angle of prism is A, then there will be no emergent ray when -
(1) A < 2C (2) A = 2C (3) A > 2C (4) A ≥ 2C

5. A ray of monochromatic light is incident on one refracting face of a prism of angle 75_0. It passes through the prism and is incident on the other face at the critical angle. If the refractive index of the material of the prism is √2, the angle of incidence on the first face of the prism is
(1) 30_0 (2) 45_0 (3) 60_0 (4) 0_0

6. A ray of light is incident at angle *i* on a surface of a prism of small angle A and emerges normally from the opposite surface. If the refractive index of the material of the prism is μ, the angle of incidence *i* is nearly equal to :
(1) A/μ (2) A/(2 μ) (3) μ A (4) μ A/2

7. A prism having an apex angle of 4_0 and refractive index of 1.50 is located in front of a vertical plane mirror as shown. A horizontal ray of light is incident on the prism. The total angle through which the ray is deviated is:



(1) 4º clockwise (2) 178º clockwise (3) 2º clockwise (4) 8º clockwise

8. The critical angle between an equilateral prism and air is 45°. If the incident ray is perpendicular to the refracting surface, then
(1) After deviation it will emerge from the second refaracting sufrace
(2) It is totally reflected on the second surface and emerges out perpendicularly from third surface in air
(3) It is totally reflected from the second and third refracting surfaces and finally emerges out from the first surface
(4) It is totally reflected from all the three sides of prism and never emerges out

9. When light rays are incident on a prism at an angle of 45°, the minimum deviation is obtained. If refractive index of the material of prism is $\sqrt{2}$, then the angle of prism will be
(1) 30° (2) 40° (3) 50° (4) 60°

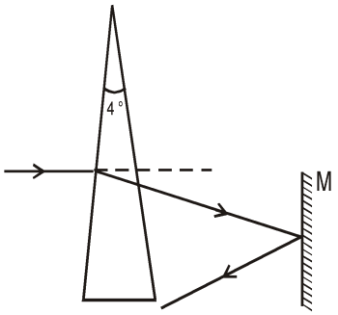
10. The refractive indedx of a prism for a monochromatic wave is $\sqrt{2}$ and its refracting angle is 60°. For minimum deviation, the angle of incidence will be
(1) 30° (2) 45° (3) 60° (4) 75°

11. A parallel beam of monochromatic light is incident at one surface of a equilateral prism. Angle of incidence is 55° and angle of emergence is 46°. The angle of minimum deviation will be
(1) Less than 41° (2) Equal to 41° (3) More than 41° (4) None of the above

12. The minimum refractive index of a material, of a prism of apex angle 90º, for which light cannot be transmitted for any value of i:

(1) $\sqrt{3}$ (2) 1.5 (3) $\sqrt{2}$ (4) None of these

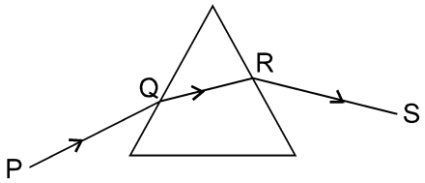
13. A horizontal light ray passes through a prism (μ = 1.5) of angle 4°. Further, it is incident on a plane mirror M that has been placed vertically. By what angle the mirror is rotated so that the ray after reflection becomes horizontal?



(1) 1° (2) 2° (3) 4° (4) 8°

14. For a prism of refractive index $\sqrt{3}$, the angle of the prism is equal to the angle of minimum deviation. The value of the angle of the prism is–
(1) 60º (2) 50º (3) 45º (4) 30º

15. An equilateral prism is kept on a horizontal surface. A typical ray of light PQRS is shown in the figure. For minimum deviation



(1) the ray PQ must be horizontal (2) the ray RS must be horizontal
(3) the ray QR must be horizontal (4) any one of them can be horizontal

16. A prism has a refracting angle of 60°. If it produces a minimum deviation of 30° in an incident ray, the angle of incidence is
(1) 15° (2) 30° (3) 45° (4) 60°

17. A thin prism P of angle 4° made of glass of refractive index 1.54 is combined to a thin prism Q made of glass of refractive index 1.72 to produce dispersion without deviation. The angle of prism Q is :
(1) 4° (2) 3° (3) 2.6° (4) 5.3°

18. A prism has a refracting angle 60º. A ray of given monochromatic light suffers minimum deviation of 38° in passing through prism refractive index of the material of the prism is :
(1) 1.5094 (2) 1.3056 (3) 0.7849 (4) 2.425

19. An equilateral prism has μ = $\sqrt{3}$. its angle of minimum deviation will be :
(1) 30° (2) 60° 3) 120° (4) 45°

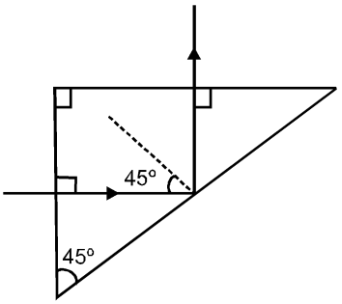
20. The deviation is maximum for which colour ?
(1) vilot (2) Red (3) Blue (4) Green

21. The refractive indices of violet and red light are 1.54 and 1.52 respectively. If the angle of the prism is 10°, the angular dispersion is
(1) 0.02° (2) 0.2° (3) 3.06° (4) 30.6°

22. A microscope is focussed on a mark on a piece of paper and then a slab of glass of thickness 3 cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?
(1) 1 cm upward (2) 4.5 cm downward (3) 1 cm downward (4) 2 cm upward

23. The refractive index of glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be angles of minimum deviation for red and blue light respectively in a prism of this glass. Then,
(1) D_1 can be less than or greater than D_2 depending upon the angle of prism
(2) $D_1 > D_2$
(3) $D_1 < D_2$
(4) $D_1 = D_2$

24. A light ray is incident perpendicularly to one face to a 90º prism and is totally internally reflected at the glass-air interface. If the angle of reflection is 45º, we conclude that the refractive index n is



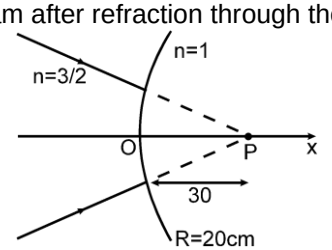
(1) $n < \frac{1}{\sqrt{2}}$ (2) $n > \sqrt{2}$ (3) $n > \frac{1}{\sqrt{2}}$ (4) $n < \sqrt{2}$

SECTION (E) : REFRACTION BY SPHERICAL SURFACE

1. An object is placed at a distance of 20 cm, in rarer medium, from the pole of a convex spherical refracting surface of radius of curvature 10 cm. If the refrective index of the rarer medium is 1 and of the refracting medium is 2, then the position of the image is at-
(1) (40/3) cm from the pole & inside the denser medium
(2) 40 cm from the pole & inside the denser medium.
(3) (40/3) cm from the pole & outside the denser medium
(4) 40 cm from the pole & outside the denser medium.

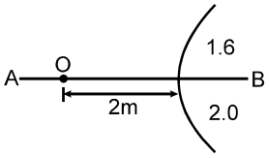
2. There is a small black dot at the centre C of a solid glass sphere of refractive index μ. When seen from outside, the dot will appear to be located:
(1) away from C for all values of μ (2) at C for all values of μ
(3) at C for μ = 1.5, but away from C for μ ≠ 1.5 (4) at C only for ≤ μ ≤ 1.5.

3. The image for the converging beam after refraction through the curved surface is formed at:



(1) x = 40 cm (2) x = cm (3) $x = \frac{40}{3} - \frac{40}{3}$ cm (4) $x = \frac{180}{7}$ cm

4. In the figure shown a point object O is placed in air. A spherical boundary of radius of curvature 1.0 m separates two media. AB is principal axis. The refractive index above AB is 1.6 and below AB is 2.0. The separation between the images formed due to refraction at spherical surface is:



(1) 12 m (2) 20 m (3) 14 m (4) 10 m

SECTION (F) : LENS

1. 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 -
(1) Become zero (2) Become infinite
(3) Become small, but non-zero (4) Remain unchanged

2. A biconvex lens with equal radii of curvature has refractive index 1.6 and focal length 10 cm. Its radius of curvature will be:
(1) 20 cm (2) 16 cm (3) 10 cm (4) 12 cm

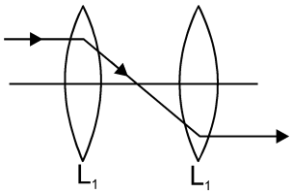
3. A convex lens forms a real image 9 cm long (high) on a screen. Without altering the position of the object and the screen, the lens is displaced and we get again a real image 4 cm long (high) on the screen. Then the length of the object is-
(1) 9 cm (2) 4 cm (3) 6 cm (4) 36 cm

4. An object is placed at a distance of 5 cm from a convex lens of focal length 10 cm, then the image is-
(1) Real, diminished and at a distance of 10 cm from the lens.
(2) Real, enlarged and at a distance of 10 cm from the lens.
(3) Virtual, enlarged and at a distance of 10 cm from the lens.
(4) Virtual, diminished and at a distance of 10/3 cm from the lens.

5. Inside water, an air bubble behave-
(1) Always like a convex lens
(2) Always like a concave lens
(3) Always like a slab of equal thickness
(4) Sometimes concave and sometimes like a convex lens

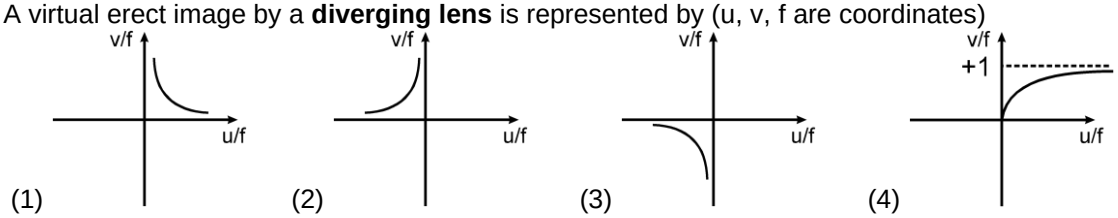
6. A lens behaves as a converging lens in air and a diverging lens in water. The refractive index of the material is (refractive index of water = 1.33)
(1) equal to unity (2) equal to 1.33
(3) between unity and 1.33 (4) greater than 1.33

7. In the figure given below, there are two convex lens L_1 and L_2 having focal length of f_1 and f_2 respectively. The distance between L_1 and L_2 will be



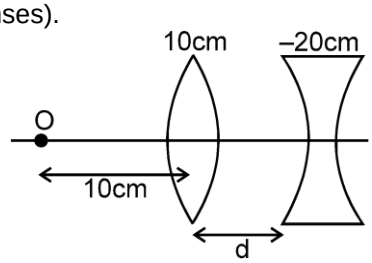
(1) f_1 (2) f_2 (3) $f_1 + f_2$ (4) $f_1 - f_2$

8. A virtual erect image by a **diverging lens** is represented by (u, v, f are coordinates)



(1) (2) (3) (4)

9. What should be the value of distance d so that final image is formed on the object itself. (focal lengths of the lenses are written on the lenses).



(1) 10 cm (2) 20 cm (3) 5 cm (4) none of these

10. A thin linear object of size 1 mm is kept along the principal axis of a convex lens of focal length 10 cm. The object is at 15 cm from the lens. The length of the image is:
(1) 1 mm (2) 4 mm (3) 2 mm (4) 8 mm

11. A glass lens is placed in a medium in which it is found to behave like a glas plate. Refractive index of the medium will be :
(1) Greater than the refractive index of glass (2) Smaller than the refractive index of glass
(3) Equal to refractive index of glass (4) No case will be possible from above

12. A divergent lens will produce
(1) Always a virtual image (2) Always real image
(3) Sometimes real and sometimes virtual (4) None of above

13. The minimum distance between an object and its real image formed by a convex lens is
(1) 1.5 f (2) 2 f (3) 2.5 f (4) 4 f

14. A biconvex lens forms a real image of an object placed perpendicular to its principal axis. Suppose the radii of curvature of the lens tend to infinity. Then the image would
(1) Disappear (2) Remain as real image still
(3) Be virtual and of the same size as the object (4) Suffer from aberrations

15. The radius of curvature of convex surface of a thin plano-convex lens is 15 cm and refractive index of its material is 1.6. The power of the lens will be
(1) +1D (2) –2D (3) +3D (4) +4D

16. A lens is placed between a source of light and a wall. It forms images of area A_1 and A_2 on the wall for its two different postions. The area of the sourece of light is

(1) $\frac{A_1 + A_2}{2}$ (2) $\left[\frac{1}{A_1} + \frac{1}{A_2}\right]^{-1}$ (3) $\sqrt{A_1 A_2}$ (4) $\left[\frac{\sqrt{A_1} + \sqrt{A_2}}{2}\right]^2$

17. If the central portion of a convex lens is wrapped in black paper as shown in the figure

(1) No image will be formed by the remaining portion of the lens
(2) The full image will be formed but it will be less bright
(3) The central portion of the image will be missing
(4) There will be two images each produced by one of the exposed portions of the lens

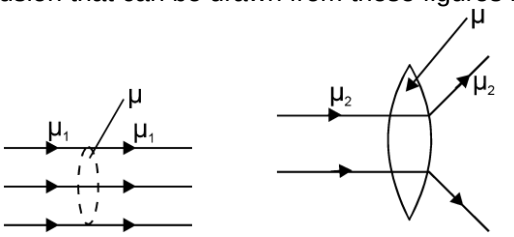
18. A convex lens form a real image of a point object placed on its principal axis. If the upper half of the lens is painted black, the image will
(1) Be shifted downwards (2) Be shifted upwards
(3)Not be shifted (4) Shift on the principal axis

19. In the figure, an air lens of radii of curvature 10 cm ($R_1 = R_2 = 10$ cm) is cut in a cylinder of glass ($\mu = 1.5$). The focal length and the nature of the lens is

(1) 15 cm, concave (2) 15 cm,convex
(3) ∞, neither concave nor convex (4) 0, concave

20. A lens made of glass of refractive index 1.5 has a focal length of 10 cm in air and 50 cm when completely immersed in a liquid. Then the refractive index of the liquid is-
(1) 1.36 (2) 1.33 (3) 1.30 (4) 1.38

21. The correct conclusion that can be drawn from these figures is



(1) $\mu_1 < \mu$ but $\mu < \mu_2$ (2) $\mu_1 > \mu$ but $\mu < \mu_2$

(3) $\mu_1 = \mu$ but $\mu < \mu_2$ (4) $\mu_1 = \mu$ but $\mu_2 < \mu$

22. A magnifying glass is to be used at the fixed object distance of 1 inch. if it is to produce an erect image magnified 5 times, its focal length should be

(1) 0.2 inch (2) 0.8 inch (3) 1.25 inch (4) 5 inch

23. A convex lens of focal length f produces a virtual image n times the size of the object. Then the distance of the object from the lens is-

(1) $\frac{n-1}{n}f$ (2) $\frac{n+1}{n}f$ (3) $\frac{f}{n}$ (4) $\frac{n}{n-1}f$

24. The focal length of a convex lens made from a material of refractive index 1.52 is 10 cm when placed in air. If it is immersed in carbon disulphide of refractive index 1.68, then its focal length and nature will be–

(1) + 36.4 cm, convex lens. (2) – 36.4 cm, concave lens.

(3) + 54.6 cm, convex lens. (4) – 54.6 cm, concave lens.

25. Two symmetric double convex lenses A and B have same focal length, but the radii of curvature differ so that, $R_A = 0.9\ R_B$. If $n_A = 1.63$, find n_B.

(1) 1.7 (2) 1.6 (3) 1.5 (4) 4/3

26. When a lens of power P (in air) made of material of refractive index μ is immersed in liquid of refractive index μ_0. Then the power of lens is:

(1) $\frac{\mu - 1}{\mu - \mu_0}$ P (2) $\frac{\mu - \mu_0}{\mu - 1}$ P (3) $\frac{\mu - \mu_0}{\mu - 1} \cdot \frac{P}{\mu_0}$ (4) none of these

27. A thin symmetrical double convex lens of power P is cut into three parts, as shown in the figure. Power of A is:

(1) 2 P (2) $\frac{P}{2}$ (3) $\frac{P}{3}$ (4) P

28. A convex lens makes a real image of 4 cm long (height) on a screen. When the lens is shifted to a new position without disturbing the object or the screen, we get a real image on the screen, which is 16 cm long. The length (height) of the object is :

(1) 1/4 cm (2) 8 cm (3) 20 cm (4) 2 cm

29. An object is placed at a distance of 10 cm from a convex lens of power 5D. Find the position of the image :

(1) – 40 cm (2) 30 cm (3) 20 cm (4) – 10 cm

30. The radius of the convex surface of plano-convex lens is 20 cm and the refractive index of the material of the lens is 1.5 The focal length is :

(1) 30 cm (2) 50 cm (3) 20 cm (4) 40 cm

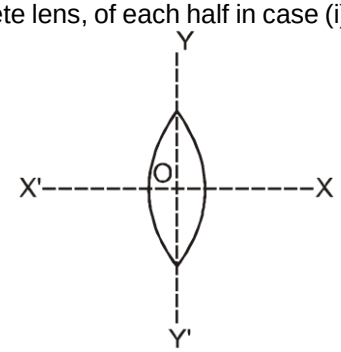
31. A symmetric double convex lens is cut in two equal parts by a plane perpendicular to the principal axis.If the power of the original lens is 4D, the power of a cut lens will be
(1) 2D (2) 3D (3) 4D (4) 5D

32. A point object is placed at the focus of a double concave lens. The image is formed
(1) at infinity (2) between the focus and the lens
(3) at focus (4) between the focus and infinity

33. A thin convex lens of refractive index 1.5 is placed in a liquid with refractive index 2.0. Then power of the lens in air is 10 D. Then in the liquid its power will be
(1) 20 D (2) 10 D (3) –10 D (4) –5 D

34. 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:
(1) Only $\frac{d}{4}$ (2) Only $\frac{d}{2}$
(3) More than $\frac{d}{4}$ but less than $\frac{d}{2}$ (4) Less than $\frac{d}{4}$

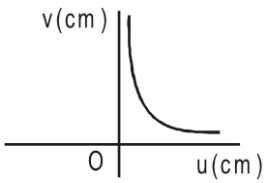
35. An equiconvex lens is cut into two halves along (i) XOX' and (ii) YOY' as shown in the figure. Let f, f ',f '' be the focal lengths of the complete lens, of each half in case (i), and of each half in case (ii), respectively.

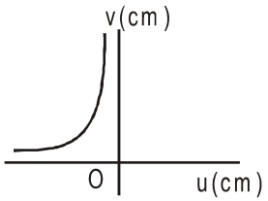


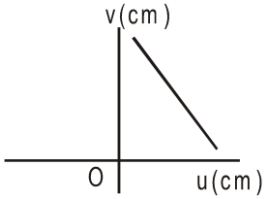
Choose the correct statement from the following :
(1) f ' = f, f '' = f (2) f ' = 2f, f '' = 2f (3) f ' = f, f '' = 2f (4) f ' = 2f, f '' = f

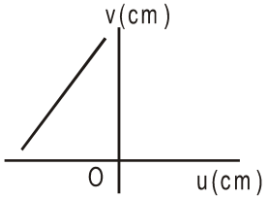
36. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will :
(1) Become small, but non-zero (2) Remain unchanged
(3) Become zero (4) Become infinite

37. A student measures the focal length of a convex lens by putting an object pin at a distance |u| from the lens and measuring the distance 'v' of the image pin. The graph between 'u' and 'v' plotted by the student should look like -

(1) 

(2) 

(3) 

(4) 

38. Image formed on retina of eye is proportional to :

(1) size of object (2) area of object (3) $\frac{\text{size of object}}{\text{size of image}}$ (4) $\frac{\text{size of image}}{\text{size of object}}$

39. In order to obtain image on wall of a bulb at a distance d from the wall a convex lens is placed between bulb and wall. Focal length of lens will be -

(1) d/2 (2) Between d/2 & d/4

(3) More then d/2 (4) Less than d/4

40. An object is placed 12 cm to the left of a converging lens of focal length 8 cm. Another converging lens of 6 cm focal length is placed at a distance of 30 cm from object to the right of the first lens. The second lens will produce–

(1) a virtual enlarged image (2) no image

(3) a real inverted image (4) a real enlarged image

41. A biconvex lens of focal length f forms a circular image of radius r of sun in focal plane. Then which option is correct :

(1) $\pi r^2 \propto f$

(2) $\pi r^2 \propto f^2$

(3) If lower half part is convered by black sheet, then area of the image is equal to $\pi r^2/2$

(4) if f is doubled, intensity will increase

42. A slide projector magnified a film of 100 cm^2 on a screen. If linear magnification is 4, then area of the magnified image will be :

(1) 1600 cm^2 (2) 800 cm^2 (3) 400 cm^2 (4) 200 cm^2

SECTION (G) : COMBINATION OF THIN LENS/LENS AND MIRRORS.

1. A convex lens of focal length 25 cm and a concave lens of focal length 20 cm are mounted coaxially separated by a distance d cm. If the power of the combination is zero, *d* is equal to

(1) 45 (2) 30 (3) 15 (4) 5

2. A convex lens of power 4D and a concave lens of power 3D are placed in contact, the equivalent power of combination:

(1) 1D (2) D (3) 7D (4) D

3. Two thin lenses of power +5D and –2D are placed in contact with each other. Focal length of the combination will behave like a-

(1) Convex lens of focal length 3m (2) Concave lens of focal length 0.33m

(3) Convex lens of focal length 0.33m (4) None of the above

4. The focal length of a plano-concave lens is –10 cm, then its focal length when its plane surface is polished is (n = 3/2):

(1) 20 cm (2) − 5 cm (3) 5 cm (4) none of these

5. A combination of two thin lenses with focal lengths f_1 and f_2 respectively forms an image of distant object at distance 60 cm when lenses are in contact. The position of this image shifts by 30 cm towards the combination when two lenses are separated by 10 cm. The corresponding values of f_1 and f_2 are

(1) 30 cm, –60 cm (2) 20 cm, –30cm (3) 15cm, –20 cm (4) 12 cm, –15 cm

6. A plano convex lens (f = 20 cm) is silvered at plane surface. Now f will be

(1) 20 cm (2) 40 cm (3) 30 cm (4) 10 cm

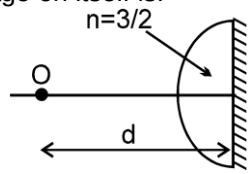
7. A luminous object is placed at a distance of 30 cm from a convex lens of focal length 20 cm. On the other side of the lens, at what distance from the lens must a convex mirror of radius of curvature 10 cm be placed in order to have and erect image of the object coincident with it ?

(1) 12 cm (2) 30 cm (3) 50 cm (4) 60cm

8. The plane surface of a plano - convex lens of focal lenght f is silvered. It will behave as:
(1) plane mirror (2) convex mirror of focal length 2f
(3) concave mirror of focal length f/2 (4) none of the above

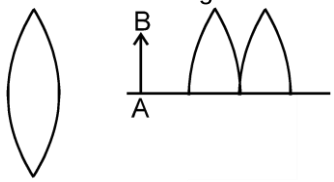
9. A concave lens of focal length 20 cm placed in contact with a plane mirror acts as a :
(1) Convex mirror of focal length 10 cm (2) Concave mirror of focal length 40 cm
(3) Concave mirror of focal length 60 cm (4) Concave mirror of focal length 10 cm

10. A plano-convex lens of focal length 10 cm is silvered at its plane face. The distance d at which an object must be placed in order to get its image on itself is:



(1) 5 cm (2) 20 cm (3) 10 cm (4) 2.5 cm

11. In the figure (i) a thin lens of focal length 10 cm is shown. The lens is cut into two equal parts, and the parts are arranged as shown in the figure (ii). An object AB of height 1 cm is placed at distance of 7.5 cm from the arrangement. The height of the final image will be:



(i) (ii)

(1) 0.5 cm (2) 2 cm (3) 1 cm (4) 4 cm

12. A convex lens of focal length 40 cm is kept in contact with a concave lens of focal length 25 cm. The power of the combination is

(1) – 6.5 D (2) + 6.5 D (3) $\frac{f_0}{f_e}$ – 1.5 D (4) $\frac{f_e}{f_o}$ + 1.5 D

13. The plane faces of two identical plano-convex lenses, each having focal length of 40 cm, are placed against each other to form a common convex lens. The distance from this lens at which an object must be placed to obtain a real inverted image with magnification equal to unity is
(1) 80 cm (2) 40 cm (3) 20 cm (4) 160 cm

14. A convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in diopters of the combination is :
(1) 25 (2) 50 (3) Infinite (4) Zero

15. A plano convex lens of refractive index 1.5 and radius of curvature 30 cm is silvered at the curved surface. Now this lens has been used to from the image of an object. At what distance from this lens an object be placed in order to have a real image of the size of the object.
(1) 20 cm (2) 30 cm (3) 60 cm (4) 80 cm

16. A plano-convex lens is made of a material of refractive index μ = 1.5. The radius of curvature of curved surface of the lens is 20 cm. If its plane surface is silvered, the focal length of the silvered lens will be :
(1) 10 cm (2) 20 cm (3) 40 cm (4) 80 cm

17. power of combination of two lens of focal lengths 20 cm and 25 cm respectively :
(1) + 1 D (2) + 9 D (3) – 1 D (4) – 9 D

SECTION (H) : DISPERSION OF LIGHT

1. Dispersive power of a prism depends on-
(1) Material (2) Prism angle (3) Shape of prism (4) Angle on incidence

2. When light is passed through a prism, the colour which deviates least is:
(1) Red (2) violet (3) Blue (4) Green

3. If refractive index of red, violet and yellow lights are 1.42, 1.62 and 1.50 respectively for a medium, its dispersive power will be -
(1) 0.4 (2) 0.3 (3) 0.2 (4) 0.1

4. Two thin lenses, one convex of focal length 30 cm and the other concave of focal length 10cm are put into contact. If this combination is equivalent to an achromatic lens then the ratio of dispersive powers (ω_1/ω_2) of above two lenses is -
(1) 1/3 (2) – 3 (3) 3 (4) – 1/3

5. The colour are characterised by which of following character of light-
(1) Frequency (2) Amplitude (3) Wavelength (4) Velocity

6. The dispersion of light in a medium implies that :
(1) lights of different wavelengths travel with different speeds in the medium
(2) lights of different frequencies travel with different speeds in the medium
(3) the refractive index of medium is different for different wavelengths
(4) all of the above.

7. Critical angle of light passing from glass to air is minimum for
(1) red (2) green (3) yellow (4) violet

8. A plane glass slab is placed over various coloured letters. The letter which appears to be raised the least is:
(1) violet (2) yellow (3) red (4) green

9. A medium has $n_v = 1.56$, $n_r = 1.44$. Then its dispersive power is:
(1) 3/50 (2) 6/25 (3) 0.03 (4) none of these

10. All the listed things below are made of flint glass. Which one of these have greatest dispersive power (ω).
(1) prism (2) glass slab (3) biconvex lens (4) all have same ω

11. Light of wavelength 4000 Å is incident at small angle on a prism of apex angle 4º. The prism has $n_v = 1.5$ & $n_r = 1.48$. The angle of dispersion produced by the prism in this light is:
(1) 0.2º (2) 0.08º (3) 0.192º (4) None of these

12. When white light passes through a glass prism, one gets spectrum on the other side of the prism. In the emergent beam, the ray which is deviating least is or Deviation by a prism is lowest for
(1) Violet ray (2) Green ray (3) Red ray (4) Yellow ray

13. A spectrum is formed by a prism of dispersive power 'ω'. If the angle of deviation is 'δ', then the angular dispersion is
(1) ω/δ (2) δ/ω (3) 1/ ωδ (4) ωδ

14. When white light passes through the achromatic combination of prisms, then what is observed
(1) Only deviation (2) Only dispersion
(3) Deviation and dispersion (4) None of the above

15. An achromatic combination of lenses is formed by joining
(1) 2 convex lenses (2) 2 concave lenses
(3) 1 convex lens and 1 concave lens (4) Convex lens and plane mirror

16. An achromatic convergent doublet of two lenses in contact has a power of + 2D. The convex lens has power + 5 D. What is the ratio of the dispersive powers of the convergent and divergent lenses ?
(1) 2 : 5 (2) 3 : 5 (3) 5 : 2 (4) 5 : 3

17. The ratio of angle of minimum deviation of a prism when dipped in water and when in airwill be

($_a\mu_g$= 3/2 and $_a\mu_w$= 4/3)
If prism angle is very small
(1) 1/8 (2) 1/2 (3) 3/4 (4) 1/4

18. The respective angle of the flint and crown glass prisms are A' and A. They are to be used for dispersion without deviation, then the ratio of their angles A'/A will be
(1) $-\frac{(\mu_y - 1)}{(\mu_y' - 1)}$ (2) $-\frac{(\mu_y' - 1)}{(\mu_y - 1)}$ (3) $(\mu_y' - 1)$ (4) $(\mu_y - 1)$

19. Focal length of a convex lens will be maximum for
(1) Blue light (2) Yellow light (3) Green light (4) Red light

20. Rainbows are formed by :
(1) Reflection and diffraction (2) Refraction and scattering
(3) Dispersion and total internal reflection (4) Interference only

21. The ratio of the refractive index of red light to blue light in air is
(1) Less than unity
(2) Equal to unity
(3) Greater than unity
(4) Less as well as greater than unity depending upon the experimental arrangement

22. The refractive index of a piece of transparent quartz is the greatest for
(1) Red light (2) Violet light (3) Green light (4) Yellow light

23. Refractive index for a material for infrared light is
(1) Equal to that of ultraviolet light (2) Less than that for ultraviolet light
(3) Equal to that for red colour of light (4) Greater than that for ultraviolet light

24. With respect to air critical angle in a medium for light of red colour [λ_1] is θ. Other facts remaining same, critical angle for light of yellow colour [λ_2] will be
(1) θ (2) More than θ (3) Less than θ (4) None of these

25. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out of the opposite parallel face, the red and green rays emerge from :

(1) Two points propagating in two different non-parallel directions
(2) Two points propagating in two different parallel directions
(3) One point propagating in two different directions
(4) One point propagating in the same direction

SECTION (I) : DEFECTS OF VISION

1. A shortsighted person can read a book clearly at a distance of 10 cm from the eyes. The lenses required to read the book kept at 60cm are :
(1) Convex lenses of focal length 30 cm (2) convex lenses of focal length 30 cm
(3) convex lenses of focal length 12 cm (4) concave lenses of focal length 12 cm

2. A person can't see the objects clearly placed at a distance more than 40 cm. He is advised to use a lens of power -
(1) + 2.5 D (2) – 2.5 D (3) + 0.4 D (4) – 0.4 D

3. A person can see clearly only upto a distance of 25cm. He wants to read a book placed at a distance of 50cm. What kind of lens does he required for his spectacles and what must be its power ?
(1) concave, – 1.0 D (2) Convex, + 1. 5 D
(3) Concave, – 2.0 D (4) Convex, + 2.0 D

4. Astigmatism (for a human eye) can be removed by using

(1) Concave lens (2) Convex lens (3) Cylindrical lens (4) Prismatic lens

5. Circular part in the centre of retina is called
(1) Blind spot (2) Yellow spot (3) Red spot (4) None of the above

6. A person cannot see distinctly at the distance less than one metre. Calculate the power of the lens that he should use to read a book at a distance of 25 cm
(1) +3.0 D (2) +0.125D (3) – 3.0 D (4) + 4.0 D

7. A person who can see things most clearly at a distance of 10 cm, requires spectacles to enable to see clearly thinges at a distance of 30 cm. what should be the focal length of the spectacles ?
(1) 15 cm (concave) (2) 15 cm (convex)
(3) 10 cm (4) 0

8. The power of lens used by a short-sighted person is - 2 D. Find the maximum distance of an object, which he can see without spectacles
(1) 25 cm (2) 50 cm (3) 100 cm (4) 10 cm

SECTION (J) : OPTICAL INSTRUMENT

1. A simple microscope has a focal length of 5 cm. The magnification at the least distance of distinct vision is-
(1) 1 (2) 5 (3) 4 (4) 6

2. In a compound microscope, the intermediate image is -
(1) virtual, erect and magnified (2) real, erect and magnified
(3) real, inverted and magnified (4) virtual, erect and reduced

3. The resolving power of a telescope is more when its objective lens has
(1) greater focal length (2) smaller focal length
(3) greater diameter (4) smaller diameter

4. A Galileo telescope has an objective of focal length 100 cm & magnifying power 50. The distance between the two lenses in normal adjustment will be
(1) 150 cm (2) 100 cm (3) 98 cm (4) 200 cm

5. The convex lens is used in-
(1) Microscope (2) Telescope (3) Projector (4) All of the above

6. The magnifying power of a simple microscope can be increased if an eyepiece of :
(1) shorter focal length is used (2) longer focal length is used
(3) shorter diameter is used (4) longer diameter is used

7. The focal length of the objective of a microscope is
(1) arbitrary (2) less than the focal length of eyepiece
(3) equal to the focal length of eyepiece (4) greater than the focal length of eyepiece

8. Resolving power of a microscope depends upon
(1) the focal length and aperture of the eye lens (2) the focal lengths of the objective and the eye lens
(3) the apertures of the objective and the eye lens (4) the wavelength of light illuminating the object

9. An astronomical telescope has an eyepiece of focal-length 5 cm. If the angular magnification in normal adjustment is 10, when final image is at least distance of distinct vision (25cm) from eye piece, then angular magnification will be :
(1) 10 (2) 12 (3) 50 (4) 60

10. A person with a defective sight is using a lens having a power of +2D. The lens he is using is
(1) concave lens with $f = 0.5$ m (2) convex lens with $f = 2.0$ m
(3) concave lens with $f = 0.2$ m (4) convex lens with $f = 0.5$ m

11. The focal lengths of the objective and eye-lens of a microscope are 1 cm and 5 cm respectively. If the magnifying power for the relaxed eye is 45, then the length of the tube is :
(1) 30 cm (2) 25 cm (3) 15 cm (4) 12 cm

12. In a compound microscope magnification will be large, if the focal length of the eye piece is :
(1) Large (2) Smaller
(3) Equal to that of objective (4) Less than that of objective

13. The focal length of the objective lens of a compound microscope is :
(1) Equal to the focal length of its eye piece (2) Less than the focal length of eye piece
(3) Greater than the focal length of eye piece (4) Any of the above three

14. Microscope is an optical instrument which :
(1) Enlarges the object
(2) Increases the visual angle formed by the object at the eye
(3) Decreases the visual angle formed by the object at the eye
(4) Brings the object nearer

15. For which of the following colour, the magnifying power of a microscope will be maximum :
(1) White colour (2) Red colour (3) Violet colour (4) Yellow colour

16. The length of the compound microscope is 14 cm. The magnifying power for relaxed eye is 25. If the focal length of eye lens is 5 cm, then the object distance for objective lens will be :
(1) 1.8 cm (2) 1.5 cm (3) 2.1 cm (4) 2.4 cm

17. If the focal length of objective and eye lens are 1.2 cm and 3 cm respectively and the object is put 1.25 cm away from the objective lens and the final image is formed at infinity. The magnifying power of the microscope is :
(1) 150 (2) 200 (3) 250 (4) 400

18. When the object is self-luminous, the resolving power of a microscope is given by expression :
(1) $\frac{2\mu\sin\theta}{1.22\lambda}$ (2) $\frac{\mu\sin\theta}{\lambda}$ (3) $\frac{2\mu\cos\theta}{1.22\lambda}$ (4) $\frac{2\mu}{\lambda}$

19. the focal length of objective and eye lens of a stronomical telescope are respectively 2m and 5 cm. Final image is formed at (i) least distance of distinct vision (ii) infinity. The magnifying power in both cases will be:
(1) –48, –40 (2) –40, –48 (3) –40, 48 (4) –48, 40

20. For observing a cricket match, a binocular is preferred to a terrestrial telescope because :
(1) The binocular gives the proper three dimensional view
(2) The binocular has shorter length
(3) The telescope does not give erect image
(4) Telescope have chromatic aberrations

21. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The seperation between the objective and the eye piece is 36 cm and the final image is formed at infinity. The focal length f_0 of the objective and the focal length f_e of the eye piece are :
(1) f_0 = 45 cm and f_e = –9 cm (2) f_0 = 7.2 cm and f_e = 5 cm
(3) f_0 = 50 cm and f_e = 10 cm (4) f_0 = 30 cm and f_e = 6 cm

22. In Gallilean telescope, if the powers of an objective and eye lens are respectively +1.25 D and –20D, then for relaxed vision, the length and magnification will be :
(1) 21.25 cm and 16 (2) 75 cm and 20
(3) 75 cm and 16 (4) 8.5 cm and 21.25

23. An astronomical telescope has two lenses of focal powers 0.5 D and 20D. Then its magnifying power will be :
(1) 8 (2) 20 (3) 30 (4) 40

24. The magnifying power of objective of a compound microscope is 7. If the magnifying power of microscope is 35, the magnifying power of eye lens will be :
(1) 5 (2) 30 (3) 35 (4) 28

25. For a telescope, larger the diameter of the objective lens
(1) greater is the resolving power (2) smaller is the resolving power
(3) greater is the magnifying power (4) smaller is the magnifying power

26. The focal length of the objective and eye-piece of a telescope are respectively 100 cm and 2 cm. The moon substends an angle of 0.5° at the eye. If it is looked through the telescope, the angle subtended by the moon's image will be
(1) 100° (2) 50° (3) 25° (4) 10°

27. Focal lengths of objective & eye piece of a microscope are 4 cm & 8 cm respectively and distance of object from objective lens is 4.5 cm then magnifying power is :
(1) 18 (2) 32 (3) 64 (4) 20

28. When length of tube of microsocpe is increased then magnifying power :-
(1) decreases (2) increases
(3) remains unchanged (4) may decrease or increase

29. Electron microscope is better than optical microscope, because of :
(1) more resolving power (2) Comfortable use
(3) Low purchasing cost (4) observation can be taken fastly

30. For a compound microscope, the focal lengths of object lens and eye lens are f_0 and f_e respectively, then magnification will be done by microscope when
(1) $f_0 = f_e$ (2) $f_0 > f_e$ (3) $f_0 < f_e$ (4) none of these

31. An astronomical telescope has a large aperture to
(1) reduce spherical aberration (2) have high resolution
(3) increase span of observation (4) have low dispersion

32. Wavelength of light used in an optical instrument are λ_1 = 4000 Å and λ_2 = 5000 Å, then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is
(1) 16 : 25 (2) 9 : 1 (3) 4 : 5 (4) 5 : 4

33. The image formed by an objective of a compound microscope is
(1) virtual and diminished (2) real and diminished
(3) real and enlarged (4) virtual and enlarged

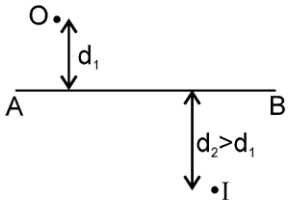
Exercise-2

ONLY ONE OPTION CORRECT TYPE

1 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:
(1) 1.5m (2) 1.0m (3) 0.8m (4) 0.6m

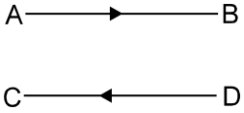
2. A point object is kept in front of a plane mirror. The plane mirror is performing SHM of amplitude 2 cm. The plane mirror moves along the x-axis and x- axis is normal to the mirror. The amplitude of the mirror is such that the object is always infront of the mirror. The amplitude of SHM of the image is
(1) zero (2) 2 cm (3) 4 cm (4) 1 cm

3. In the figure shown, the image of a real object is formed at point I. AB is the principal axis of the mirror. The mirror must be:



(1) concave and placed towards right of I (2) concave and placed towards left of O
(3) convex and placed towards right of I (4) convex and placed towards left of I.

4. AB is an incident beam of light and DC is a reflected beam (the number of reflections for this may be 1 or more than 1) of light. AB & DC are separated by some distance (may be large). It is possible by placing what type of mirror on the right side.



(1) two plane mirror (2) one concave mirror (3) one prism (4) all of the above

5. A point object at 15 cm from a concave mirror of radius of curvature 20 cm is made to oscillate along the principal axis with amplitude 2 mm. The amplitude of its image will be
(1) 2 mm (2) 4 mm (3) 8 mm (4) 16 mm

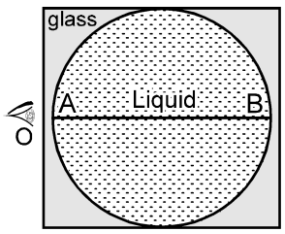
6. The distance between an object and its doubly magnified image by a concave mirror is:
[Assume f = focal length]
(1) 3 f/2
(2) 2 f/3
(3) 3 f
(4) depends on whether the image is real or virtual.

7. A ray of light is incident on a parallel slab of thickness *t* and refractive index *n*. If the angle of incidence θ is small, than the displacement in the incident and emergent ray will be:

(1) $\frac{t\theta\ (n-1)}{n}$ (2) $\frac{t\theta}{n}$ (3) $\frac{t\theta\ n}{n-1}$ (4) none

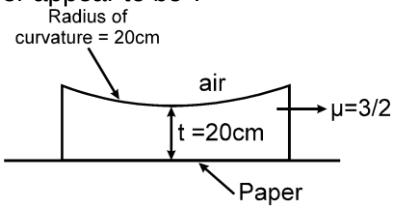
8. A concave spherical surface of radius of curvature 10 cm separates two mediums X and Y of refractive indices 4/3 and 3/2 respectively. Centre of curvature of the surface lies in the medium X. An object is placed in medium X.
(1) Image is always real
(2) Image is real if the object distance is greater than 90 cm.
(3) Image is always virtual
(4) Image is virtual only if the object distance is less than 90 cm.

9. The observer 'O' sees the distance AB as infinitely large. If refractive index of liquid is μ_1 and that of glass is μ_2, then $\frac{\mu_1}{\mu_2}$ is :



(1) 2 (2) 1/2 (3) 4 (4) None of these

10. In the given figure a plano-concave lens is placed on a paper on which a flower is drawn. How far above its actual position does the flower appear to be ?



(1) 10 cm (2) 15 cm (3) 50 cm (4) none of these

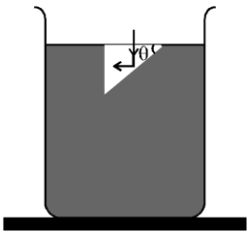
11. The focal lengths of the objective & the eyepiece of a compound microscope are 1 cm & 5 cm respectively. An object placed at a distance of 1.1 cm from the objective has its final image formed at 25 cm from the eye piece. The length of the microscope tube is:
(1) 6.1 cm (2) 49/8 cm (3) 6 cm (4) 91/6 cm

12. A concave mirror of focal length 15 cm forms an image having twice the linear dimension (height) of the object. The position of the object when the image is virtual will be :
(1) 45 cm (2) 30 cm (3) 7.5 cm (4) 22.5 cm

13. Four lenses are made from the same type of glass. The radius of curvature of each face is given below. Which will have the greatest positive power ?
(1) 10 cm convex and 15 cancave (2) 5 cm convex and 10 cm concave
(3) 15 cm convex and plane (4) 20 cm convex and 30 cm concave

14. A prism of refractive index has a refracting angle of 60°.Ar what angle a ray must be incident on it so that it suffers a minimum deviation ?
(1) 45° (2) 60° (3) 90° (4) 180°

15. The refractive index of the material of the prism and liquid are 1.56 and 1.32 respectively. What will be the value of θ for the following refraction ?

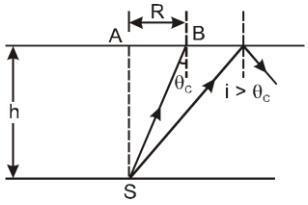


(1) $\sin\theta > \frac{13}{11}$ (2) $\sin\theta > \frac{11}{13}$ (3) $\sin\theta > \frac{\sqrt{3}}{2}$ (4) $\sin\theta > \frac{1}{\sqrt{2}}$

16. In a laboratory four convex lenses L_1, L_2, L_3 and L_4 of focal lengths 2, 4, 6 and 8 cm, respectively are available. Two of these lenses form a telescope of length 10 cm and magnifying power 4. The objective and eye lenses are respectively
(1) L_2, L_3, (2) L_2, L_4 (3) L_1, L_2, (4) L_4, L_1

17. Distance stars are viewed with the help of an astronomical telescope. The angular separation between two stars which can be just resolved by the telescope.
(1) Is independent of the diameter of the aperture of the telescope
(2) increases with the increases in the diameter of the aperture of the telescope
(3) decreases with the increase in the diameter of the telescope aperture
(4) increases quadritically with the diameter of the telescope aperture

18. Refractive index of water is 5/3. A light source is placed in water at a depth of 4 m. Then what must be the minimum radius of disc placed on water surface so that the light of source can be stopped?



(1) 3 m (2) 4 m (3) 5 m (4) ∞

19. **STATEMENT-1 :** The formula connecting u, v and f for a spherical mirror is valid only for mirrors whose sizes are very small compared to their radii of curvature.
because
STATEMENT-2 : Laws of reflection are strictly valid for plane surfaces, but not for large spherical surfaces.
(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True.

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. A boy is trying to start a fire by focusing sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m. What is the diameter of the sun's image on the paper ? **[AIPMT-2008]**
(1) 9.2×10^{-4} m (2) 6.5×10^{-4} m (3) 6.5×10^{-5} m (4) 12.4×10^{-4} m

2. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combination is : **[AIPMT-2008]**
(1) $\sqrt{\frac{f_1}{f_2}}$ (2) $\sqrt{\frac{f_2}{f_1}}$ (3) $\frac{f_1 - f_2}{f_2 f_1}$ (4) $\frac{f_1 + f_2}{f_1 f_2}$

3. A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45º. For which of the following value of μ the ray can undergo total internal reflection? **[AIPMT-2010]**
(1) μ = 1.33 (2) μ = 1.40 (3) μ = 1.50 (4) μ = 1.25

4. A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively **[AIPMT-2010]**
(1) f and $\frac{I}{4}$ (2) $\frac{3f}{4}$ and $\frac{I}{2}$ (3) f and $\frac{3I}{4}$ (4) $\frac{f}{2}$ and $\frac{I}{2}$

5. The speed of light in media M_1 and M_2 are 1.5×10^8 m/s and 2.0×10^8 m/s respectively. A ray of light enters from medium M_1 to M_2 at an incidence angle i. If the ray suffers total internal reflection, the value of i is **[AIPMT-2010 Mains]**
(1) Equal to $\sin^{-1}\left(\frac{2}{3}\right)$ (2) Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$
(3) Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$ (4) Less than $\sin^{-1}\left(\frac{2}{3}\right)$

6. A ray of light is incident on a 60° prism at the minimum deviation position. The angle of refraction at the first face (i.e., incident face) of the prism is **[AIPMT-2010 Mains]**
(1) zero (2) 30° (3) 45° (4) 60°

7. Which of these is not due to total internal reflection? **[AIPMT-2011]**
(1) working of optical fibre
(2) difference between apparent and real depth of pond
(3) mirage on hot summer days
(4) brillance of diamond

8. The dimensions of $(\mu_0\in_0)^{-1/2}$ are : **[AIPMT-2011]**
(1) $[L^{1/2}\ T^{-1/2}]$ (2) $[L^{-1}\ T]$ (3) $[\ L\ T^{-1}]$ (4) $[L^{-1/2}\ T^{1/2}]$

9. A bioconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options describe best the image formed of an object of height 2 cm placed 30 cm from the lens ?(Refractive index of lens material = 1.5) **[AIPMT-2011]**
(1) Virtual, upright, height = 1 cm (2) Virtual, upright, height = 0.5 cm
(3) Real, inverted, height = 4 cm (4) Real, inverted, height = 1cm

10. A thin prism of angle 15º made of glass of refractive index $\mu_1 = 1.5$ is combined with another prism of glass of refractive index $\mu_2 = 1.75$. The combination of the prism produces dispersion without deviation. The angle of the second prism should be: **[AIPMT Mains 2011]**
(1) 7º (2) 10º (3) 12º (4) 5º

11. A conversing beam of rays is incident on a diverging lens. Having passed though the lens the rays intersect at a point 15 cm from the lens on the opposite side. If the lens is removed the point where the rays meets will move 5 cm closer to the lens. The focal length of the lens is : **[AIPMT Mains 2011]**
(1) – 10 cm (2) 20 cm (3) – 30 cm (4) 5 cm

12. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index. **[AIPMT Pre 2012]**
(1) equal to that of glass (2) less then one
(3) greater than that of glass (4) less then that of glass

13. A ray of light is incident at an angle of incidence, i, on one face of prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is μ, the angle of incidence i, is nearly equal to : **[AIPMT_Pre_2012]**
(1) μA (2) (3) A/μ (4) A/2μ

14. A concave mirror of focal length 'f_1' is placed at a distance of 'd' from a convex lens of focal length 'f_2' A beam of light coming from infinity and falling on this convex lens – concave mirror combination returns to infinity. The distance 'd' must equal : **[AIPMT_Pre_2012]**
(1) $f_1 + f_2$ (2) $-f_1 + f_2$ (3) $2f_1 + f_2$ (4) $-2f_1 + f_2$

15. The magnifying power of a telescope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are : **[AIPMT_Pre_2012]**
(1) 10 cm, 10 cm (2) 15 cm, 5 cm (3) 18 cm, 2 cm (4) 11 cm, 9 cm

16. The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are : **[AIPMT_Main_2012]**
(1) $[L^{1/2}T^{-1/2}]$ (2) $[L^{-1}T]$ (3) $[LT^{-1}]$ (4) $[L^{1/2}T^{1/2}]$

17. A plano convex lens fits exactly into a plano concave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is : **[NEET_2013]**

(1) $\frac{R}{2(\mu_1-\mu_2)}$ (2) $\frac{R}{(\mu_1-\mu_2)}$ (3) $\frac{2R}{(\mu_2-\mu_1)}$ (4) $\frac{R}{2(\mu_1+\mu_2)}$

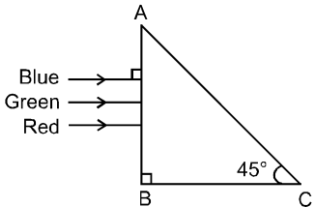
18. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea - eye lens can be estimated to be : **[NEET_2013]**
(1) 2.5 cm (2) 1.67 cm (3) 1.5 cm (4) 5 cm

19. It the focal length of objective lens is increased then magnifying power of : **[AIPMT_2014]**
(1) microscope will increase but that of telescope decrease
(2) microscope and telescope both will increase
(3) microscope and telescope both will decrease
(4) microscope will decrease but that of telescope will increase.

20. The refracting angle of a prism 'A', and refractive index of the material of the prism is cot(A/2). The angle of minimum deviation is : **[AIPMT-2015]**
(1) $180_0 - 2A$ (2) $90_0 - A$ (3) $180_0 + 2A$ (4) $180_0 - 3A$

21. Two identical thin plano-convex glass lenses (refractive index × 1.5) each haveing radius of curvature of 20 cm are placed with their convex surfaces in contact at the center. The intervening space is filled with oil of refractive index 1.7. The focal length of the combination is : **[AIPMT-2015]**
(1) –25 cm (2) –50 cm (3) 50 cm (4) –20 cm

22. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47, respectively. **[AIPMT-2015]**



The prism will:
(1) separate all the three colours from one another
(2) not separate the three colours at all
(3) separate the red colour part from the green and blue colours
(4) separate the blue coloure part from the red and green colours

23. In an astronomical telescope in normal adjustment a straight black line of lenght L is drawn on inside part of objective lens. The eye-piece forms a real image of this line. The length of this image is I. The magnification of the telescope is : **[AIPMT-2015]**
(1) $\frac{L}{I}-1$ (2) $\frac{L+I}{L-I}$ (3) $\frac{L}{I}$ (4) $\frac{L}{I}+1$

24. Match the corresponding entries of column–1 with column–2. [Where m is the magnification produced by the mirror] **[AIPMT_2016]**

	Column–1		**Column–2**
(A)	m = –2	(a)	Convex mirror
(B)	$m = -\frac{1}{2}$	(b)	Concave mirror
(C)	m = +2	(c)	Real image
(D)	$m = +\frac{1}{2}$	(d)	Virtual image

(1) A → c and d; B → b and d; C → b and c; D → a and d
(2) A → b and c; B → b and c; C → b and d; D → a and d
(3) A → a and c; B → a and d; C → a and b; D → c and d
(4) A → a and d; B → b and c; C → b and d; D → b and c

25. A astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance : **[AIPMT_2016]**

(1) 54.0 cm (2) 37.3 cm (3) 46.0 cm (4) 50.0 cm

26. The angle incidence for a ray of light at a refracting surface of a prism is 45º. The angle of prism is 60º. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are **[AIPMT_2016_*XII*]**

(1) 30º; $\frac{1}{\sqrt{2}}$ (2) 45º ; $\frac{1}{\sqrt{2}}$ (3) 30º ; $\sqrt{2}$ (4) 45º ; $\sqrt{2}$

27. A person can see clearly object only when they lie between 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens, the person has to use, will be : **[NEET 2016]**

(1) conves, +0.15 diopter (2) conves, +2.25 diopter
(3) conves, –0.25 diopter (4) conves, –0.2 diopter

28. Two identical glass (μ_g = 3/2) equiconvex lenses of focal length f each are kept in contact. The space between that two lenses in filled with water (μ_w = 4/3). The focal length of the combination is **[NEET 2016]**

(1) $\frac{3f}{4}$ (2) $\frac{f}{3}$ (3) f (4) $\frac{4f}{3}$

29. An air bubble in a glass slab with refractive index 1.5 (near normal incidence) is 5 cm deep when viewed from one surface and 3 cm deep when viewed from the opposite face. The thickness (in cm) of the slab is **[NEET 2016]**

(1) 16 (2) 8 (3) 10 (4) 12

30. A thin prism having refracting angle 10º is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be : **[NEET 2017]**

(1) 4º (2) 6º (3) 8º (4) 10º

31. A beam of light from a souce L is incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back as a spot on a scale placed just above the source L. When the mirror is rotated through a small angle θ, the spot of the light is found to move through a distance y on the scale. The angle θ is given by : **[NEET 2017]**

(1) $\frac{y}{2x}$ (2) $\frac{y}{x}$ (3) $\frac{x}{2y}$ (4) $\frac{x}{y}$

32. An astronomical refracting telescope will have large angular magnification and high angular resolution when it has an objective lens of **[NEET 2018]**

(1) small focal length and large diameter (2) small focal length and small diameter
(3) large focal length and large diameter (4) large focal length and small diameter

33. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30º. On of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace its path (after reflection from the silvered surface) if its angle of incidence on the prism is **[NEET 2018]**

(1) 60º (2) zero (3)30º (4) 45º

34. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be

(1) 30 cm away from the mirror (2) 36 cm towards the mirror
(3) 30 cm towards the mirror (4) 36 cm away from the mirror

35. Pick the wrong answer in the context with rainbow. **[NEET_2019-I]**

(1) Rainbow is combined effect of dispersion, refraction and reflection of sunlight.
(2) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.
(3) The order of colours is reversed in the secondary rainbow.

(4) An observer can see a rainbow when his front is towards the sun.

36. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of medium in contact, what will be angle of refraction? **[NEET_2019-I]**

(1) 90º (2) 180º (3) 0º (4) equal to angle of incidence

37. Two similar thin equi-convex lenses, of focal f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1. When the space between the two lens is filled with glycerin (which has the same refractive index (μ = 1.5) as that of glass) then the equivalent focal length is F_2. The ratio $F_1 : F_2$ will be **[NEET_2019-I]**

(1) 3 : 4 (2) 2 : 1 (3) 1 : 2 (4) 2 : 3

38. An equiconvex lens has power P. It is cut into two symmetrical halves by a plane containing the principal axis. The power of one part will be, **[NEET_2019-II]**

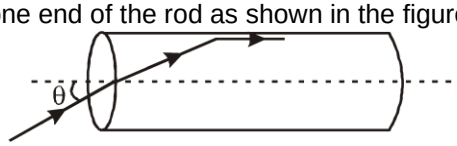
(1) 0 (2) $\frac{P}{2}$ (3) $\frac{P}{4}$ (4) P

39. A double convex lens has focal length 25 cm. The radius of curvature of one of the surfaces is double of the other. Find the radii if the refractive index of the material of the lens is 1.5. **[NEET_2019-II]**

(1) 100 cm, 50 cm (2) 25 cm, 50 cm (3) 18.75 cm, 37.5 cm (4) 50 cm, 100 cm

PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. A transparent solid cylindrical rod has a refractive index of $\frac{2}{\sqrt{3}}$. It is surrounded by air. A light ray is incident at the mid-point of one end of the rod as shown in the figure. **[AIEEE-2009, 4/144]**



The incident angle (θ) for which the light ray grazes along the wall of the rod is:

(1) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (2) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (3) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (4) $\sin^{-1}\left(\frac{1}{2}\right)$

2. A car is fitted with a convex side–view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at a relative speed of 15 m/s. The speed of the image of the second car as seen in the mirror of the first one is : **[AIEEE 2011]**

(1) $\frac{1}{10}$ m/s (2) $\frac{1}{15}$ m/s (3) 10 m/s (4) 15 m/s

3. A beaker contains water up to a height h_1 and kerosene of height h_2 above water so that the total height of (water + kerosene) is ($h_1 + h_2$). Refractive index of water is μ_1 and that of kerosene is μ_2. The apparent shift in the position of the bottom of the beaker when viewed from above is : **[AIEEE 2011]**

(1) $\left(1+\frac{1}{\mu_1}\right) h_1 - \left(1+\frac{1}{\mu_2}\right) h_2$ (2) $\left(1-\frac{1}{\mu_1}\right) h_1 + \left(1-\frac{1}{\mu_2}\right) h_2$

(3) $\left(1+\frac{1}{\mu_1}\right) h_2 - \left(1+\frac{1}{\mu_2}\right) h_1$ (4) $\left(1-\frac{1}{\mu_1}\right) h_2 + \left(1-\frac{1}{\mu_2}\right) h_1$

4. When monochromatic red light is used instead of blue light in a convex lens, its focal length will : **[AIEEE 2011]**

(1) increase (2) decrease
(3) remain same (4) does not depend on colour of light

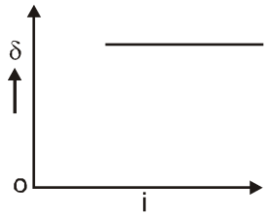
5. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object shifted to be in sharp focus on film ? **[AIEEE 2012]**

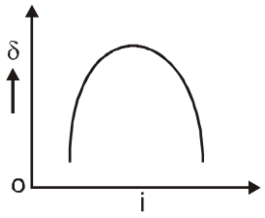
(1) 7.2 m (2) 2.4 m (3) 3.2 m (4) 5.6 m

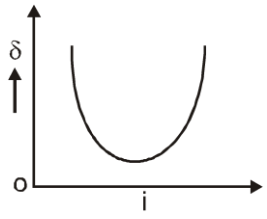
6. Diameter of a plano - convex lens is 6 cm and thickness at the centre is 3 mm. If speed of light in material of lens is $2 \times 10_8$ m/s, the focal length of the lens is : **[JEE-Main_2013]**

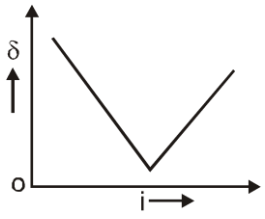
(1) 15 cm (2) 20 cm (3) 30 cm (4) 10 cm

7. The graph between angle of deviation (δ) and angle of incidence (i) for a triangular prism is represented by : **[JEE-Main_2013]**

(1) 

(2) 

(3) 

(4) 

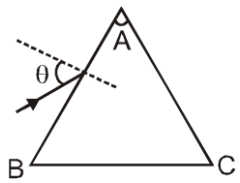
8. A thin convex lens made from crown glass $\left(\mu = \frac{3}{2}\right)$ has focal length f. When it is measured in two different liquids having refractive indices $\frac{4}{3}$ and $\frac{5}{3}$, it has the focal lengths f_1 and f_2 respectively. The correct relation between the focal length is : **[JEE-Mains 2014]**

(1) $f_1 = f_2 < f$ (2) $f_1 > f$ and f_2 becomes negative
(3) $f_2 > f$ and f_1 becomes negative (4) f_1 and f_2 both become negative

9. A green light is incident from the water to the air - water interface at the critical angle (θ). Select the correct statement. **[JEE-Mains 2014]**

(1) The entire spectrum of visible light will come out of the water at an angle of 90º to the normal.
(2) The spectrum of visible light whose frequency is less than that of green light will come out ot the air medium.
(3) The spectrum of visible light whose frequency is more than that of green light will come out to the air medium.
(4) The entire spectrum of visible light will come out of the water at various angles to the normal.

10. Monochromatic light is incident on a glass prism of angle A. If the refractive index of the material of the prism is μ, a ray, incident at an angle θ, on the face AB would get transmitted through the face AC of the prism provided: **[JEE(Main)-2015; 4/120, –1]**



(1) $\theta > \sin^{-1}\left[\mu\sin\left(A-\sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$ (2) $\theta < \sin^{-1}\left[\mu\sin\left(A-\sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

(3) $\theta > \cos^{-1}\left[\mu\sin\left(A+\sin\left(\frac{1}{\mu}\right)\right)\right]$ (4) $\theta < \cos^{-1}\left[\mu\sin\left(A+\sin\left(\frac{1}{\mu}\right)\right)\right]$

11. An observer looks at a distant tree of height 10 m with a telescope of magnifying power of 20. To the observer the tree appears: **[JEE(Main)-2016; 4/120, –1]**

(1) 10 times nearer (2) 20 times taller

(3) 20 times nearer (4) 10 times taller

12. In an experiment for determination of refractive index of glass of a prism by i – δ, plot, it was found that a ray incident at angle 35º, suffers a deviation of 40º and that it emerges at angle 79º. In that case which of the following is closest to the maximum possible value of the refractive index?

[JEE(Main)-2016]

(1) 1.6 (2) 1.7 (3) 1.8 (4) 1.5

13. A diverging lens with magnitude of focal length 25cm is placed at a distance of 15 cm from a converging lens of magnitude of focal length 20 cm. A beam of parallel light falls on the diverging lens. The final image formed is : **[JEE Main 2017]**

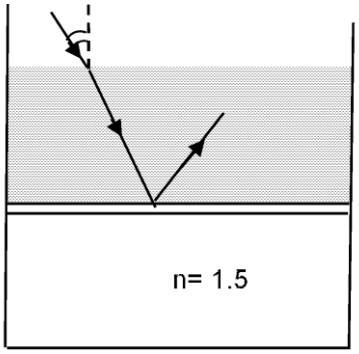
(1) real and at a distance of 6 cm from the convergent lens

(2) real and at a distance of 40 cm from convergent lens.

(3) virtual and at a distance of 40 cm from convergent lens

(4) real and at distance of 40 cm from the divergent lens.

14. Consider a tank made of glass (refractive index 1.5) with a thick bottom. It is filled with a liquid of refractive index μ. A student finds that, irrespective of what the incident angle i (see figure) is for a beam of light entering the liquid, the light reflected from the liquid glass interface is never completely polarized. For this to happen, the minimum value of μ is : **[JEE Main 2019]**



(1) $\frac{5}{\sqrt{3}}$ (2) $\frac{4}{3}$ (3) $\frac{3}{\sqrt{5}}$ (4) $\sqrt{\frac{5}{3}}$

15. A convex lens is put 10 cm from a light source and it makes a sharp image on a screen, kept 10 cm from the lens. Now a glass block (refractive index 1.5) of 1.5 cm thickness is placed in contact with the light source. To get the sharp image again,, the screen is shifted by a distance d. Then d is :

[JEE Main 2019]

(1) 1.1 cm away from the lens (2) 0.55 cm away from the lens

(3) 0.55 cm towards the lens (4) 0

16. Two plane mirrors are inclined to each other such that a ray of light incident on the first mirror (M_1) and parallel to the second mirror (M_2) is finally reflected from the second mirror (M_2) parallel to the first mirror (M_1). The angle between the two mirrors will be : **[JEE Main 2019]**

(1) 75º (2) 90º (3) 45º (4) 60º

17. A plano convex lens of refractive index μ_1 and focal length f_1 is kept in contact with another plano concave lens of refractive index μ_2 and focal length f_2. If the radius of curvature of their spherical faces is R each and $f_1 = 2f_2$, then μ_1 and μ_2 are related as : **[JEE Main 2019]**

(1) $2\mu_1 - \mu_2 = 1$ (2) $\mu_1 + \mu_2 = 3$ (3) $3\mu_2 - 2\mu_1 = 1$ (4) $2\mu_2 - \mu_1 = 1$

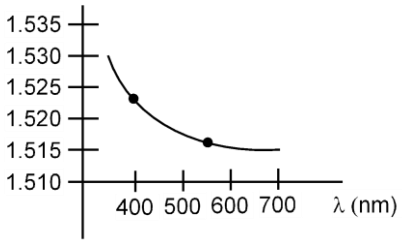
18. The eye can be regarded as a single refracting surface. The radius of curvature of this surface is equal to that of cornea (7.8 mm). This surface separates two media of refractive indices 1 and 1.34. Calculate the distance from the refracting surface at which a parallel beam of light will come to focus:

[JEE Main 2019]

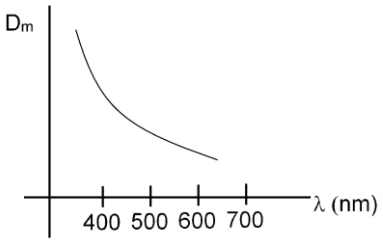
(1) 4.0 cm (2) 2 cm (3) 1 cm (4) 3.1 cm

19. The variation of refractive index of a crown glass thin prism with wavelength of the incident light is shown. Which of the following graphs is the correct one, if D_m is the angle of minimum deviation ?

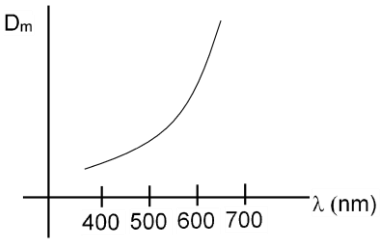
[JEE Main 2019]



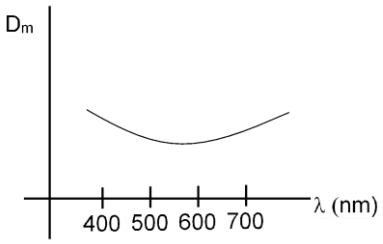
(1)



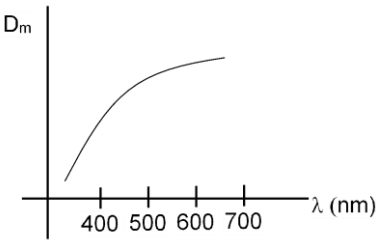
(2)



(3)



(4)



20. An object is at a distance of 20 m from a convex lens of focal length 0.3 m. The lens forms an image of the object. If the object moves away from the lens at a speed of 5 m/s, the speed and direction of the image will be : **[JEE Main 2019]**

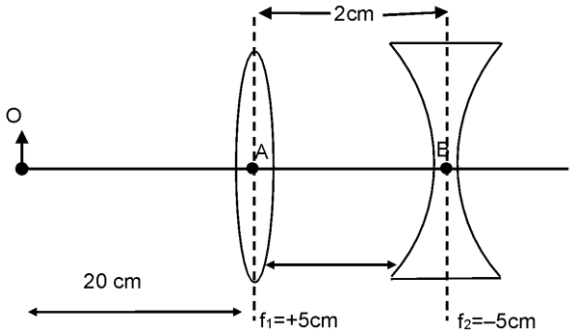
(1) 0.92×10^{-3} m/s away from the lens (2) 3.22×10^{-3} m/s towards the lens
(3) 1.16×10^{-3} m/s towards the lens (4) 2.26×10^{-3} m/s away from the lens

21. A monochromatic light is incident at a certain angle on an equilateral triangular prism and suffers minimum deviation. If the refractive index of the material of the prism is $\sqrt{3}$, then the angle of incidence is :

[JEE Main 2019]

(1) 30º (2) 90° (3) 60° (4) 45°

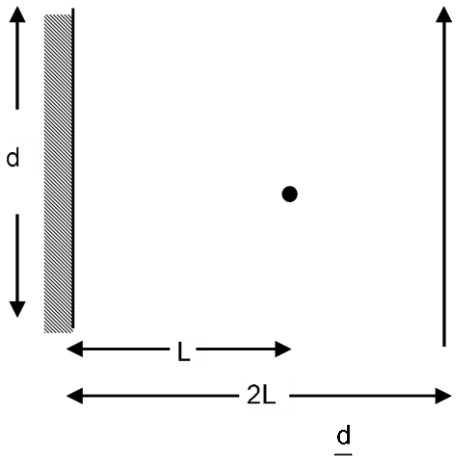
22. What is the position and nature of image formed by lens combination shown in figure ? (f_1, f_2 are focal lengths) **[JEE Main 2019]**



(1) 70 cm from point B at left ; virtual (2) 70 cm from point B at right ; real

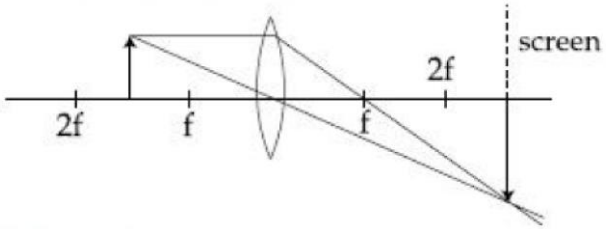
(3) 40 cm from point B at right; real (4) $\frac{20}{3}$ cm from point B at right, real

23. A point source of light S is placed at a distance L in front of the centre of plane mirror of width d which is hanging vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror, at a distance 2L as shown below. The distance over which the man can see the image of the light source in the mirror is : **[JEE Main 2019]**



(1) d (2) 3d (3) $\frac{d}{2}$ (4) 2d

24. Formation of real image using a biconvex lens is shown below : **[JEE Main 2019]**



(1) Erect real image (2) No change (3) Image disappears (4) Magnified image

25. A plano-convex lens (focal length f_2, refractive index μ_2, radius of curvature R) fits exactly into a plano-concave lens (focal length f_1, refractive index μ_1, radius of curvature R). Their plane surfaces are parallel to each other. Then, the focal length of the combination will be : **[JEE Main 2019]**

(1) $\frac{R}{\mu_2 - \mu_1}$ (2) $f_1 - f_2$ (3) $\frac{2f_1f_2}{f_1 + f_2}$ (4) $f_1 + f_2$

Answers

EXERCISE - 1

SECTION (A)

1.	(1)	**2.**	(4)	**3.**	(2)	**4.**	(2)	**5.**	(2)	**6.**	(1)	**7.**	(2)
8.	(4)	**9.**	(2)	**10.**	(2)	**11.**	(2)	**12.**	(2)	**13.**	(4)	**14.**	(3)
15.	(3)	**16.**	(2)	**17.**	(1)	**18.**	(2)	**19.**	(4)				

SECTION (B) :

1.	(3)	**2.**	(2)	**3.**	(3)	**4.**	(4)	**5.**	(3)	**6.**	(3)	**7.**	(1)
8.	(1)	**9.**	(4)	**10.**	(3)	**11.**	(2)	**12.**	(1)	**13.**	(2)	**14.**	(3)
15.	(3)	**16.**	(3)	**17.**	(3)	**18.**	(2)						

SECTION (C) :

1.	(4)	**2.**	(1)	**3.**	(3)	**4.**	(2)	**5.**	(3)	**6.**	(3)	**7.**	(2)
8.	(1)	**9.**	(2)	**10.**	(4)	**11.**	(1)	**12.**	(4)	**13.**	(1)	**14.**	(1)
15.	(3)	**16.**	(1)	**17.**	(3)	**18.**	(3)	**19.**	(2)	**20.**	(3)	**21.**	(4)
22.	(4)	**23.**	(3)	**24.**	(1)	**25.**	(3)	**26.**	(1)	**27.**	(4)	**28.**	(4)
29.	(4)	**30.**	(3)	**31.**	(4)	**32.**	(2)	**33.**	(3)	**34.**	(1)	**35.**	(1)
36.	(4)	**37.**	(3)	**38.**	(2)	**39.**	(1)	**40.**	(2)	**41.**	(3)	**42.**	(2)
43.	(3)	**44.**	(2)	**45.**	(4)	**46.**	(2)	**47.**	(2)	**48.**	(4)	**49.**	(2)

SECTION (D) :

1.	(1)	**2.**	(1)	**3.**	(2)	**4.**	(3)	**5.**	(2)	**6.**	(3)	**7.**	(2)
8.	(2)	**9.**	(4)	**10.**	(2)	**11.**	(1)	**12.**	(3)	**13.**	(1)	**14.**	(1)
15.	(3)	**16.**	(3)	**17.**	(2)	**18.**	(1)	**19.**	(2)	**20.**	(1)	**21.**	(2)
22.	(1)	**23.**	(3)	**24.**	(2)								

SECTION (E) :

1.	(2)	**2.**	(2)	**3.**	(1)	**4.**	(1)

SECTION (F) :

1.	(2)	**2.**	(4)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(3)	**7.**	(3)
8.	(4)	**9.**	(1)	**10.**	(2)	**11.**	(3)	**12.**	(1)	**13.**	(4)	**14.**	(3)
15.	(4)	**16.**	(3)	**17.**	(2)	**18.**	(3)	**19.**	(1)	**20.**	(1)	**21.**	(3)
22.	(3)	**23.**	(1)	**24.**	(4)	**25.**	(1)	**26.**	(3)	**27.**	(4)	**28.**	(2)
29.	(3)	**30.**	(4)	**31.**	(1)	**32.**	(2)	**33.**	(4)	**34.**	(2)	**35.**	(3)
36.	(4)	**37.**	(2)	**38.**	(1)	**39.**	(4)	**40.**	(3)	**41.**	(2)	**42.**	(1)

SECTION (G) :

1.	(4)	**2.**	(1)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(3)
8.	(3)	**9.**	(1)	**10.**	(3)	**11.**	(2)	**12.**	(3)	**13.**	(2)	**14.**	(4)
15.	(1)	**16.**	(2)	**17.**	(2)								

SECTION (H) :

1.	(1)	**2.**	(1)	**3.**	(1)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(2)	**10.**	(4)	**11.**	(4)	**12.**	(3)	**13.**	(4)	**14.**	(1)
15.	(3)	**16.**	(2)	**17.**	(4)	**18.**	(1)	**19.**	(4)	**20.**	(3)	**21.**	(1)
22.	(2)	**23.**	(2)	**24.**	(3)	**25.**	(2)						

SECTION (I) :

1.	(4)	**2.**	(2)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(1)	**7.**	(1)
8.	(2)												

SECTION (J) :

1.	(4)	**2.**	(3)	**3.**	(3)	**4.**	(3)	**5.**	(4)	**6.**	(1)	**7.**	(2)
8.	(4)	**9.**	(2)	**10.**	(4)	**11.**	(3)	**12.**	(2)	**13.**	(2)	**14.**	(2)
15.	(3)	**16.**	(1)	**17.**	(2)	**18.**	(1)	**19.**	(1)	**20.**	(1)	**21.**	(4)
22.	(3)	**23.**	(4)	**24.**	(1)	**25.**	(1)	**26.**	(3)	**27.**	(2)	**28.**	(1)

29.	(1)	**30.**	(3)	**31.**	(2)	**32.**	(4)	**33.**	(3)				

EXERCISE - 2

1	(4)	**2.**	(3)	**3.**	(2)	**4.**	(4)	**5.**	(3)	**6.**	(1)	**7.**	(1)
8.	(3)	**9.**	(1)	**10.**	(1)	**11.**	(4)	**12.**	(3)	**13.**	(2)	**14.**	(1)
15.	(2)	**16.**	(4)	**17.**	(3)	**18.**	(1)	**19.**	(3)				

EXERCISE - 3

PART-I

1.	(1)	**2.**	(4)	**3.**	(3)	**4.**	(3)	**5.**	(3)	**6.**	(2)	**7.**	(2)
8.	(3)	**9.**	(3)	**10.**	(2)	**11.**	(3)	**12.**	(1)	**13.**	(1)	**14.**	(3)
15.	(3)	**16.**	(3)	**17.**	(2)	**18.**	(2)	**19.**	(4)	**20.**	(1)	**21.**	(2)
22.	(3)	**23.**	(3)	**24.**	(2)	**25.**	(1)	**26.**	(3)	**27.**	(3)	**28.**	(1)
29.	(4)	**30.**	(2)	**31.**	(1)	**32.**	(3)	**33.**	(4)	**34.**	(4)	**35.**	(4)
36.	(1)	**37.**	(3)	**38.**	(4)	**39.**	(3)						

PART-II

1.	(3)	**2.**	(2)	**3.**	(2)	**4.**	(1)

5. (4)

Initially the object distance is 240 cm and the image distance is 12 cm so

$$\frac{1}{f}=\frac{1}{12}+\frac{1}{240}=\frac{20+1}{240} \Rightarrow f=\frac{240}{21}\text{m}$$

due to the slab, the shifting of the image will be:

shift = $1\left(1-\frac{2}{3}\right)=\frac{1}{3}$

Now v′ = $12-\frac{1}{3}=\frac{35}{3}$ cm

$$\therefore \frac{21}{240}=\frac{3}{35}-\frac{1}{u}$$

$$\frac{1}{u}=\frac{3}{35}-\frac{21}{240}=\frac{1}{5}\left(\frac{3}{7}-\frac{21}{48}\right)$$

$$\frac{5}{u}=\left|\frac{144-147}{48\times 7}\right|$$

u = 560 cm = 5.6 m

6.	(3)	**7.**	(3)	**8.**	(2)	**9.**	(2)	**10.**	(1)	**11.**	(3)	**12.**	(4)
13.	(2)	**14.**	(3)	**15.**	(2)	**16.**	(4)	**17.**	(1)	**18.**	(4)	**19.**	(1)
20.	(3)	**21.**	(3)	**22.**	(2)	**23.**	(2)	**24.**	(3)	**25.**	(1)		