28. Ray Optics – Multiple Choice Questions

1. Plane Mirror

1. A plane mirror reflecting a ray of incident light is rotated through an angle θ about an axis through the point of incidence in the plane of the mirror perpendicular to the plane of incidence, then

(a) The reflected ray does not rotate

(b) The reflected ray rotates through an angle θ

(c) The reflected ray rotates through an angle 2θ

(d) The incident ray is fixed

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

(a) 180 cm (b) 90cm

(c) 85 cm (d) 170 cm

3. A plane mirror produces a magnification of

(a) –1 (b) +1

(c) Zero (d) Between 0 and $+\infty$

4. A small object is placed 10 *cm* infront of a plane mirror. If you stand behind the object 30 *cm* from the mirror and look at its image, the distance focused for your eye will be

(a) 60 *cm* (b) 20 *cm*

(c) 40 *cm* (d) 80 *cm*

5. What should be the angle between two plane mirrors so that whatever be the angle of incidence, the incident ray and the reflected ray from the two mirrors be parallel to each other

(a) 60^0 (b) 90^0

(c) 120^0 (d) 175^0

6. A ray is reflected in turn by three plane mirrors mutually at right angles to each other. The angle between the incident and the reflected rays is

(a) 90^0 (b) 60^0

(c) 180^0 (d) None of these

7. Two mirrors at an angle θ produce 5 images of a point. The number of images produced when θ is decreased to $30°$ is

(a) 9 (b) 10

(c) 11 (d) 12

8. A man runs towards a mirror at a speed 15 *m/s* The speed of the image relative to the man is

(a) 15 ms^{-1} (b) 30 ms^{-1}

(c) 35 ms^{-1} (d) 20 ms^{-1}

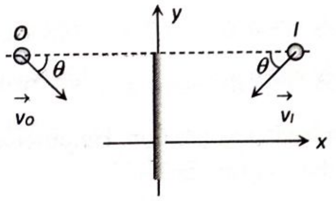
9. If an object moves towards a plane mirror with a speed υ at an angle θ to the perpendicular to the plane of the mirror, find the relative velocity between the object and the image

(a) υ

(b) 2υ

(c) $2v\cos\theta$

(d) $2v\sin\theta$

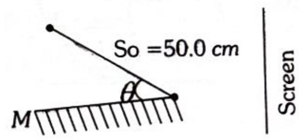


10. A small plane mirror placed at the centre of a spherical screen of radius R. A beam of light is falling on the mirror. If the mirror makes n revolution per second, the speed of light on the screen after reflection from the mirror will be

(a) $4\pi nR$ (b) $2\pi nR$

(c) $\frac{nR}{2\pi}$ (d) $\frac{nR}{4\pi}$

11. A monochromatic light source s of wavelength 440 nm is placed slightly above a plane mirror M as shown. Image of s in M can be used as a virtual source to produce interference fringes on the screen. The distance of sources s from o is 20.0 cm and the distance of screen from o is 100.0 cm (figure is not to scale). If the angle $\theta = 0.50 \times 10^{-3}$ radius, the width of the interference fringes observed on the screen is



(a) 2.20 mm (b) 2.64 mm

(c) 1.10 mm (d) 0.55

2. Spherical Mirror

1. A concave mirror of focal length f (in air) is immersed in water ($\mu = 4/3$). The focal length of the mirror in water will be

(a) f (b) $\frac{4}{3}f$

(c) $\frac{3}{4}f$ (d) $\frac{7}{3}f$

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

(a) $(n-1)f$ (b) $\left(\frac{n-1}{n}\right)f$

(c) $\left(\frac{n+1}{n}\right)f$ (d) $(n+1)f$

3. A point object is placed at a distance of 30 *cm* from a convex mirror of focal length 30*cm*. The image will form at

(a) Infinity (b) Focus

(c) Pole (d) 15 *cm* behind the mirror

4. Under which of the following conditions will a convex mirror of focal length f produce an image that is erect, diminished and virtual

(a) Only when $2f > u > f$ (b) Only when $u = f$

(c) Only when $u < f$ (d) Always

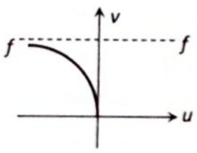
5. A man having height 6 *m*. He observes image of 2 *m* height erect, then mirror used is

(a) Concave (b) Convex

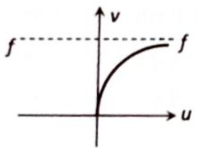
(c) Plane (d) None of these

6. The graph between u and v for a convex mirror is

(a)



(b)



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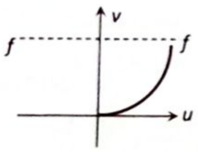

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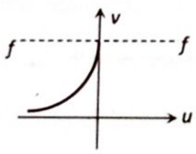


7. A 2.0 cm tall object is placed 15 cm in front of a concave mirror of focal length 10 cm. What is the size and nature of the image

(a) 4 cm, real (b) 4 cm, virtual

(c) 1.0 cm, real (d) None of these

8. An object is kept at a distance of 60 *cm* from a concave mirror. For getting a magnification of $\frac{1}{2}$, focal length of the concave mirror required is

(a) 20 *cm* (b) 40 *cm*

(c) –20 *cm* (d) 30 *cm*

(e) 10 *cm*

9. An object of length 6 *cm* is placed on the principal axis of a concave mirror of focal length f at a distance of $4f$. The length of the image will be

(a) 2 *cm* (b) 12 *cm*

(c) 4 *cm* (d) 1.2 *cm*

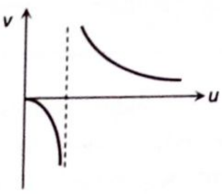
10. A virtual image larger than the object can be obtained by

(a) Concave mirror (b) Convex mirror

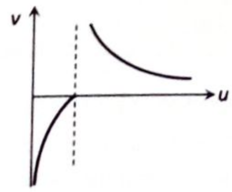
(c) Plane mirror (d) Concave lens

11. As the position of an object (u) reflected from a concave mirror is varied, the position of the image (v) also varies. By letting the u changes from 0 to $+\infty$ the graph between v versus u will be

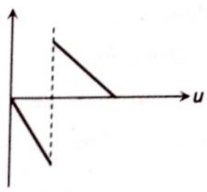
(a)



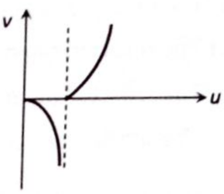
(b)



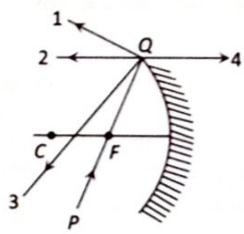
(c)



(d)



12. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (figure). Which of the four rays correctly shows the direction of reflected ray



(a) 1 (b) 2

(c) 3 (d) 4

13. A square wire of side 1*cm* is placed perpendicular to the principal axis of a concave mirror of focal length 15*cm* at a distance of 20 *cm*. The area enclosed by the image of the wire is

(a) $4\ cm^2$ (b) $6 cm^2$

(c) $2 cm^2$ (d) $8 cm^2$

(e) $9 cm^2$

14. In a concave mirror experiment, an object is placed at a distance x_1 from the focus and the image is formed at a distance x_2 from the focus. The focal length of the mirror would be

(a) $x_1 x_2$ (b) $\sqrt{x_1 x_2}$

(c) $\frac{x_1 + x_2}{2}$ (d) $\sqrt{\frac{x_1}{x_2}}$

15. If the lower half of a concave mirror's reflecting surface is made opaque, which of the following statements describe the image of an object placed infront of the mirror

S1 : Intensity of the image will increase

S2 : The image will show only half of the object

S3 : No change in the image

S4 : Intensity of the image will be reduced to half

(a) S1 only (b) S2 only

(c) S2 and S3 (d) S4 only

16. A person wants a real image of his own, 3 times enlarged. Where should he stand infront of a concave mirror of radius of curvature 30 *cm*

(a) 30 *cm* (b) 20 *cm*

(c) 10 *cm* (d) 90 *cm*

17. A concave mirror of radius of curvature R has a circular outline of radius r. A circular disk is to be placed normal to the axis at the focus so that it collects all the light that is reflected from the mirror from a beam parallel to the axis. For $r << R$, the area of this disc has to be at least

(a) $\frac{\pi r^6}{4R^4}$ (b) $\frac{\pi r^6}{4R^2}$

(c) $\frac{\pi r^5}{4R^3}$ (d) $\frac{\pi r^4}{R^2}$

18. An object moving at a speed of $5 m/s$ towards a concave mirror of focal length $f = 1 m$ is at a distance of $9 m$. The average speed of the image is

(a) $\frac{1}{5} m/s$ (b) $\frac{1}{10} m/s$

(c) $\frac{5}{9} m/s$ (d) $\frac{2}{5} m/s$

19. A car is moving with at a constant speed of $60 km h^{-1}$ on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of $100 m$ and is approaching with a speed of $5 km h^{-1}$.

In order to keep track of the car in the rear, the driver begins to glance alternatively at the rear and side mirror of his car after every 2s till the other car overtakes. If the two cars were maintaining their speeds, which of the following statement (s) is / are correct

(a) The speed of the car in the rear is $65 km h^{-1}$

(b) In the side mirror, the car in the rear would appear to approach with a speed of $5 km h^{-1}$ to the driver of the leading car

(c) In the rear view mirror, the speed of the approaching car would appear to decrease as the distance between the cars decreases

(d) In the side mirror, the speed of the approaching car would appear to increase as the distance between the cars decreases

3. Refraction of Light at Plane Surfaces

1. When light travels from one medium to the other of which the refractive index is different, then which of the following will change

(a) Frequency, wavelength and velocity

(b) Frequency and wavelength

(c) Frequency and velocity

(d) Wavelength and velocity

2. When a light wave goes from air into water, the quality that remains unchanged is its

(a) Speed (b) Amplitude

(c) Frequency (d) Wavelength

3. The refractive indices of glass and water *w.r.t.* air are 3/2 and 4/3 respectively. The refractive index of glass *w.r.t.* water will be

(a) 8/9 (b) 9/8

(c) 7/6 (d) None of these

4. Monochromatic light of wavelength 589 *nm* is incident from air on a water surface. The refractive index of water is 1.33. The wavelength of the refracted light is

(a) 589 *nm* (b) 443 *nm*

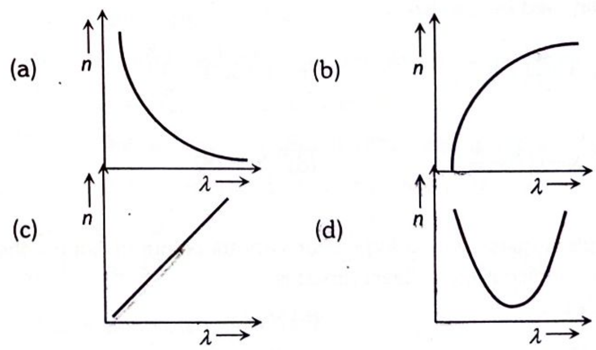
(c) 333 *nm* (d) 221 *nm*

5. The wavelength of sodium light in air is 5890 Å. The velocity of light in air is $3 \times 10^8 ms^{-1}$. The wavelength of light in a glass of refractive index 1.6 would be close to

(a) 5890 Å (b) 3681 Å

(c) 9424 Å (d) 15078 Å

6. Which of the following graphs show appropriate variation of refractive index μ with wavelength λ



7. On a glass plate a light wave is incident at an angle of 60°. If the reflected and the refracted waves are mutually perpendicular, the refractive index of material is

(a) $\frac{\sqrt{3}}{2}$ (b) $\sqrt{3}$

(c) $\frac{3}{2}$ (d) $\frac{1}{\sqrt{3}}$

8. The angles of incidence and refraction of a monochromatic ray of light of wavelength λ at an air glass interface are i and r, respectively. A parallel beam of light with a small spread $\delta\lambda$ in wavelength about a mean wavelength λ is refracted at the same air glass interface. The refracted index μ of glass depends on the wavelength λ as $\mu(\lambda) = a + b/\lambda^2$ where a and b are constant. Then the angular spread in the angle of refraction of the beam is

(a) $\left|\frac{\sin i}{\lambda^3 \cos r}\delta\lambda\right|$ (b) $\left|\frac{2b}{\lambda^3}\delta\lambda\right|$

(c) $\left|\frac{2b\tan r}{a\lambda^3 + b\lambda}\delta\lambda\right|$ (d) $\left|\frac{2b(a+b/\lambda^2)\sin i}{\lambda^3}\delta\lambda\right|$

9. Each quarter of a vessel of depth H is filled with liquids of the refractive indices n_1, n_2, n_3 and n_4 from the bottom respectively. The apparent depth of the vessel when looked normally is

(a) $\frac{H(n_1+n_2+n_3+n_4)}{4}$ (b) $\frac{H\left(\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}+\frac{1}{n_4}\right)}{4}$

(c) $\frac{(n_1+n_2+n_3+n_4)}{4H}$ (d) $\frac{H\left(\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}+\frac{1}{n_4}\right)}{2}$

10. A glass slab of thickness 3 *cm* and refractive index 3/2 is placed on ink mark on a piece of paper. For a person looking at the mark at a distance 5.0 *cm* above it, the distance of the mark will appear to be

(a) 3.0 *cm* (b) 4.0 *cm*

(c) 4.5 *cm* (d) 5.0 *cm*

11. A fish in water (refractive index n) looks at a bird vertically above in the air. If y is the height of the bird and x is the depth of the fish from the surface, then the distance of the bird as estimated by the fish is

(a) $x + y\left(1+\frac{1}{n}\right)$ (b) $y + x\left(1-\frac{1}{n}\right)$

(c) $x + y\left(1-\frac{1}{n}\right)$ (d) $x + ny$

12. A plane glass slab is kept over various coloured letters, the letter which appears least raised is

(a) Blue (b) Violet

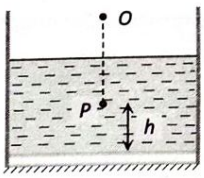
(c) Green (d) Red

13. An under water swimmer is at a depth of 12 *m* below the surface of water. A bird is at a height of 18 *m* from the surface of water, directly above his eyes. For the swimmer the bird appears to be at a distance from the surface of water equal to (Refractive Index of water is $\frac{4}{3}$)

(a) 24 *m* (b) 12 *m*

(c) 18 *m* (d) 9 *m*

14. A plane mirror is placed at the bottom of the tank containing a liquid of refractive index n. P is a small object at a height h above the mirror. An observer O-vertically above P outside the liquid see P and its image in the mirror. The apparent distance between these two will be



(a) 2nh

(b) $\frac{2h}{n}$

(c) $\frac{2h}{n-1}$

(d) $h\left(1+\frac{1}{n}\right)$

15. A microscope is focussed on a coin lying at the bottom of a beaker. The microscope is now raised up by 1 *cm*. To what depth should the water be poured into the beaker so that coin is again in focus (Refractive index of water is $\frac{4}{3}$)

(a) 1 *cm* (b) $\frac{4}{3}$ *cm*

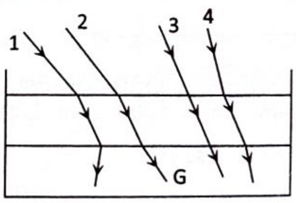
(c) 3 *cm* (d) 4 *cm*

16. A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first colour to emerge is

(a) Blue (b) Green

(c) Violet (d) Red

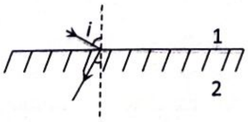
17. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in figure, the path shown is correct



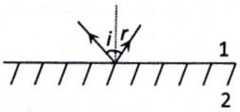
(a) 1 (b) 2

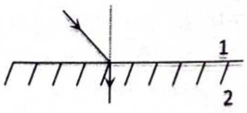
(c) 3 (d) 4

18. There are certain material developed in laboratories which have a negative refractive index figure. A ray incident from air (Medium 1) into such a medium (Medium 2) shall follow a path given by

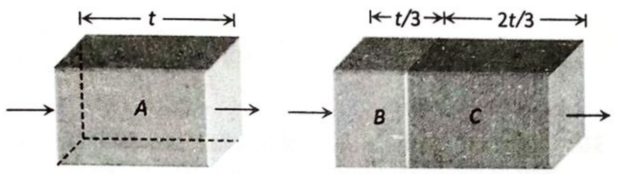
(a) 

(b) 

(c) 

(d) 

19. Two transparent slabs have the same thickness as shown. One is made of material A of refractive index 1.5. The other is made of two materials B and C with thickness in the ratio 1 : 2. The refractive index of C is 1.6. If a monochromatic parallel beam passing through the slabs has the same number of waves inside both, the refractive index of B is



(a) 1.1 (b) 1.2

(c) 1.3 (d) 1.4

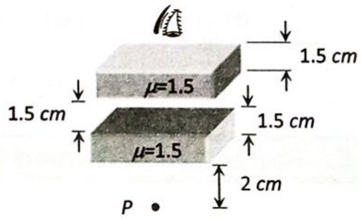
20. The image of point P when viewed from top of the slabs will be

(a) 2.0 cm above P

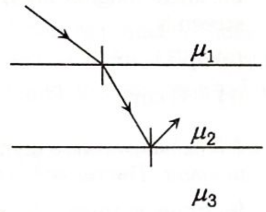
(b) 1.5 cm above P

(c) 2.0 cm below P

(d) 1 cm above P



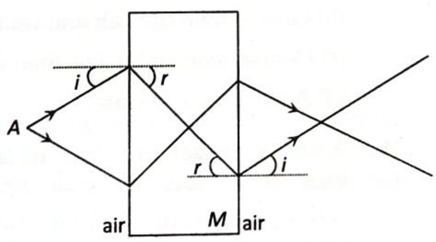
21. Three transparent media of refractive indices μ_1, μ_2 and μ_3 respectively, are stacked as shown, A ray of light follows the path shown. No light enters the third medium. Then



(a) $\mu_1 < \mu_2 < \mu_3$ (b) $\mu_2 < \mu_1 < \mu_3$

(c) $\mu_1 < \mu_3 < \mu_2$ (d) $\mu_3 < \mu_1 < \mu_2$

22. Electromagnetic waves emanating from a point A (in air) are incident on a rectangular block of material M and emerge from the other side as shown. The angles i and r are angles of incidence and refraction when the wave travels from air to the medium. Such paths for the rays are possible



(a) If the material has a refractive index very nearly equal to zero

(b) Only with gamma rays with a wavelength smaller than atomic nuclei of the material

(c) If the material has a refractive index less than zero

(d) Only if the wave travels in M with a speed faster than the speed of light in vacuum

23. The ratio of thickness of plates of two transparent mediums A and B is 6 : 4. If light takes equal time in passing through them, then refractive index of B with respect to A will be

(a) 1.4 (b) 1.5

(c) 1.75 (d) 1.33

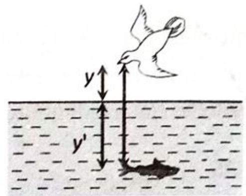
24. A fish rising vertically up towards the surface of water with speed 3 ms^{-1} observes a bird diving vertically down towards it with speed 9 ms^{-1}. The actual velocity of bird is

(a) 4.5 ms^{-1}

(b) 5. ms^{-1}

(c) 3.0 ms^{-1}

(d) 3.4 ms^{-1}



25. A light is travelling from air into a medium. Velocity of light in a medium is reduced to 0.75 times the velocity in air. Assume that angle of incidence 'i' is very small, the deviation of the ray is

(a) i (b) $\frac{i}{3}$

(c) $\frac{i}{4}$ (d) $\frac{3i}{4}$

4. Total Internal Reflection

1. Pick out the correct statements about optical fibres from the following

S1 : Optical fibres are used for the transmission of optical signals only.

S2 : Optical fibres are used for transmitting and receiving electrical signals

S3 : The intensity of light signals sent through optical fibres suffer very small loss

S4 : Optical fibres effectively employ the principle of multiple total internal reflections

S5 : Optical fibres are glass fibres coated with a thin layer of a material with lower refractive index

(a) S1 and S2 (b) S2 and S3

(c) S3 and S4 (d) S2, S3, S4 and S5

2. Optical fibres are related with

(a) Communication (b) Light

(c) Computer (d) None of these

3. A passenger in an aeroplane shall

(a) Never see a rainbow

(b) May see a primary and a secondary rainbow as concentric circles

(c) May see a primary and a secondary rainbow as concentric arcs

(d) Shall never see a secondary rainbow

4. The phenomena involved in the reflection of radiowaves by ionosphere is similar to

(a) Reflection of light by a plane mirror

(b) Total internal reflection of light in air during a mirage

(c) Dispersion of light by water molecules during the formation of a rainbow

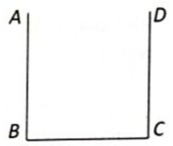
(d) Scattering of light by the particles of air

5. A ray of light incident on a glass sphere (refractive index $\sqrt{3}$) suffers total internal reflection before emerging out exactly parallel to the incident ray. The angle of incidence was

(a) 75° (b) 30°

(c) 45° (d) 60°

6. A cubical vessel has opaque walls. An observer (dark circle in figure below) is located such that she can see only the wall CD but not the bottom.



Nearly to what height should water be poured so that she can see an object placed at the bottom at a distance of 10 cm from the corner C (Refractive index of water 1.33)

(a) 10 cm (b) 16 cm

(c) 27 cm (d) 45 cm

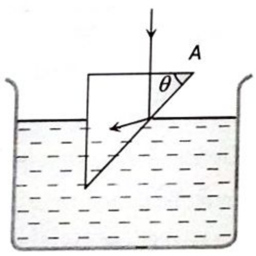
7. The refractive index of the material of the prism and liquid are 1.56 and 1.32 respectively. What will be the value of θ for the following refraction

(a) $\sin\theta \geq \frac{13}{11}$

(b) $\sin\theta \geq \frac{11}{13}$

(c) $\sin\theta \geq \frac{\sqrt{3}}{2}$

(d) $\sin\theta \geq \frac{1}{\sqrt{2}}$



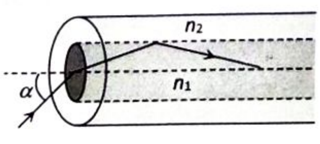
8. An optical fibre consists of core of n_1 surrounded by a cladding of $n_2 < n_1$. A beam of light enters from air at an angle α with axis of fibre. The highest α for which ray can be travelled through fibre is

(a) $\cos^{-1}\sqrt{n_2^2 - n_1^2}$

(b) $\sin^{-1}\sqrt{n_1^2 - n_2^2}$

(c) $\tan^{-1}\sqrt{n_1^2 - n_2^2}$

(d) $\sec^{-1}\sqrt{n_1^2 - n_2^2}$



9. A point source of light is placed at the bottom of a vessel which is filled with water of refractive index μ to a height h. If a floating opaque disc has to be placed exactly above it so that the source is invisible from above, the radius of the disc should be

(a) $\frac{h}{\sqrt{\mu - 1}}$ (b) $\frac{h}{\sqrt{\mu^2 - 1}}$

(c) $\frac{h}{\mu^2 - 1}$ (d) $\frac{\mu h}{\sqrt{\mu^2 - 1}}$

10. Bright sunny day a diver of height h stands at the bottom of a lake of depth H. Looking upward, he can see objects outside the lake in a circular region of radius R. Beyond this circle he sees the images of objects lying on the floor of the lake. If refractive index of water is $4/3$, then the value of R is

(a) $\frac{3(H-h)}{\sqrt{7}}$ (b) $3h\sqrt{7}$

(c) $\frac{(H-h)}{\sqrt{\frac{7}{3}}}$ (d) $\frac{(H-h)}{\sqrt{\frac{5}{3}}}$

5. Refraction at Curved Surface

1. A film projector magnifies a 100 cm^2 film strip on a screen. If the linear magnification is 4, the area of magnified film on the screen is

(a) 1600 cm^2 (b) 400 cm^2

(c) 800 cm^2 (d) 200 cm^2

2. A lens behaves as a converging lens in air and a diverging lens in water. The refractive index of the material is

(a) Equal to unity (b) Equal to 1.33

(c) Between unity and 1.33 (d) Greater than 1.33

3. A substance is behaving as convex lens in air and concave in water, then its refractive index is

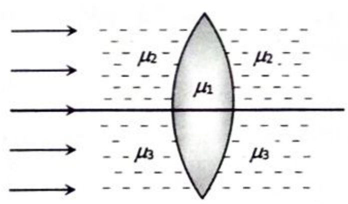
(a) Smaller than air

(b) Greater than both air and water

(c) Greater than air but less than water

(d) Almost equal to water

4. A double convex lens, lens made of a material of refractive index μ_1, is placed inside two liquids or refractive indices μ_2 and μ_3, as shown. $\mu_2 > \mu_1 > \mu_3$. A wide, parallel beam of light is incident on the lens from the left. The lens will give rise to



(a) A single convergent beam

(b) Two different convergent beams

(c) Two different divergent beams

(d) A convergent and a divergent beam

5. The radius of curvature of the curved surface of a plano-convex lens is $20\,cm$. If the refractive index of the material of the lens be 1.5, it will

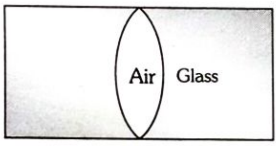
(a) Act as a convex lens only for the objects that lie on its curved side

(b) Act as a concave lens for the objects that lie on its curved side

(c) Act as a convex lens irrespective of the side on which the object lies

(d) Act as a concave lens irrespective of side on which the object lies.

6. 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



(a) 15 *cm*, concave

(b) 15 *cm*, convex

(c) ∞, neither concave nor convex

(d) 0, concave

7. A thin equiconvex lens is made of glass of refractive index 1.5 and its focal length is 0.2 *m*, if it acts as a concave lens of 0.5 *m* focal length when dipped in a liquid, the refractive index of the liquid is

(a) $17/8$ (b) $15/8$

(c) $13/8$ (d) $9/8$

8. A plano-convex lens when silvered in the plane side behaves like a concave mirror of focal length 30*cm*. However, when silvered on the convex side it behaves like a concave mirror of focal length 10 *cm*. Then the refractive index of its material will be

(a) 3.0 (b) 2.0

(c) 2.5 (d) 1.5

9. A plano – convex lens made of material of refractive index μ with radius of curvature R is silvered on the curved side. How far away from the lens–mirror must you place a object so that the image coincides with the object

(a) $\frac{R}{\mu}$ (b) R

(c) $\frac{R}{\mu-1}$ (d) μR

10. The flat face of a plano – convex lens of focal length 10 cm is silvered. A point source placed 30 cm in front of the curved surface will produce a

(a) Real image 15 cm away from the lens

(b) Real image 6 cm away from the lens

(c) Virtual image 15 cm away from the lens

(d) Virtual image 6 cm away from the lens

11. A convex lens of focal length f produces an image $\frac{1}{n}$ times than that of the size of the object. The distance of the object from the lens is

(a) nf (b) $\frac{f}{n}$

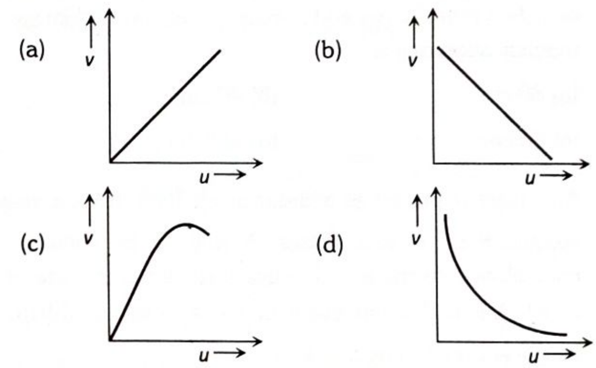
(c) $(n+1)f$ (d) $(n-1)f$

12. For a convex lens the distance of the object is taken on X-axis and the distance of the image is taken on Y-axis, the nature of the graph so obtained is

(a) Straight line (b) Circle

(c) Parabola (d) Hyperbola

13. The distance v of the real image formed by a convex lens is measured for various object distance u. A graph is plotted between v and u, which one of the following graphs is correct



14. An object has image thrice of its original size when kept at 8 *cm* and 16 *cm* from a convex lens. Focal length of the lens is

(a) 8 cm

(b) 16 cm

(c) Between 8 cm and 16 cm

(d) Less than 8 cm

15. A square card of side length 1mm is being seen through a magnifying lens of focal length 10cm. The card is placed at a distance of 9*cm* from the lens. The apparent area of the card through the lens is

(a) $1 cm^2$ (b) $0.81 cm^2$

(c) $0.27 cm^2$ (d) $0.60 cm^2$

16. A point object O is placed on the principal axis of a convex lens of focal length 20 *cm* at a distance of 40 cm to the left of it. The diameter of the lens is 10 *cm*. If the eye is placed 60 *cm* to the right of the lens at a distance *h* below the principal axis, then the maximum value of *h* to see the image will be

(a) 0 (b) 5 *cm*

(c) 2.5 *cm* (d) 10 *cm*

17. A concave and convex lens have the same focal length of 20 cm and are put into contact to form a lens combination. The combination is used to view an object of 5 *cm* length kept at 20 cm from the lens combination. As compared to the object, the image will be

(a) Magnified and inverted

(b) Reduced and erect

(c) Of the same size as the object and erect

(d) Of the same size as the object but inverted

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

(a) 20 *cm* (b) 40 *cm*

(c) 30 *cm* (d) 10 *cm*

19. The plane faces of two identical plano-convex lenses each having focal length of 40 *cm* are pressed against each other to form a usual convex lens. The distance from this lens, at which an object must be placed to obtain a real, inverted image with magnification one is

(a) 80 *cm* (b) 40 *cm*

(c) 20 *cm* (d) 162 *cm*

20. An object is placed at a distance of $10cm$ from a co-axial combination of two lenses *A* and *B* in contact. The combination forms a real image three times the size of the object. If lens *B* is concave with a focal length of $30cm$, the nature and focal length of lens *A* is

(a) Convex, $12cm$ (b) Concave, $12cm$

(c) Convex, $6cm$ (d) Convex, $18cm$

21. The image of an electric bulb fixed in a wall is to be obtained on the wall opposite to it at a distance of 3 *m*. The maximum possible focal length of the convex lens is

(a) 3.25 *m* (b) 1.55 *m*

(c) 0.75 *m* (d) 0.28 *m*

22. A convex lens makes a real image 4 *cm* long on a screen. When the lens is shifted to a new position without disturbing the object, we again get a real image on the screen which is 16 *cm* tall. The length of the object must be

(a) 1/4 *cm* (b) 8 *cm*

(c) 12 *cm* (d) 20 *cm*

23. The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall 4*m* away by means of a large convex lens. The maximum possible focal length of the lens required for this purpose will be

(a) 0.5 *m* (b) 1.0 *m*

(c) 1.5 *m* (d) 2.0 *m*

24. An object approaches a convergent lens from the left of the lens with a uniform speed $5\,m/s$ and stops at the focus. The image

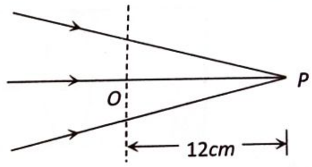
(a) Moves away from the lens with an uniform speed $5\,m/s$

(b) Moves away from the lens with an uniform acceleration

(c) Moves away from the lens with a non-uniform acceleration

(d) Moves towards the lens with a non-uniform acceleration

25. Figure given below shows a beam of light converging at point *P*. When a concave lens of focal length 16 *cm* is introduced in the path of the beam at a place *O* shown by dotted line such that *OP* becomes the axis of the lens, the beam converges at a distance *x* from the lens. The value *x* will be equal to



(a) 12 *cm*

(b) 24 *cm*

(c) 36 *cm*

(d) 48 *cm*

26. An air bubble in sphere having 4 *cm* diameter appears 1 *cm* from surface nearest to eye when looked along diameter. If ${}_a\mu_g$ = 1.5, the distance of bubble from refracting surface is

(a) 1.2 *cm* (b) 3.2 *cm*

(c) 2.8 *cm* (d) 1.6 *cm*

6. Prism Theory & Dispersion of Light

1. The refractive index 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

(a) 30° (b) 45°

(c) 60° (d) 75°

2. The angle of minimum deviation for a prism is 40° and the angle of the prism is 60°. The angle of incidence in this position will be

(a) 30° (b) 60°

(c) 50° (d) 100°

3. The angle of minimum deviation measured with a prism is 30° and the angle of prism is 60°. The refractive index of prism material is

(a) $\sqrt{2}$ (b) 2

(c) 3/2 (d) 4/3

4. A ray of light passes through an equilateral glass prism in such a manner that the angle of incidence is equal to the angle of emergence and each of these angles is equal to 3/4 of the angle of the prism. The angle of deviation is

(a) 45° (b) 39°

(c) 20° (d) 30°

5. When light of wavelength λ is incident on an equilateral prism kept in its minimum deviation position, it is found that the angle of deviation equals the angle of the prism itself. The refractive index of the material of the prism for the wavelength λ is, then

(a) $\sqrt{3}$ (b) $\frac{\sqrt{3}}{2}$

(c) 2 (d) $\sqrt{2}$

6. A ray incident at 15° on one refracting surface of a prism of angle 60°, suffers a deviation of 55°. What is the angle of emergence

(a) 95° (b) 45°

(c) 30° (d) None of these

7. A ray of light is incident at 60° on one face of a prism of angle 30° and the emergent ray makes 30° with the incident ray. The refractive index of the prism is

(a) 1.732 (b) 1.414

(c) 1.5 (d) 1.33

(e) 1.6

8. A prism of refractive index n and angle A is placed in the minimum deviation position. If the angle of minimum deviation is A, then the value of A in terms of n is

(a) $\sin^{-1}\left(\frac{n}{2}\right)$ (b) $\sin^{-1}\sqrt{\frac{n-1}{2}}$

(c) $2\cos^{-1}\left(\frac{n}{2}\right)$ (d) $\cos^{-1}\left(\frac{n}{2}\right)$

9. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5, the angle of incidence is

(a) 7.5° (b) 5°

(c) 15° (d) 2.5°

10. The refracting angle of prism is A and refractive index of material of prism is $\cot\frac{A}{2}$. The angle of minimum deviation is

(a) 180°– 3A (b) 180° + 2A

(c) 90° –A (d) 180° – 2A

11. A glass prism has a right – triangular cross section ABC with $\angle A = 90^\circ$. A ray of light parallel to the hypotenuse BC and incident on the side AB emerges grazing the side AC. Another ray again parallel to the hypotenuse BC, incident on the side AC suffers total internal reflection at the side AB. Which one of the following must be true about the refractive index μ of the material of the prism

(a) $\sqrt{\frac{3}{2}} < \mu < \sqrt{2}$ (b) $\mu > \sqrt{3}$

(c) $\mu < \sqrt{\frac{3}{2}}$ (d) $\sqrt{2} < \mu < \sqrt{3}$

12. You are given four sources of light each one providing a light of a single colour – red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is 90°. Which of the following statements is correct if the source of yellow light is replaced with that of other lights without changing the angle of incidence

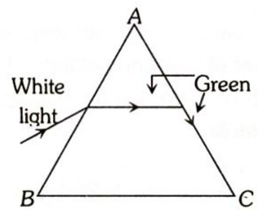
(a) The beam of red light would undergo total internal reflection

(b) The beam of red light would bend towards normal while it gets refracted through the second medium

(c) The beam of blue light would undergo total internal reflection

(d) The beam of green light would bend away from the normal as it gets refracted through the second medium

13. White light is incident on face AB of a glass prism. The path of the green component is shown in the figure. If the green light is just totally internally reflected at face AC as shown, the light emerging from face AC will contain



(a) Yellow, orange and red colours

(b) Violet, indigo and blue colours

(c) All colours

(d) All colours except green

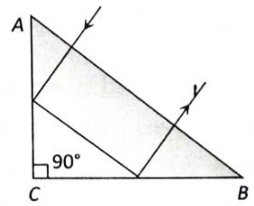
14. A ray of light incident normally on an isosceles right angled prism travels as shown in the figure. The least value of the refractive index of the prism must be

(a) $\sqrt{2}$

(b) $\sqrt{3}$

(c) 1.5

(d) 2.0



15. At sun rise or sunset, the sun looks more red than at mid-day because]

(a) The sun is hottest at these times

(b) Of the scattering of light

(c) Of the effects of refraction

(d) Of the effects of diffraction

16. Sir C.V. Raman was awarded Nobel Prize for his work connected with which of the following phenomenon of radiation

(a) Scattering (b) Diffraction

(c) Interference (d) Polarisation

17. Frequencies of light incident on a system of scattering particles are in the ratio of 1 : 2. Then, the intensity of scattered light in a particular direction is

(a) 1 : 4 (b) 1 : 2

(c) 1 : 8 (d) 1 : 16

18. Check the correct statements on scattering of light

S1 : Rayleigh scattering is responsible for the bluish appearance of sky.

S2 : Rayleigh scattering is proportional to $1/\lambda^4$ when the size of the scatterer is much less than λ.

S3 : Clouds having droplets of water (large scattering objects) scatter all wavelengths are almost equal and so are generally white.

S4 : The sun looks reddish at sunset and sunrise due to Rayleigh scattering.

(a) S1 only (b) S1 and S2

(c) S2 and S3 (d) S1, S2, S3 and S4

19. When sunlight is scattered by atmospheric atoms and molecules, the amount of scattering of light of wavelength 440 nm is A. The amount of scattering for the light of wavelength 660 nm is approximately

(a) $\frac{4}{9}$A (b) 2.25A

(c) 1.5A (d) 0.66A

(e) $\frac{A}{5}$

20. Fraunhofer lines are obtained in

(a) Solar spectrum

(b) The spectrum obtained from neon lamp

(c) Spectrum from a discharge tube

(d) None of the above

21. The spectrum of light emitted by a glowing solid is

(a) Continuous spectrum (b) Line spectrum

(c) Band spectrum (d) Absorption spectrum

22. The spectrum of an oil flame is an example for

(a) Line emission spectrum

(b) Continuous emission spectrum

(c) Line absorption spectrum

(d) Band emission spectrum

23. At the time of total solar eclipse, the spectrum of solar radiation would be

(a) A large number of dark Fraunhofer lines

(b) A less number of dark Fraunhofer lines

(c) No lines at all

(d) All Fraunhofer lines changed into brilliant colours

24. The spectrum obtained from an electric lamp or red hot heater is

(a) Line spectrum (b) Band spectrum

(c) Absorption spectrum (d) Continuous spectrum

25. Missing lines in a continuous spectrum reveal

(a) Defects of the observing instrument

(b) Absence of some elements in the light source

(c) Presence in the light source of hot vapours of some elements

(d) Presence of cool vapours of some elements around the light source

26. Consider the following two statements A and B and identify the correct choice in the given answers

A : Line spectra is due to atoms in gaseous state

B : Band spectra is due to molecules

(a) Both A and B are false

(b) A is true and B is false

(c) A is false and B is true

(d) Both A and B are true

27. Physical process are sometimes described visually by lines. Only the following can cross

(a) Streamlines in fluid flow

(b) Lines of forces in electrostatics

(c) Rays in geometrical option

(d) Lines of force in magnetism

28. Dispersive power depends upon

(a) The shape of prism (b) Material of prism

(c) Angle of prism (d) Height of the prism

29. Dispersion can take place for

(a) Transverse waves only but not for longitudinal waves

(b) Longitudinal waves only but not for transverse waves

(c) Both transverse and longitudinal waves

(d) Neither transverse nor longitudinal waves

30. Monochromatic light passes through a prism. Compares to that in air, inside the prism the light's

(a) Speed and wavelength are different but frequency remains same

(b) Speed and frequency are different but wavelength remains same

(c) Frequency and wavelength are different but speed remains same

(d) Speed, wavelength and frequency are all different

31. Three prisms of crown glass, each have angle of prism 9° and two prisms of flint glass are used to make direct vision spectroscope. What will be the angle of flint glass prisms if μ for flint is 1.60 and μ for crown glass is 1.53

(a) 11.9° (b) 16.0°

(c) 15.3° (d) 9.11°

32. An achromatic prism is made by crown glass prism $(A_C = 19°)$ and flint glass prism $(A_F = 6°)$. If ${}^C n_v = 1.5$ and ${}^F n_v = 1.66$, then resultant deviation for red coloured ray will be

(a) 1.04° (b) 5°

(c) 0.96° (d) 13.5°

7. Human Eye and Lens Camera

1. Ability of the eye to see objects at all distances is called

(a) Binocular vision (b) Myopia

(c) Hypermetropia (d) Accommodation

2. The impact of an image on the retina remains for

(a) 0.1 *s* (b) 0.5 *s*

(c) 10 *s* (d) 15 *s*

3. The far point of a myopia eye is at 40 *cm*. For removing this defect, the power of lens required will be

(a) 40 *D* (b) – 4 *D*

(c) $-2.5\,D$ (d) 0.25 *D*

4. A person can see objects clearly only upto a maximum distance of 50 *cm*. His eye defect, nature of the corrective lens and its focal length are respectively

(a) Myopia, concave, 50*cm*

(b) Myopia, convex, 50*cm*

(c) Hypermetropia, concave, 50 *cm*

(d) Catract, convex, 50*cm*

5. A person who can see things most clearly at a distance of 10 *cm*. Requires spectacles to enable to him to see clearly things at a distance of 30 *cm*. What should be the focal length of the spectacles

(a) 15 *cm* (Concave) (b) 15 *cm* (Convex)

(c) 10 *cm* (d) 0

6. Lens used to remove long sightedness (hypermetropia) is

or

A person suffering from hypermetropia requires which type of spectacle lenses

(a) Concave lens

(b) Plano-concave lens

(c) Convexo-concave lens

(d) Convex lens

7. A person suffering from 'presbyopia' (myopia and hyper metropia both defects) should use

(a) A concave lens

(b) A convex lens

(c) A bifocal lens whose lower portion is convex

(d) A bifocal lens whose upper portion is convex

8. In an eye-piece, field lens and eye lens have focal lengths 7.5 *cm* and 7.3 *cm*. To eliminate spherical aberration, distance between them would be

(a) 0.2 *cm* (b) 0.4 *cm*

(c) 0.1 *cm* (d) 0.5 *cm*

9. 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*

(a) $+3.0\,D$ (b) $+0.125\,D$

(c) $-3.0\,D$ (d) $+4.0\,D$

10. A person cannot see objects clearly beyond 2.0 *m*. The power of lens required to correct his vision will be

(a) + 2.0 *D* (b) – 1.0 *D*

(c) + 1.0 *D* (d) – 0.5 *D*

11. A student can distinctly see the object upto a distance 15 *cm*. He wants to see the black board at a distance of 3 *m*. Focal length and power of lens used respectively will be

(a) $-4.8\,cm, -3.3\,D$ (b) $-5.8\,cm, -4.3\,D$

(c) $-7.5\,cm, -6.3\,D$ (d) $-15.8\,cm, -6.3\,D$

12. A satisfactory photographic print is obtained when the exposure time is 10 *s* at a distance of 2 *m* from a 60 *cd* lamp. The time of exposure required for the same quality print at a distance of 4 *m* from a 120 *cd* lamp is

(a) 5 *s* (b) 10 *s*

(c) 15 *s* (d) 20 *s*

8. Microscope and Telescope

1. The magnifying power of compound microscope is 32. If the magnifying power of the objective is 8, then the magnifying power of the eyepiece is

(a) 24 (b) 256

(c) 4 (d) 40

2. In order to increase the magnifying power of a compound microscope

(a) The focal lengths of the objective and the eye piece should be small

(b) Objective should have small focal length and the eye piece large

(c) Both should have large focal lengths

(d) The objective should have large focal length and eye piece should have small

3. Resolving power of a microscope depends upon

(a) The focal length and aperture of the eye lens

(b) The focal lengths of the objective and the eye lens

(c) The apertures of the objective and the eye lens

(d) The wavelength of light illuminating the object

4. The focal lengths of the objective and of the eye-piece of a compound microscope are f_o and f_e respectively. If L is the tube length and D, the least distance of distinct vision, then its angular magnification, when the image is formed at infinity, is

(a) $\left(1-\frac{L}{f_o}\right)\left(\frac{D}{f_e}\right)$ (b) $\left(1+\frac{L}{f_o}\right)\left(\frac{D}{f_e}\right)$

(c) $\frac{L}{f_o}\left(1-\frac{D}{f_e}\right)$ (d) $\frac{L}{f_o}\left(1+\frac{D}{f_e}\right)$

(e) $\frac{L}{f_o}\left(\frac{D}{f_e}\right)$

5. 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

(a) 1.8 *cm* (b) .5 *cm*

(c) 2.1 *cm* (d) 2.4 *cm*

6. The head lights of a jeep are 1.2 m apart. If the pupil of the eye of an observer has a diameter of 2 mm and light of wavelength 5896 Å is used, what should be the maximum distance of the jeep from the observer if the two head lights are just separated

(a) 33.9 *km* (b) 33.9 *m*

(c) 3.39 *km* (d) 3.39 *m*

7. A compound microscope has an eye piece of focal length 10 *cm* and an objective of focal length 4 *cm*. Calculate the magnification, if an object is kept at a distance of 5 *cm* from the objective so that final image is formed at the least distance vision (20 *cm*)

(a) 12 (b) 11

(c) 10 (d) 13

8. Two points separated by a distance of 0.1 *mm* can just be resolved in a microscope when a light of wavelength 6000 Å is used. If the light of wavelength 4800Å is used this limit of resolution becomes

(a) 0.08 *mm* (b) 0.10 *mm*

(c) 0.12 *mm* (d) 0.06 *mm*

9. In a compound microscope, the focal length of the objective and the eye lens are 2.5 *cm* and 5 *cm* respectively. An object is placed at 3.75 *cm* before the objective and image is formed at the least distance of distinct vision, then the distance between two lenses will be (*i.e.* length of the microscopic tube)

(a) 11.67 *cm* (b) 2.67 *cm*

(c) 13.00 *cm* (d) 12.00 *cm*

10. At Kavalur in India, the astronomers using a telescope whose objective had a diameter of one meter started using a telescope of diameter 2.54 *m*. This resulted in

(a) The increase in the resolving power by 2.54 times for the same λ

(b) The increase in the limiting angle by 2.54 times for the same λ

(c) Decrease in resolving power

(d) No effect on the limiting angle

11. A photograph of the moon was taken with telescope. Later on, it was found that a housefly was sitting on the objective lens of the telescope. In photograph

(a) The image of housefly will be reduced

(b) There is a reduction in the intensity of the image

(c) There is an increase in the intensity of the image

(d) The image of the housefly will be enlarged

12. For a telescope to have large resolving power the

(a) Focal length of its objective should be large

(b) Focal length of its eye piece should be large

(c) Focal length of its eye piece should be small

(d) Aperture of its objective should be large

13. A Galileo telescope has an objective of focal length 100*cm* and magnifying power 50. The distance between the two lenses in normal adjustment will be

(a) 96 *cm* (b) 98 *cm*

(c) 102 *cm* (d) 104 *cm*

14. Two convex lenses of focal lengths 0.3 *m* and 0.05 *m* are used to make a telescope. The distance kept between the two is

(a) 0.35 *m* (b) 0.25 *m*

(c) 0.175 *m* (d) 0.15 *m*

15. If tube length of astronomical telescope is 105 *cm* and magnifying power is 20 for normal setting, calculate the focal length of objective

(a) 100 *cm* (b) 10 *cm*

(c) 20 *cm* (d) 25 *cm*

16. Which of the following is true for the minimum angular separation of two stars, $\Delta\theta_{min}$, that can be resolved by a telescope? In the following, aperture is the diameter of the objective

(a) It decreases with the increase in aperture of the telescope

(b) It is independent of the aperture of the telescope

(c) It increases linearly with the aperture of the telescope

(d) It increases quadratically with the aperture of the telescope

17. Which of the following is not correct regarding the radio telescope

(a) It can not work at night

(b) It can detect a very faint radio signal

(c) It can be operated even in cloudy weather

(d) It is much cheaper than optical telescope

18. A simple telescope, consisting of an objective of focal length 60 *cm* and a single eye lens of focal length 5 *cm* is focussed on a distant object is such a way that parallel rays come out from the eye lens. If the object subtends an angle 2° at the objective, the angular width of the image

(a) 10° (b) 24°

(c) 50° (d) 1/6°

19. The diameter of moon is $3.5 \times 10^3\ km$ and its distance from the earth is $3.8 \times 10^5\ km$. If it is seen through a telescope whose focal length for objective and eye lens are 4 *m* and 10 *cm* respectively, then the angle subtended by the moon on the eye will be approximately

(a) 15° (b) 20°

(c) 30° (d) 35°

9. IIT-JEE/AIEEE

1. A light bulb is placed between two plane mirrors inclined at an angle of $60°$. The number of images formed are **[2002]**

(a) 6 (b) 2

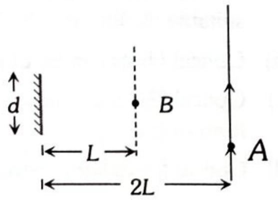
(c) 5 (d) 4

2. To get three images of a single object, one should have two plane mirrors at an angle of **[2003]**

(a) 30° (b) 60°

(c) 90° (d) 150°

3. A point source of light *B* is placed at a distance *L* in front of the centre of a mirror of width *d* hung vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance 2*L* from it as shown. The greatest distance over which he can see the image of the light source in the mirror is **[2000]**



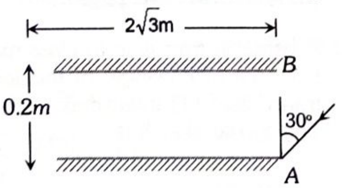
(a) *d*/2

(b) *d*

(c) 2*d*

(d) 3*d*

4. Two plane mirrors *A* and *B* are aligned parallel to each other, as shown in the figure. A light ray is incident at an angle of 30° at a point just inside one end of *A*. The plane of incidence coincides with the plane of the figure. The maximum number of times the ray undergoes reflections (including the first one) before it emerges out is **[2002]**



(a) 28

(b) 30

(c) 32

(d) 34

5. Short linear object of length l lies along the axis of a concave mirror of focal length *f* at a distance u from the pole of the mirror. The size of the image is approximately equal to **[1988]**

(a) $l\left(\frac{u-f}{f}\right)^{1/2}$ (b) $l\left(\frac{u-f}{f}\right)^{2}$

(c) $l\left(\frac{f}{u-f}\right)^{1/2}$ (d) $l\left(\frac{f}{u-f}\right)^{2}$

6. In an experiment to determine the focal length (f) of a concave mirror by the $u-v$ method, a student places the object pin *A* on the principal axis at a distance x from the pole *P*. The student looks at the pin and its inverted image from a distance keeping his/her eye in line with PA. When the student shifts his/her eye towards left, the image appears to the right of the object pin. Then **[2007]**

(a) $x < f$ (b) $f < x < 2f$

(c) $x = 2f$ (d) $x > 2f$

7. 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 **[2011]**

(a) $\frac{1}{10} m/s$ (b) $\frac{1}{15} m/s$

(c) $10 m/s$ (d) $15 m/s$

8. When light is refracted from air into glass **[1980]**

(a) Its wavelength and frequency both increase

(b) Its wavelength increases but frequency remains unchanged

(c) Its wavelength decreases but frequency remains unchanged

(d) Its wavelength and frequency both decrease

9. If ε_0 and μ_0 are respectively, the electric permittivity and the magnetic permeability of free space, ε and μ the corresponding quantities in a medium, the refractive index of the medium is **[1982]**

(a) $\sqrt{\frac{\mu\varepsilon}{\mu_0\varepsilon_0}}$ (b) $\frac{\mu\varepsilon}{\mu_0\varepsilon_0}$

(c) $\sqrt{\frac{\mu_0\varepsilon_0}{\mu\varepsilon}}$ (d) $\sqrt{\frac{\mu\mu_0}{\varepsilon\,\varepsilon_0}}$

10. A ray of light travelling in the direction $\frac{1}{2}(\hat{i}+\sqrt{3}\hat{j})$ is incident on a plane mirror. After reflection, it travels along the direction $\frac{1}{2}(\hat{i}-\sqrt{3}\hat{j})$. The angle of incidence is **[2013]**

(a) 30° (b) 45°

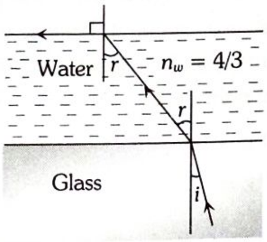
(c) 60° (d) 75°

11. Let the *x-z* plane be the boundary between two transparent media. Medium 1 in $z \geq 0$ has refractive index of $\sqrt{2}$ and medium 2 with $z < 0$ has a refractive index of $\sqrt{3}$. A ray of light in medium 1 given by the vector $\vec{A} = 6\sqrt{3}\hat{i} + 8\sqrt{3}\hat{j} - 10\hat{k}$ incident on the plane of separation. The angle of refraction in medium 2 is **[2011]**

(a) 30° (b) 45°

(c) 60° (d) 75°

12. A ray of light is incident at the glass–water interface at an angle i, it emerges finally parallel to the surface of water, then the value of n_g would be **[2003]**



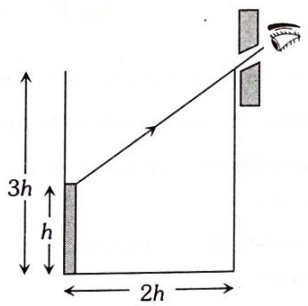
(a) (4/3) sin i

(b) 1/sin i

(c) 4/3

(d) 1

13. An observer can see through a pin–hole the top end of a thin rod of height h, placed as shown in the figure. The beaker height is $3h$ and its radius h. When the beaker is filled with a liquid up to a height $2h$, he can see the lower end of the rod. Then the refractive index of the liquid is **[2002]**



(a) 5/2 (b) $\sqrt{(5/2)}$

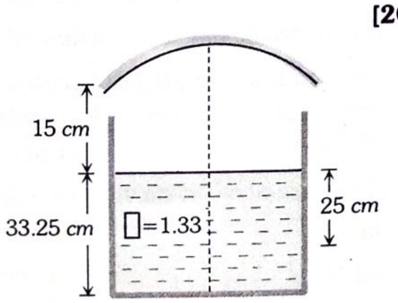
(c) $\sqrt{(3/2)}$ (d) 3/2

14. A ball is dropped from a height of 20 m above the surface of water in a lake. The refractive index of water is 4/3. A fish inside the lake, in the line of fall of the ball, is looking at the ball. At an instant, when the ball is 12.8 m above the water surface, the fish sees the speed of ball as [$g = 10 m/s^2$] **[2009]**

(a) 9 m/s (b) 12 m/s

(c) 16 m/s (d) 21.33 m/s

15. A container is filled with water (μ = 1.33) upto a height of 33.25 cm. A concave mirror is placed 15 cm above the water level and the image of an object placed at the bottom is formed 25 cm below the water level. The focal length of the mirror is **[2005]**



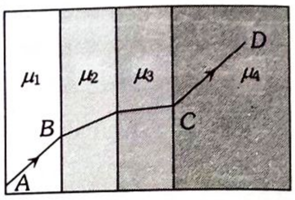
(a) 10

(b) 15

(c) 20

(d) –18.31

16. A ray of light passes through four transparent media with refractive indices μ_1, μ_2, μ_3, and 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 **[2001]**



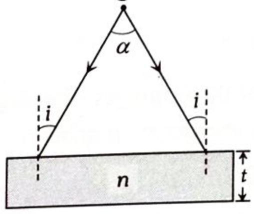
(a) $\mu_1 = \mu_2$

(b) $\mu_2 = \mu_3$

(c) $\mu_3 = \mu_4$

(d) $\mu_4 = \mu_1$

17. A diverging beam of light from a point source S having divergence angle α, falls symmetrically on a glass slab as shown. The angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index n, then the divergence angle of the emergent beam is **[2000]**



(a) Zero

(b) α

(c) $\sin^{-1}(1/n)$

(d) $2\sin^{-1}(1/n)$

18. The phenomenon utilised in an optical fibre is **[2002]**

(a) Refraction (b) Interference

(c) Polarization (d) Total internal reflection

19. Consider telecommunication through optical fibres. Which of the following statements is not true **[2003]**

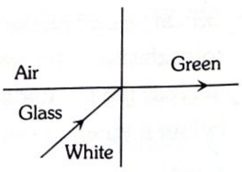
(a) Optical fibres may have homogeneous core with a suitable cladding

(b) Optical fibres can be of graded refractive index

(c) Optical fibres are subject to electromagnetic interference from outside

(d) Optical fibres have extremely low transmission loss

20. White light is incident on the interface of glass and air as shown in the figure. If green light is just totally internally reflected then the emerging ray in air contains **[2004]**



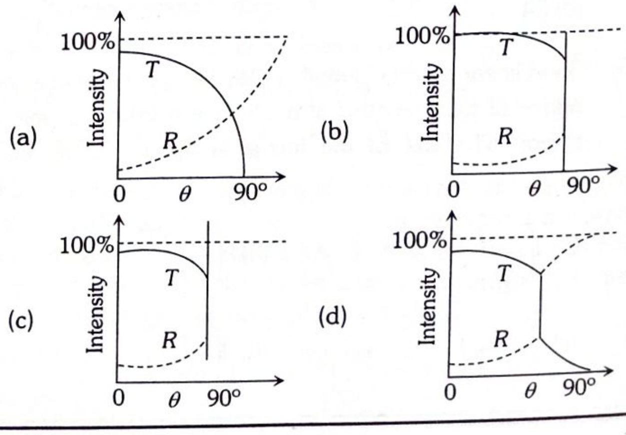
(a) Yellow, orange, red

(b) Violet, indigo, blue

(c) All colours

(d) All colours except green

21. A light ray travelling in glass medium is incident on glass-air interface at an angle of incidence θ. The reflected (R) and transmitted (T) intensities, both as function of θ, are plotted. The correct sketch is **[2011]**



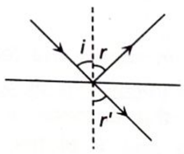
22. A ray of light is incident at an angle i from denser to rare medium. The reflected and the refracted rays are mutually perpendicular. The angle of reflection and the angle of refraction are respectively r and r', then the critical angle will be **[1983]**

(a) $\sin^{-1}(\sin r)$

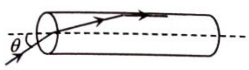
(b) $\sin^{-1}(\tan r')$

(c) $\sin^{-1}(\tan i)$

(d) $\sin^{-1}(\sin i)$



23. 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



The incident angle θ for which the light ray grazes along the wall of the rod is **[2009]**

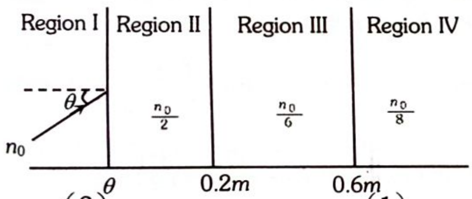
(a) $\sin^{-1}(1/2)$

(b) $\sin^{-1}(\sqrt{3}/2)$

(c) $\sin^{-1}(2/\sqrt{3})$

(d) $\sin^{-1}(1/\sqrt{3})$

24. A light beam is travelling from Region I to Region IV (Refer Figure). The refractive index in Regions I, II, III and IV are $n_0, \frac{n_0}{2}, \frac{n_0}{6}$ and $\frac{n_0}{8}$, respectively. The angle of incidence θ for which the beam just misses entering Region IV is **[2008]**



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

(b) $\sin^{-1}\left(\frac{1}{8}\right)$

(c) $\sin^{-1}\left(\frac{1}{4}\right)$

(d) $\sin^{-1}\left(\frac{1}{3}\right)$

25. A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is $\frac{4}{3}$ and the fish is 12 *cm* below the surface, the radius of this circle in *cm* is **[2005;2010]**

(a) $36\sqrt{5}$

(b) $4\sqrt{5}$

(c) $36\sqrt{7}$

(d) $36/\sqrt{7}$

26. A ray of light travelling 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 **[2007]**

(a) Only a reflected ray and no refracted ray

(b) Only a refracted ray and no reflected ray

(c) A reflected ray and a refracted ray and the angle between them would be less than $180° - 2\theta$

(d) A reflected ray and a refracted ray and the angle between them would be greater than $180° - 2\theta$

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

(a) The entire spectrum of visible light will come out of the water at an angle of 90° to the normal

(b) The spectrum of visible light whose frequency is less than that of green light will come out of the air medium

(c) The spectrum of visible light whose frequency is more than that of green light will come out to the air medium

(d) The entire spectrum of visible light will come out of the water at various angles to the normal

28. On a hot summer night, the refractive index of air is smallest near the ground and increases with height from the ground. When a light beam is directed horizontally, the Huygens' principle leads us to conclude that as it travels, the light beam **[2015]**

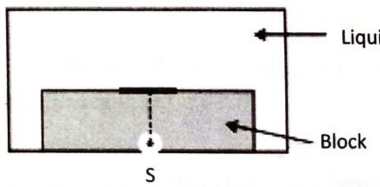
(a) Becomes narrower

(b) Goes horizontally without any deflection

(c) Bends downward

(d) Bends upward

29. A point source S is placed at the bottom of a transparent block of height 10 *mm* and refractive index 2.72. It is immersed in a lower refractive index liquid as shown in the figure. It is found that the light emerging from the block to the liquid forms a circular bright spot of diameter 11.54 *mm* on the top of the block. The refractive index of the liquid is **[2014]**



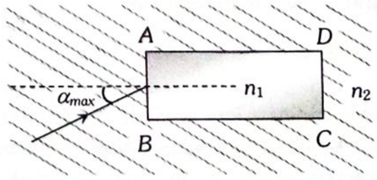
(a) 1.21

(b) 1.30

(c) 1.36

(d) 1.42

30. A rectangular glass slab $ABCD$, of refractive index n_1, is immersed in water of refractive index n_2 $(n_1 > n_2)$. A ray of light in incident at the surface AB of the slab as shown. The maximum value of the angle of incidence α_{max}, such that the ray comes out only from the other surface CD is given by **[2000]**



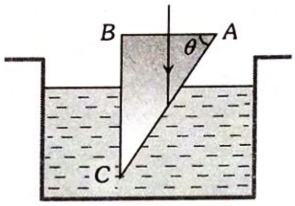
(a) $\sin^{-1}\left[\frac{n_1}{n_2}\cos\left(\sin^{-1}\frac{n_2}{n_1}\right)\right]$

(b) $\sin^{-1}\left[n_1\cos\left(\sin^{-1}\frac{1}{n_2}\right)\right]$

(c) $\sin^{-1}\left(\frac{n_1}{n_2}\right)$

(d) $\sin^{-1}\left(\frac{n_2}{n_1}\right)$

31. A glass prism ($\mu = 1.5$) is dipped in water ($\mu = 4/3$) as shown in figure. A light ray is incident normally on the surface AB. It reaches the surface BC after totally reflected, if **[1981]**



(a) $\sin\theta \geq 8/9$

(b) $2/3 < \sin\theta < 8/9$

(c) $\sin\theta \leq 2/3$

(d) It is not possible

32. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\frac{2}{3}$ times the wavelength in free space. The radius of the curved surface of the lens is **[2013]**

(a) 1 m (b) 2 m

(c) 3 m (d) 6 m

33. A concave lens of glass, refractive index 1.5, has both surfaces of same radius of curvature R. On immersion in a medium of refractive index 1.75, it will behave as a **[1999]**

(a) Convergent lens of focal length 3.5 R

(b) Convergent lens of focal length 3.0 R

(c) Divergent lens of focal length 3.5 R

(d) Divergent lens of focal length 3.0 R

34. A thin glass (refractive index 1.5) lens has optical power of $-5D$ in air. It's optical power in a liquid medium with refractive index 1.6 will be **[2005]**

(a) 25 D (b) -25 D

(c) 1 D (d) None of these

35. 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 length f_1 and f_2 respectively. The correct relation between the focal length is **[2014]**

(a) $f_1 = f_2 < f$

(b) $f_1 > f$ and f_2 becomes negative

(c) $f_2 > f$ and f_1 becomes negative

(d) f_1 and f_2 both become negative

36. A hollow double concave lens is made of very thin transparent material. It can be filled with air or either of two liquids L_1 and L_2 having refractive indices n_1 and n_2 respectively ($n_2 > n_1 > 1$). The lens will diverge a parallel beam of light if it is filled with **[2000]**

(a) Air and placed in air

(b) Air and immersed in L_1

(c) L_1 and immersed in L_2

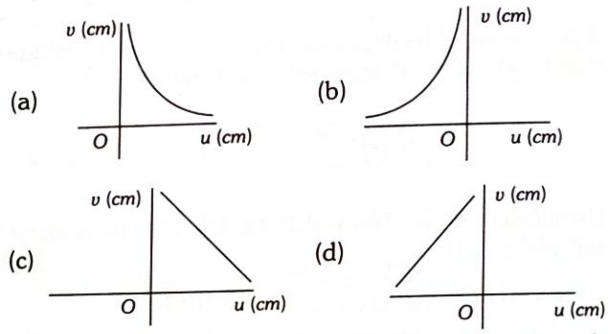
(d) L_2 and immersed in L_1

37. Diameter of a plano–convex lens is 6 cm and thickness at the centre is 3 mm. If the speed of light in the material of the lens is 2×10^8 m/s, the focal length of the lens is **[2013]**

(a) 15 cm (b) 20 cm

(c) 30 cm (d) 10 cm

38. 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 **[2008]**



39. In an optics experiment, with the position of the object fixed, a student varies the position of a convex lens and for each position, the screen is adjusted to get a clear image of the object. A graph between the object distance u and the image distance v, from the lens, is plotted using the same scale for the two axes. A straight line passing through the origin and making an angle of 45° with the x-axis meets the experimental curve at P. The coordinates of P will be **[2009]**

(a) $(2f, 2f)$ (b) $\left(\frac{f}{2}, \frac{f}{2}\right)$

(c) (f, f) (d) $(4f, 4f)$

40. 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 1cm 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 **[2012]**

(a) 7.2m (b) 2.4m

(c) 3.2m (d) 5.6m

41. A point object is placed at the center of a glass sphere of radius 6 cm and refractive index 1.5. The distance of the virtual image from the surface of the sphere is **[2004]**

(a) 2 cm (b) 4 cm

(c) 6 cm (d) 12 cm

42. A bi-convex lens of focal length f forms a circular image of sun of radius r in focal plane. Then **[2006]**

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

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

(c) If lower half part is covered by black sheet, then area of the image is equal to $\frac{\pi r^2}{2}$

(d) If f is doubled, intensity will increase

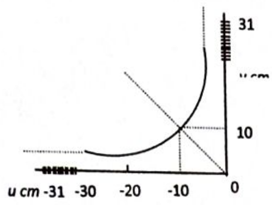
43. Graph of position of image *vs* position of point object from a convex lens is shown. Then, focal length of the lens is **[2006]**

(a) $0.50 \pm 0.05 cm$

(b) $0.50 \pm 0.10 cm$

(c) $5.00 \pm 0.05 cm$

(d) $5.00 \pm 0.10 cm$



44. A converging lens is used to form an image on a screen. When upper half of the lens is covered by an opaque screen **[1986]**

(a) Half the image will disappear

(b) Complete image will be formed of same intensity

(c) Half image will be formed of same intensity

(d) Complete image will be formed of decreased intensity

45. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of combination is **[1982]**

(a) – 1.5 *D* (b) – 6.5 *D*

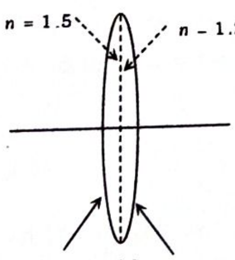
(c) + 6.5 *D* (d) + 6.67 *D*

46. Two lenses of power +12 and – 2 dioptres are placed in contact. What will the focal length of combination **[2007]**

(a) 10 *cm* (b) 12.5 *cm*

(c) 16.6 *cm* (d) 8.33 *cm*

47. A bi-convex lens is formed with two thin plano-convex lenses as shown in the figure. Refractive index *n* of the first lens is 1.5 and that of the second lens is 1.2. Both the curved surfaces are of the same radius of curvature $R = 14 cm$. For this bi-convex lens, for an object distance of $40 cm$, the image distance will be **[2012]**



(a) $-280.0 cm$ (b) $40.0 cm$

(c) $21.5 cm$ (d) $13.3 cm$

48. A convex lens is in contact with concave lens. The magnitude of the ratio of their focal length is 2/3. Their equivalent focal length is 30 *cm*. What are their individual focal lengths **[2005]**

(a) – 75, 50 (b) – 10, 15

(c) 75, 50 (d) – 10, – 15

49. A diminished image of an object is to be obtained on a screen 1.0 *m* from it. This can be achieved by appropriately placing **[1995]**

(a) A convex mirror of suitable focal length

(b) A concave mirror of suitable focal length

(c) A concave lens of suitable focal length

(d) A convex lens of suitable focal length less than 0.25 *m*

50. 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 form 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 **[2004]**

(a) 20 *cm* (b) 30 *cm*

(c) 60 *cm* (d) 80 *cm*

51. A biconvex lens of focal length 15 *cm* is in front of a plane mirror. The distance between the lens and the mirror is 10 *cm*. A small object is kept at a distance of 30 *cm* from the lens. The final image is **[2010]**

(a) Virtual and at a distance of 16 *cm* from mirror

(b) Real and at distance of 16 *cm* from the mirror

(c) Virtual and at a distance of 20 *cm* from the mirror

(d) Real and at a distance of 20 *cm* from the mirror

52. A concave mirror is placed on a horizontal table with its axis directed vertically upwards. Let *o* be the pole of the mirror and *c* its centre of curvature. A point object is placed at *C*. It has a real image, also located at *C*. If the mirror is now filled with water, the image will be **[1998]**

(a) Real, and will remain at C

(b) Real, and located at a point between C and ∞

(c) Virtual and located at a point between C and O

(d) Real, and located at a point between C and O

53. A convex lens *A* of focal length 20 *cm* and a concave lens *B* of focal length 5 *cm* are kept along the same axis with the distance *d* between them. If a parallel beam of light falling on *A* leaves *B* as a parallel beam, then distance *d* in *cm* will be **[1985]**

(a) 25 (b) 15

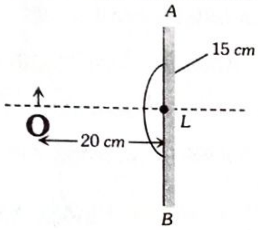
(c) 30 (d) 50

54. The size of the image of an object, which is at infinity, as formed by a convex lens of focal length 30*cm* is 2 *cm*. If a concave lens of focal length 20 *cm* is placed between the convex lens and the image at a distance of 26 *cm* from the convex lens, calculate the new size of the image **[2003]**

(a) 1.25 *cm* (b) 2.5 *cm*

(c) 1.05 *cm* (d) 2 *cm*

55. A point object is placed at a distance of 20 cm from a thin plano-convex lens of focal length 15 cm , if the plane surface is silvered. The image will form at **[2006]**



(a) 60 cm left of AB (b) 30 cm left of AB

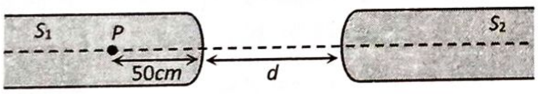
(c) 12 cm left of AB (d) 60 cm right of AB

56. A spherical surface of radius of curvature R separates air (refractive index 1.0) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object P placed in air is found to have a real image Q in the glass. The line PQ cuts the surface at a point O, and $PO = OQ$. The distance PO is equal to **[1998]**

(a) 5 R (b) 3 R

(c) 2 R (d) 1.5 R

57. Two identical glass rods S_1 and S_2 (refractive index = 1.5) have one convex end of radius of curvature 10cm. They are placed with the curved surfaces at a distance d as shown in the figure, with their axes (shown by the dashed line) aligned. When a point source of light P is placed inside rod S_1 on its axis at a distance of 50 cm from the curved face, the light rays emanating from it are found to be parallel to the axis inside S_2. The distance d is **[2015]**



(a) 60 cm (b) 70 cm

(c) 80 cm (d) 90 cm

58. A diverging lens with magnitude of focal length 25 cm 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 **[2017]**

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

(b) Real and at a distance of 40 cm from convergent lens

(c) Virtual and at a distance of 40 cm from convergent lens

(d) Real and at distance of 40 cm from the divergent lens

59. Two beams of red and violet colours are made to pass separately through a prism (angle of the prism is 60°). In the position of minimum deviation, the angle of refraction will be **[2008]**

(a) 30° for both the colours

(b) Greater for the violet colour

(c) Greater for the red colour

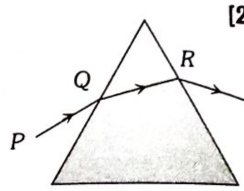
(d) Equal but not 30° for both the colours

60. Three prisms 1, 2 and 3 have the prism angle $A = 60°$, but their refractive indices are respectively 1.4, 1.5 and 1.6. If δ_1, δ_2, δ_3 be their respective angles of deviation then **[2006]**

(a) $\delta_3 > \delta_2 > \delta_1$ (b) $\delta_1 > \delta_2 > \delta_3$

(c) $\delta_1 = \delta_2 = \delta_3$ (d) $\delta_2 > \delta_1 > \delta_3$

61. A ray of light is incident on an equilateral glass prism placed on a horizontal table. For minimum deviation which of the following is true **[2004]**



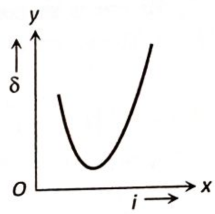
(a) PQ is horizontal

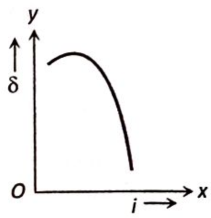
(b) QR is horizontal

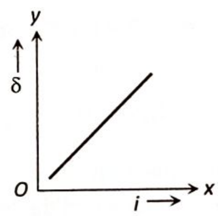
(c) RS is horizontal

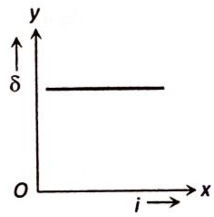
(d) Either PQ or RS is horizontal

62. A graph is plotted between angle of deviation (δ) and angle of incidence (i) for a prism. The nearly correct graph is **[2013]**

(a) 

(b) 

(c) 

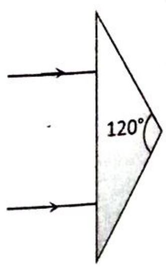
(d) 

63. In an experiment for determination of refractive index of glass of a prism by $i-\delta$, plot, it was found that a ray incident at angle 35°, suffers a deviation of 40° and that it emerges at angle 79°. In that case which of the following is closest to the maximum possible value of the refractive index **[2016]**

(a) 1.6 (b) 1.7

(c) 1.8 (d) 1.5

64. An isosceles prism of angle 120° has a refractive index of 1.44. Two parallel monochromatic rays enter the prism parallel to each other in air as shown. The rays emerging from the opposite faces **[1995]**



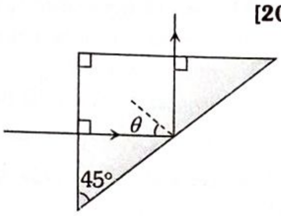
(a) Are parallel to each other

(b) Are diverging

(c) Make an angle $2\sin^{-1}(0.72)$ with each other

(d) Make an angle $2\{\sin^{-1}(0.72)-30°\}$ with each other

65. A triangular prism of glass is shown in the figure. A ray incident normally to one face is totally reflected, if $\theta = 45^\circ$. The index of refraction of glass is **[2004]**



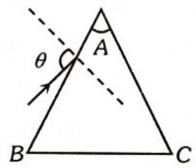
(a) Less than 1.41

(b) Equal to 1.41

(c) Greater than 1.41

(d) None of the above

66. 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 **[2015]**



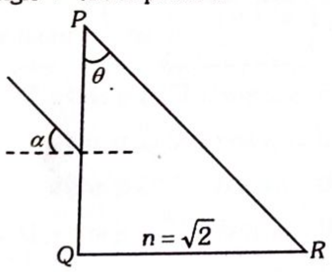
(a) $\theta > \sin^{-1}\left[\mu \sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

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

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

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

67. A parallel beam of light is incident from air at an angle α on the side PQ of a right angled triangular prism of refractive index $n = \sqrt{2}$. Light undergoes total internal reflection in the prism at the face PR when α has a minimum value of 45°. The angle θ of the prism is **[2016]**



(a) 15° (b) 22.5°

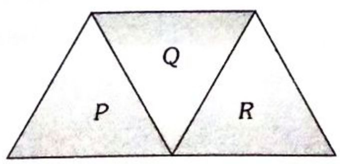
(c) 30° (d) 45°

68. Colour of the sky is blue due to **[2002]**

(a) Scattering of light (b) Total internal reflection

(c) Total emission (d) None of the above

69. A given ray of light suffers minimum deviation in an equilateral prism P. Additional prisms Q and R of identical shape and material are now added to P as shown in the figure. The ray will suffer **[2001]**



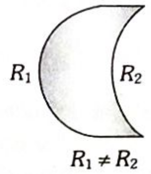
(a) Greater deviation

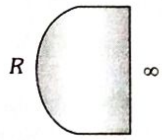
(b) Same deviation

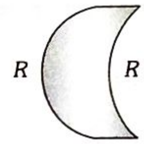
(c) No deviation

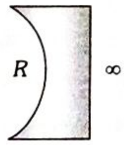
(d) Total internal reflection

70. Which one of the following spherical lenses does not exhibit dispersion? The radii of curvature of the surfaces of the lenses are as given in the diagrams **[2002]**

(a) 

(b) 

(c) 

(d) 

71. An eye specialist prescribes spectacles having a combination of convex lens of focal length 40 *cm* in contact with a concave lens of focal length 25 *cm*. The power of this lens combination in dioptres is **[1997]**

(a) + 1.5 (b) – 1.5

(c) + 6.67 (d) – 6.67

72. Assuming human pupil to have a radius of 0.25 *cm* a comfortable viewing distance of 25 *cm*, the minimum separation between two objects that human eye can resolve at 500 *nm* wavelength is **[2015]**

(a) 1 μm (b) 30 μm

(c) 100 μm (d) 300 μm

73. An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distances are measured by **[2008]**

(a) A standard laboratory scale

(b) A meter scale provided on the microscope

(c) A screw gauge provided on the microscope

(d) A vernier scale provided on the microscope

74. In a compound microscope, the intermediate image is **[2000;2003]**

(a) Virtual, erect and magnified

(b) Real, erect and magnified

(c) Real, inverted and magnified

(d) Virtual, erect and reduced

75. Wavelength of light used in an optical instrument are $\lambda_1 = 4000\,\text{Å}$ and $\lambda_2 = 5000\,\text{Å}$, then ratio of their respective resolving power (corresponding to λ_1 and λ_2) is **[2002]**

(a) 16 : 25 (b) 9 : 1

(c) 4 : 5 (d) 5 : 4

76. The separation between two microscopic particles is measured P_A and P_B by two different lights of wavelength 2000 Å and 3000 Å respectively, then **[2002]**

(a) $P_A > P_B$ (b) $P_A < P_B$

(c) $P_A < 3/2P_B$ (d) $P_A = P_B$

77. The focal lengths of the objective and the eye-piece of a compound microscope are 2.0 *cm* and 3.0 *cm* respectively. The distance between the objective and the eye-piece is 15.0 *cm*. The final image formed by the eye-piece is at infinity. The two lenses are thin. The distances in *cm* of the object and the image produced by the objective measured from the objective lens are respectively **[1995]**

(a) 2.4 and 12.0 (b) 2.4 and 15.0

(c) 2.3 and 12.0 (d) 2.3 and 3.0

78. A thin prism P_1 with angle 4° and made from glass of refractive index 1.54 is combined with another thin prism P_2 made from glass of refractive index 1.72 to produce dispersion without deviation. The angle of prism P_2 is **[1990]**

(a) 2.6° (b) 3°

(c) 4° (d) 5.33°

79. The aperture of the objective lens of a telescope is made large so as to **[2003]**

(a) Increase the magnifying power of the telescope

(b) Increase the resolving power of the telescope

(c) Make image aberration less

(d) Focus on distant objects

80. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eye piece is 36 *cm* and the final image is formed at infinity. The focal length f_o of the objective and the focal length f_e of the eye piece are **[1989]**

(a) $f_o = 45$ *cm* and $f_e = -9$ *cm*

(b) $f_o = 7.2$ *cm* and $f_e = 5$ *cm*

(c) $f_o = 50$ *cm* and $f_e = 10$ *cm*

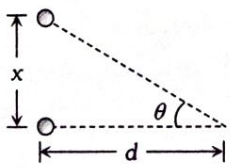
(d) $f_o = 30$ *cm* and $f_e = 6$ *cm*

81. 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 **[2016]**

(a) 10 times nearer (b) 20 times taller

(c) 20 times nearer (d) 10 times taller

82. Two point white dots are 1*mm* apart on a black paper. They are viewed by eye of pupil diameter 3 *mm*. Approximately, what is the maximum distance at which dots can be resolved by the eye ? [Take wavelength of light = 500 *nm*] **[2005]**



(a) 6 *m*

(b) 3 *m*

(c) 5 *m*

(d) 1 *m*

10. NEET/AIPMT

1. A beam of light from a source 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 **[2017]**

(a) $\frac{y}{2x}$ (b) $\frac{y}{x}$

(c) $\frac{x}{2y}$ (d) $\frac{x}{y}$

2. 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 **[2018]**

(a) $30\,cm$ away from the mirror

(b) $36\,cm$ away from the mirror

(c) $30\,cm$ towards the mirror

(d) $36\,cm$ towards the mirror

3. Match the corresponding entries of Column-I with Column-II (Where m is the magnification produced by the mirror) **[2016]**

Column-I		Column-II	
(A)	$m=-2$	(p)	Convex mirror
(B)	$m=-\frac{1}{2}$	(q)	Concave mirror
(C)	$m=+2$	(r)	Real image
(D)	$m=+\frac{1}{2}$	(s)	Virtual image

(a) A $\rightarrow$ q and r, B $\rightarrow$ q and r, C $\rightarrow$ q and s, D $\rightarrow$ p and s

(b) A $\rightarrow$ p and r, B $\rightarrow$ p and s, C $\rightarrow$ p and q, D $\rightarrow$ r and s

(c) A $\rightarrow$ p and s, B $\rightarrow$ q and r, C $\rightarrow$ q and s, D $\rightarrow$ q and r

(d) A $\rightarrow$ r and s, B $\rightarrow$ q and s, C $\rightarrow$ q and r, D $\rightarrow$ p and s

4. A rod of length $10\,cm$ lies along the principal axis of a concave mirror of focal length $10\,cm$ in such a way that its end closer to the pole is $20\,cm$ away from the mirror. The length of the image is **[2012]**

(a) $10\,cm$ (b) $15\,cm$

(c) $2.5\,cm$ (d) $5\,cm$

5. Ray optics is valid, when characteristic dimensions are **[1994]**

(a) Of the same order as the wavelength of light

(b) Much smaller than the wavelength of light

(c) Of the order of one millimetre

(d) Much larger than the wavelength of light

6. The refractive index of a certain glass is 1.5 for light whose wavelength in vacuum is 6000 Å. The wavelength of this light when it passes through glass is **[1993]**

(a) 4000 Å (b) 6000 Å

(c) 9000 Å (d) 15000 Å

7. A light wave has a frequency of 4×10^{14} *Hz* and a wavelength of 5×10^{-7} *metres* in a medium. The refractive index of the medium is **[2007]**

(a) 1.5 (b) 1.33

(c) 1.0 (d) 0.66

8. 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 **[1990]**

(a) ${}_3\mu_1$ (b) ${}_3\mu_2$

(c) $\frac{1}{{}_1\mu_4}$ (d) ${}_4\mu_2$

9. 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 be microscope moved to get the mark in focus again **[2006]**

(a) 1 *cm* downward (b) 2 *cm* upward

(c) 1 *cm* upward (d) 4.5 *cm* downward

10. Light travels through a glass plate of thickness t and having refractive index n. If c is the velocity of light in vacuum, the time taken by the light to travel this thickness of glass is **[1996]**

(a) $\frac{t}{nc}$ (b) tnc

(c) $\frac{nt}{c}$ (d) $\frac{tc}{n}$

11. What is the time taken (in *seconds*) to cross a glass of thickness 4 *mm* and $n = 3$ by light **[1993]**

(a) 4×10^{-11} (b) 2×10^{-11}

(c) 16×10^{-11} (d) 8×10^{-10}

12. If the critical angle for total internal reflection from a medium to vacuum is 30°, the velocity of light in the medium is **[2007]**

(a) 3×10^{8} *m/s* (b) 1.5×10^{8} *m/s*

(c) 6×10^{8} *m/s* (d) $\sqrt{3}\times10^{8}$ *m/s*

13. Which of the following is not due to total internal reflection **[2011]**

(a) Brilliance of diamond

(b) Working of optical fibre

(c) Difference between apparent and real depth of a pond

(d) Mirage on hot summer days

14. Relation between critical angles of water and glass is **[2000]**

(a) $(i_c) > (i_c)_g$ (b) $(i_c)_w < (i_c)_g$

(c) $(i_c)_w = (i_c)_g$ (d) $(i_c)_w = (i_c)_g = 0$

15. The speed of light in media M_1 and M_2 is 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 **[2010]**

(a) Equal to $\sin^{-1}\left(\frac{2}{3}\right)$

(b) Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$

(c) Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$

(d) Less than $\sin^{-1}\left(\frac{2}{3}\right)$

16. Light enters at an angle of incidence in a transparent rod of refractive index *n*. For what value of the refractive index of the material of the rod the light once entered into it will not leave it through its lateral face what so ever be the value of angle of incidence **[1998]**

(a) $n > \sqrt{2}$ (b) $n = 1$

(c) $n = 1.1$ (d) $n = 1.3$

17. 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 **[2012]**

(a) Equal to that of glass

(b) Less than one

(c) Greater than that of glass

(d) Less than that of glass

18. 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 **[2003]**

(a) Become infinite

(b) Become small, but non–zero

(c) Remain unchanged

(d) Become zero

19. A plane convex lens is made of refractive index 1.6. The radius of curvature of the curved surface is 60 *cm*. The focal length of the lens is **[1999]**

(a) 50 *cm* (b) 100 *cm*

(c) 200 *cm* (d) 400 *cm*

20. The focal lengths for violet, green and red light rays are f_V, f_G and f_R respectively. Which of the following is the true relationship **[1997]**

(a) $f_R < f_G < f_V$ (b) $f_V < f_G < f_R$

(c) $f_G < f_R < f_V$ (d) $f_G < f_V < f_R$

21. 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 combination is **[2013]**

(a) $\frac{2R}{(\mu_2 - \mu_1)}$ (b) $\frac{R}{2(\mu_1 + \mu_2)}$

(c) $\frac{R}{2(\mu_1 - \mu_2)}$ (d) $\frac{R}{(\mu_1 - \mu_2)}$

22. Focal length of a convex lens of refractive index 1.5 is 2 *cm*. Focal length of lens when immersed in a liquid of refractive index of 1.25 will be **[1993]**

(a) 10 *cm* (b) 2.5 *cm*

(c) 5 *cm* (d) 7.5 *cm*

23. A biconvex 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 **[2011]**

(a) Real, inverted, height = 1 *cm*

(b) Virtual, upright, height = 1 *cm*

(c) Virtual, upright, height = 0.5 *cm*

(d) Real, inverted, height = 4 *cm*

24. f_v and f_r are the focal lengths of a convex lens for violet and red light respectively and F_v and F_r are the focal lengths of a concave lens for violet and red light respectively, then **[1996]**

(a) $f_v < f_r$ and $F_v > F_r$ (b) $f_v < f_R$ and $F_v < F_r$

(c) $f_c > f_r$ and $F_v > F_r$ (d) $f_v > f_r$ and $F_v < F_r$

25. Two identical thin plano-convex glass lenses (refractive index ×1.5) each having 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 **[2015]**

(a) –25 *cm* (b) –50 *cm*

(c) 50 *cm* (d) –20 *cm*

26. 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 means distance from the earth is 1.5×10^{11} *m*. What is the diameter of the Sun's image on the paper **[2008]**

(a) $6.5 \times 10^{-5} m$ (b) $12.4 \times 10^{-4} m$

(c) $9.2 \times 10^{-4} m$ (d) $6.5 \times 10^{-4} m$

27. A thin lens has focal length f_1 and its aperture has diameter *d*. It forms an image of intensity *I*. Now the central part of the aperture upto diameter $\frac{d}{2}$ is blocked by an opaque paper. The focal length and image intensity will change to **[2010]**

(a) $\frac{f}{2}$ and $\frac{I}{2}$ (b) f and $\frac{I}{4}$

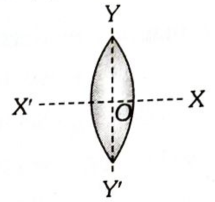
(c) $\frac{3f}{4}$ and $\frac{I}{2}$ (d) f and $\frac{3I}{4}$

28. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The combination is equivalent to a single lens of power **[2008]**

(a) $f_1 + f_2$ (b) $\frac{f_1 f_2}{f_1 + f_2}$

(c) $\frac{1}{2}(f_1 + f_2)$ (d) $\frac{f_1 + f_2}{f_1 f_2}$

29. 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 **[2003]**

(a) $f' = 2f, f'' = f$ (b) $f' = f, f'' = f$

(c) $f' = 2f, f'' = 2f$ (d) $f' = f, f'' = 2f$

30. 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 positions. The area of the source or light is **[1995]**

(a) $\frac{A_1 + A_2}{2}$ (b) $\left[\frac{1}{A_1} + \frac{1}{A_2}\right]^{-1}$

(c) $\sqrt{A_1 A_2}$ (d) $\left[\frac{\sqrt{A_1} + \sqrt{A_2}}{2}\right]^2$

31. In a plano-convex lens the radius of curvature of the convex lens is 10 *cm*. If the plane side is polished, then the focal length will be (Refractive index = 1.5) **[2000]**

(a) 10.5 *cm* (b) 10 *cm*

(c) 5.5 *cm* (d) 5 *cm*

32. 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 **[2012]**

(a) $f_1 + f_2$ (b) $-f_1 + f_2$

(c) $2f_1 + f_2$ (d) $-2f_1 + f_2$

33. A luminous object is placed at a distance of 30 *cm* from the convex lens of focal length 20 *cm*. On the other side of the lens, at what distance from the lens a convex mirror of radius of curvature 10 *cm* be placed in order to have an upright image of the object coincident with it **[1998]**

(a) 12 *cm* (b) 30 *cm*

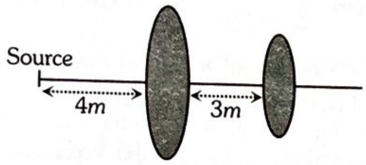
(c) 50 *cm* (d) 60 *cm*

34. A converging beam of rays is incident on a diverging lens. Having passed through 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 meet will move 5 cm closer to the lens. The focal length of the lens is **[2011]**

(a) $-30cm$ (b) $5cm$

(c) $-10cm$ (d) $20cm$

35. An object is located $4m$ from the first of two thin converging lenses of focal lengths $2m$ and $1m$ respectively. The lenses are separated by $3m$. The final image formed by the second lens is located from the source at a distance of **[2000]**



(a) 8.0 m (b) 7.5 m

(c) 6.0 m (d) 6.5 m

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

(a) $\frac{3f}{4}$ (b) $\frac{f}{3}$

(c) f (d) $\frac{4f}{3}$

37. 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 **[2016]**

(a) 16 (b) 8

(c) 10 (d) 12

38. If the refractive index of a material of equilateral prism is $\sqrt{3}$, then angle of minimum deviation of the prism is **[1999]**

(a) 30° (b) 45°

(c) 60° (d) 75°

39. The angle of incidence for a ray of light at a refracting surface of a prism is 45°. The angle of prism is 60°. 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 **[2016]**

(a) $45°, \frac{1}{\sqrt{2}}$ (b) $30°, \sqrt{2}$

(c) $45°, \sqrt{2}$ (d) $30°, \frac{1}{\sqrt{2}}$

40. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index **[2012]**

(a) Lies between $\sqrt{2}$ and 1

(b) Lies between 2 and $\sqrt{2}$

(c) Is less than 1

(d) Is greater than 2

41. A ray of light is incident at an angle of incidence i, on one face of a prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is n, the angle of incidence i, is nearly equal to **[2012]**

(a) nA (b) $\frac{nA}{2}$

(c) A/n (d) $A/2n$

42. Angle of a prism is 30° and its refractive index is $\sqrt{2}$ and one of the surfaces is silvered. At what angle of incidence, a ray should be incident on one surface so that after reflection from the silvered surface, it retraces its path **[2004]**

(a) 30° (b) 60°

(c) 45° (d) $\sin^{-1}\sqrt{1.5}$

43. For a prism of refractive index 1.732, the angle of minimum deviation is equal to the angle of the prism. The angle of the prism is **[2001]**

(a) 80° (b) 70°

(c) 60° (d) 50°

44. 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 **[2015]**

(a) 180°–2A (b) 90°–A

(c) 180°+2A (d) 180°–3A

45. A beam of light composed of red and green ray is incident obliquely at a point on the face of rectangular glass slab. When coming out on the opposite parallel face, the red and green ray emerge from **[2004]**

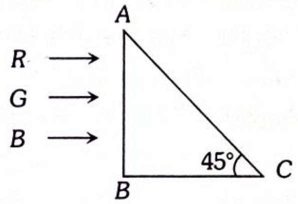
(a) Two points propagating in two different directions

(b) Two points propagating in two parallel directions

(c) One point propagating in two different directions

(d) One point propagating in the same directions

46. A beam of light consisting of red, green and blue colours is incident on a right-angled prism ABC. The refractive indices of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The colour/colours transmitted through the face AC of the prism will be **[2015]**



(a) Red only (b) Red and green

(c) All the three (d) None

47. In the formation of a rainbow light from the sun on water droplets undergoes **[2000]**

(a) Dispersion only

(b) Only total internal reflection

(c) Dispersion and total internal reflection

(d) None of these

48. A thin prism of angle 15° 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 prisms produces dispersion without deviation. The angle of the second prism should be **[2011]**

(a) 12° (b) 5°

(c) 7° (d) 10°

49. A thin prism having refracting angle 10° 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 **[2017]**

(a) 4° (b) 6°

(c) 8° (d) 10°

50. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is $30°$. One 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 **[2018]**

(a) 60° (b) 45°

(c) 30° (d) Zero

51. Astigmatism (for a human eye) can be removed by using **[1990]**

(a) Concave lens (b) Convex lens

(c) Cylindrical lens (d) Prismatic lens

52. 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 the information, the distance between the retina and the cornea eye lens can be estimated to be **[2013]**

(a) 1.5 *cm* (b) 5 *cm*

(c) 2.5 *cm* (d) 1.67 *cm*

53. 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 **[2016]**

(a) Convex, +0.15 *diopter*

(b) Convex, +2.25 *diopter*

(c) Concave, –0.25 *diopter*

(d) Concave, –0.2 *diopter*

54. Two identical glass $(\mu_g = 3/2)$ equiconvex lenses of focal length f each are kept in contact. The space between the two lenses is filled with water $(\mu_W = 4/3)$. The focal length of the combination is **[2016]**

(a) $4f/3$ (b) $3f/4$

(c) $f/3$ (d) f

55. 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 **[2012]**

(a) 10 *cm*, 10 *cm* (b) 15 *cm*, 5 *cm*

(c) 18 *cm*, 2 *cm* (d) 11 *cm*, 9 *cm*

56. The angular resolution of a 10 *cm* diameter telescope at a wavelength of 5000 Å is of the order **[2005]**

(a) $10^6\,rad$ (b) $10^{-2}\,rad$

(c) $10^{-4}\,rad$ (d) $10^{-6}\,rad$

57. If the focal length of objective lens is increased then magnifying power of **[2014]**

(a) Microscope and telescope both will decrease

(b) Microscope will decrease but that of telescope will increase

(c) Microscope will increase but that of telescope decrease

(d) Microscope and telescope both will increase

58. In an astronomical telescope in normal adjustment a straight black line of length 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 l. The magnification of the telescope is **[2015]**

(a) $\frac{L}{l} - 1$ (b) $\frac{L+l}{L-l}$

(c) $\frac{L}{l}$ (d) $\frac{L}{l} + 1$

59. 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 **[2016]**

(a) 37.3 *cm* (b) 46.0 *cm*

(c) 50.0 *cm* (d) 54.0 *cm*

60. A telescope has an objective lens of 10 *cm* diameter and is situated at a distance of one kilometre from two objects. The minimum distance between these two objects, which can be resolved by the telescope, when the mean wavelength of light is 5000 Å, is of the order of **[2004]**

(a) 0.5 *m* (b) 5 *m*

(c) 5 *mm* (d) 5 *cm*

61. On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of P, Q If T_P, T_Q and T_R are the respective absolute temperature of and R, then it can be concluded from the above observations that **[2015]**

(a) $T_P > T_R > T_Q$ (b) $T_P < T_R < T_Q$

(c) $T_P < T_Q < T_R$ (d) $T_P > T_Q T_R$

62. The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000\,Å$ and $\lambda_2 = 6000\,Å$ is **[2017]**

(a) 8 : 27 (b) 9 : 4

(c) 3 : 2 (d) 16 : 18

63. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective less of **[2018]**

(a) Small force length and large diameter

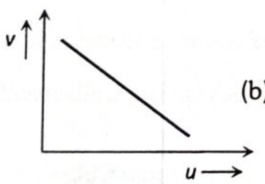
(b) Large focal length and small diameter

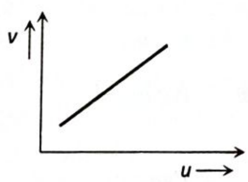
(c) Large focal length and large diameter

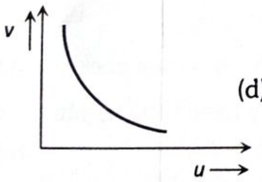
(d) Small focal length and small diameter

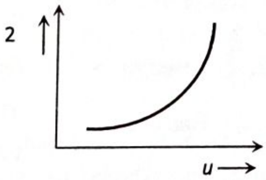
11. AIIMS

1. In an experiment to find the focal length of a concave mirror a graph is drawn between the magnitudes of u and v. The graph looks like **[2003]**

(a)


(b)


(c)


(d)


2. In refraction, light waves are bent on passing from one medium to the second medium, because, in the second medium **[2006]**

(a) The frequency is different

(b) The coefficient of elasticity is different

(c) The speed is different

(d) The amplitude is smaller

3. An object is immersed in a fluid. In order that the object becomes invisible, it should **[2004]**

(a) Behave as a perfect reflector

(b) Absorb all light falling on it

(c) Have refractive index one

(d) Have refractive index exactly matching with that of the surrounding fluid

4. A ray of light is incident on the surface of a glass plate of thickness t. If the angle of incidence θ is small, the emerging ray would be displaced side ways by an amount [take n= refractive index of glass] **[2007]**

(a) $t\theta n/(n+1)$ (b) $t\theta(n-1)/n$

(c) $t\theta n/(n-1)$ (d) $t\theta(n+1)/n$

5. 'Mirage' is a phenomenon due to **[1998]**

(a) Reflection of light

(b) Refraction of light

(c) Total internal reflection of light

(d) Diffraction of light

6. Brilliance of diamond is due to **[2002]**

(a) Shape (b) Cutting

(c) Reflection (d) Total internal reflection

7. An endoscope is employed by a physician to view the internal parts of a body organ. It is based on the principle of **[2004]**

(a) Refraction (b) Reflection

(c) Total internal reflection (d) Dispersion

8. A glass convex lens ($\mu_g = 1.5$) has a focal length of 8 *cm* when placed in air. What would be the focal length of the lens when it is immersed in water ($\mu_w = 1.33$) **[2006]**

(a) 2 *m* (b) 4 *cm*

(c) 16 *cm* (d) 32 *cm*

9. A beam of parallel rays is brought to a focus by a plano-convex lens. A thin concave lens of the same focal length is joined to the first lens. The effect of this is **[2007]**

(a) The focal point shifts away from the lens by a small distance

(b) The focus remains undisturbed

(c) The focus shifts to infinity

(d) The focal point shifts towards the lens by a small distance

10. 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 **[1995]**

(a) 30 *cm*, –60 *cm* (b) 20 *cm*, –30 *cm*

(c) 15 *cm*, –20 *cm* (d) 12 *cm*, –15 *cm*

11. Angle of prism is A and its one surface is silvered. Light rays falling at an angle of incidence 2A on first surface return back through the same path after suffering reflection at second silvered surface. Refractive index of the material of prism is **[1995]**

(a) 2 sin *A* (b) 2 cos *A*

(c) $\frac{1}{2}\cos A$ (d) $\tan A$

12. A leaf which contains only green pigments, is illuminated by a laser light of wavelength 0.632 μm. It would appear to be **[2006]**

(a) Brown (b) Black

(c) Red (d) Green

13. The Cauchy's dispersion formula is **[2002]**

(a) $n = A + B\lambda^{-2} + C\lambda^{-4}$ (b) $n = A + B\lambda^{2} + C\lambda^{-4}$

(c) $n = A + B\lambda^{-2} + C\lambda^{4}$ (d) $n = A + B\lambda^{2} + C\lambda^{4}$

14. Fraunhofer spectrum is a **[2001]**

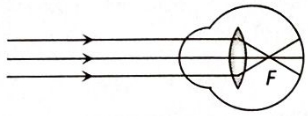
(a) Line absorption spectrum

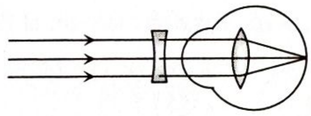
(b) Band absorption spectrum

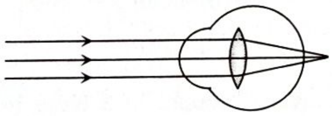
(c) Line emission spectrum

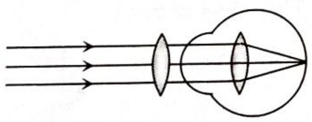
(d) Band emission spectrum

15.

1. 

2. 

3. 

4. 

Identify the wrong description of the above figures **[2007]**

(a) 1 represents far-sightedness

(b) 2 correction for short sightedness

(c) 3 represents far sightedness

(d) 4 correction for far-sightedness

16. A wire mesh consisting of very small squares is viewed at a distance of 8 *cm* through a magnifying converging lens of focal length 10 *cm*, kept close to the eye. The magnification produced by the lens is **[2006]**

(a) 5 (b) 8

(c) 10 (d) 20

17. We wish to see inside an atom. Assuming the atom to have a diameter of 100 *pm*, this means that one must be able to resolved a width of say 10 *pm*. If an electron microscope is used, the minimum electron energy required is about **[2004]**

(a) 1.5 *keV* (b) 15 *keV*

(c) 150 *keV* (d) 1.5 *keV*

18. A telescope has an objective lens of focal length 200 *cm* and an eye piece with focal length 2 *cm*. If this telescope is used to see a 50 *meter* tall building at a distance of 2 *km*, what is the height of the image of the building formed by the objective lens **[2005]**

(a) 5 *cm* (b) 10 *cm*

(c) 1 *cm* (d) 2 *cm*

19. An astronaut is looking down on earth's surface from a space shuttle at an altitude of 400 *km*. Assuming that the astronaut's pupil diameter is 5 *mm* and the wavelength of visible light is 500 *nm*. The astronaut will be able to resolve linear object of the size of about **[2003]**

(a) 0.5 *m* (b) 5 *m*

(c) 50 *m* (d) 500 *m*

12. Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion : A red object appears dark in the yellow light

Reason : A red colour is scattered less

2. Assertion : The stars twinkle while the planets do not.

Reason : The stars are much bigger in size than the planets.

3. Assertion : Owls can move freely during night.

Reason : They have large number of rods on their retina.

4. Assertion : The air bubble shines in water.

Reason : Air bubble in water shines due to refraction of light

5. Assertion : In a movie, ordinarily 24 frames are projected per second from one end to the other of the complete film.

Reason : The image formed on retina of eye is sustained upto 1/10 second after the removal of stimulus.

6. Assertion : Blue colour of sky appears due to scattering of blue colour.

Reason : Blue colour has shortest wave length in visible spectrum.

7. Assertion : The refractive index of diamond is $\sqrt{6}$ and that of liquid is $\sqrt{3}$. If the light travels from diamond to the liquid, it will totally reflected when the angle of incidence is 30°.

Reason : $\mu = \frac{1}{\sin C}$, where μ is the refractive index of diamond with respect to liquid.

8. Assertion : The setting sun appears to be red.

Reason : Scattering of light is directly proportional to the wavelength.

9. Assertion : A double convex lens (μ = 1.5) has focal length 10 *cm*. When the lens is immersed in water (μ = 4/3) its focal length becomes 40 *cm*.

Reason : $\frac{1}{f} = \frac{\mu_l - \mu_m}{\mu_m}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$.

10. Assertion : Different colours travel with different speed in vacuum.

Reason : Wavelength of light depends on refractive index of medium.

11. Assertion : The colour of the green flower seen through red glass appears to be dark.

Reason : Red glass transmits only red light.

12. Assertion : The frequencies of incident, reflected and refracted beam of monochromatic light incident from one medium to another are same

Reason : The incident, reflected and refracted rays are coplanar

13. Assertion : A concave mirror and convex lens both have the same focal length in air. When they are submerged in water, they will have same focal length.

Reason : The refractive index of water is smaller than the refractive index of air.

14. Assertion : In optical fibre, the diameter of the core is kept small.

Reason : This smaller diameter of the core ensures that the fibre should have incident angle more than the critical angle required for total internal reflection.

15. Assertion : The cloud in sky generally appear to be whitish.

Reason : Diffraction due to cloud is efficient in equal measure at all wavelengths.

16. Assertion : Diamond glitters brilliantly.

Reason : Diamond does not absorb sunlight.

17. Assertion : The images formed by total internal reflections are much brighter than those formed by mirrors or lenses.

Reason : There is no loss of intensity in total internal reflection.

18. Assertion : There is no dispersion of light refracted through a rectangular glass slab.

Reason : Dispersion of light is the phenomenon of splitting of a beam of white light into its constituent colours.

19. Assertion : By roughening the surface of a glass sheet its transparency can be reduced.

Reason : Glass sheet with rough surface absorbs more light.

20. Assertion : For the sensitivity of a camera, its aperture should be reduced.

Reason : Smaller the aperture, image focussing is also sharp.

21. Assertion : The resolving power of a telescope is more if the diameter of the objective lens is more.

Reason : Objective lens of large diameter collects more light.

22. Assertion : If the angles of the base of the prism are equal, then in the position of minimum deviation, the refracted ray will pass parallel to the base of prism.

Reason : In the case of minimum deviation, the angle of incidence is equal to the angle of emergence.

23. Assertion : Dispersion of light occurs because velocity of light in a material depends upon its colour.

Reason : The dispersive power depends only upon the material of the prism, not upon the refracting angle of the prism.

24. Assertion : The refractive index of a prism depends only on the kind of glass of which it is made of and the colour of light

Reason : The refractive index of a prism depends upon the refracting angle of the prism and the angle of minimum deviation

25. Assertion : The speed of light in a rarer medium is greater than that in a denser medium

Reason : One light year equals to 9.5×10^{12} *km*

28. Ray Optics – Answers Keys

1. Plane Mirror

1	c	2	b	3	b	4	c	5	b
6	c	7	c	8	b	9	c	10	a
11	b								

2. Spherical Mirror

1	a	2	a	3	d	4	d	5	b
6	a	7	a	8	c	9	a	10	a
11	a	12	b	13	e	14	b	15	d
16	c	17	a	18	a	19	d		

3. Refraction of Light at Plane Surfaces

1	d	2	c	3	b	4	b	5	b
6	a	7	b	8	c	9	b	10	b
11	d	12	d	13	a	14	b	15	d
16	d	17	b	18	a	19	c	20	d
21	d	22	c	23	b	24	a	25	d

4. Total Internal Reflection

1	d	2	a	3	b	4	b	5	d
6	c	7	b	8	b	9	b	10	a

5. Refraction at Curved Surface

1	a	2	c	3	c	4	d	5	c
6	a	7	b	8	d	9	a	10	b
11	c	12	d	13	d	14	c	15	a
16	c	17	c	18	d	19	b	20	c
21	c	22	b	23	b	24	c	25	d
26	a								

6. Prism Theory & Dispersion of Light

1	b	2	c	3	a	4	d	5	a
6	d	7	a	8	c	9	a	10	d
11	a	12	c	13	a	14	a	15	b
16	a	17	d	18	d	19	e	20	a
21	a	22	b	23	d	24	d	25	d
26	d	27	a	28	b	29	c	30	a
31	a	32	d						

7. Human Eye and Lens Camera

1	d	2	a	3	c	4	a	5	a
6	d	7	c	8	a	9	a	10	d
11	d	12	d						

8. Microscope and Telescope

1	c	2	a	3	d	4	e	5	a
6	c	7	a	8	a	9	a	10	a
11	b	12	d	13	c	14	a	15	a
16	a	17	a	18	b	19	b		

9. IIT-JEE/AIEEE

1	c	2	c	3	d	4	b	5	d
6	b	7	b	8	c	9	a	10	a
11	b	12	b	13	b	14	c	15	d
16	d	17	b	18	d	19	c	20	a
21	c	22	c	23	d	24	b	25	d
26	c	27	b	28	d	29	c	30	a
31	a	32	c	33	a	34	d	35	b
36	d	37	c	38	b	39	a	40	c
41	c	42	b	43	c	44	d	45	a
46	a	47	b	48	d	49	d	50	a

51	b	52	d	53	b	54	b	55	c
56	a	57	b	58	b	59	a	60	a
61	b	62	a	63	d	64	d	65	c
66	a	67	a	68	a	69	b	70	c
71	b	72	b	73	d	74	c	75	d
76	b	77	a	78	b	79	b	80	d
81	c	82	c						

10. NEET/AIPMT

1	a	2	b	3	a	4	d	5	d
6	a	7	a	8	c	9	c	10	c
11	a	12	b	13	c	14	a	15	c
16	a	17	a	18	a	19	b	20	b
21	d	22	c	23	d	24	b	25	b
26	c	27	d	28	d	29	d	30	c
31	b	32	c	33	c	34	a	35	b
36	a	37	d	38	c	39	b	40	b
41	a	42	c	43	c	44	a	45	b
46	a	47	c	48	d	49	b	50	b
51	c	52	d	53	c	54	b	55	c
56	d	57	b	58	c	59	d	60	c
61	a	62	c	63	c				

11. AIIMS

1	c	2	c	3	d	4	b	5	c
6	d	7	c	8	d	9	c	10	b
11	b	12	b	13	a	14	a	15	a
16	a	17	b	18	a	19	c		

12. Assertion & Reason

1	b	2	b	3	c	4	c	5	c
6	a	7	e	8	c	9	a	10	e
11	a	12	c	13	d	14	a	15	c
16	b	17	a	18	b	19	c	20	c
21	a	22	a	23	b	24	c	25	b