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Submission Format: 50 Seconds Video
Assignment Alloted: During LIVE Sessions

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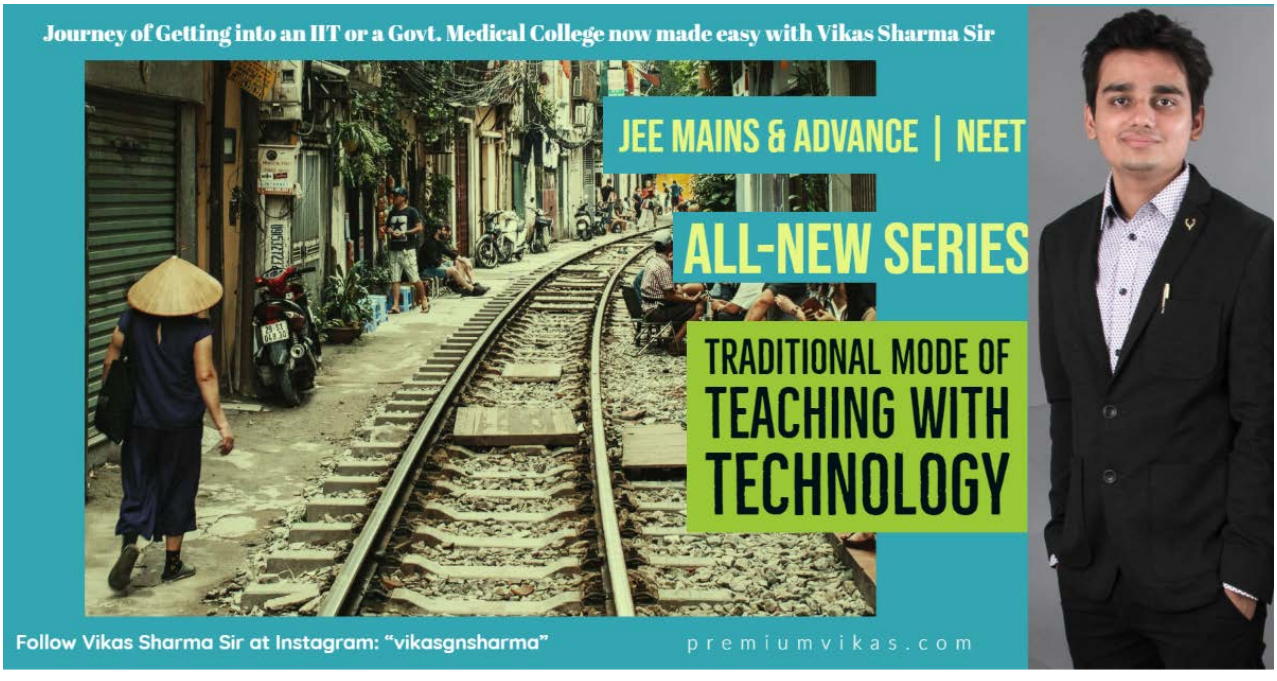


1. The angle of prism is 6^{th} and its refractive index for green light is 1.5. If a green ray passes through it, the deviation will be
(a) 3º (b) 30º (c) 0º (d) 15º

2. Two lenses of power +12 D and – 2D are combined together. What is their equivalent focal length?
(a) 16.6 cm (b) 10 cm
(c) 8.33 cm (d) 12.5 cm

3. If two lenses of power + 1.5 D and + 1.0 D are placed in contact, then the effective power of combination will be
(a) 4.5 D (b) 2.5 D (c) 5.4 D (d) 4.2 D

4. A ray of light having wavelength 720 nm enters in a glass of refractive index 1.5. The wavelength of the ray within the glass will be
(a) 720 nm (b) 360 nm
(c) 1080 nm (d) 480 nm

5. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination, is
(a) + 6.67 D (b) – 6.5 D
(c) – 1.5 D (d) + 6.5 D

6. Chromatic aberration of lens can be corrected by
(a) providing different suitable curvature to its two surfaces
(b) proper polishing of its two surfaces
(c) suitably combining it with another lens
(d) reducing its aperture

7. The objectives with large apertures are used in telescopes for
(a) greater magnification
(b) greater resolution
(c) reducing lens aberrations
(d) ease of manufacture.

8. If two mirrors are kept at 60º to each other and a body is placed at the middle, then total number of images formed, is
(a) six (b) five (c) four (d) three

9. A convex lens is placed in a medium in which it behaves like a glass plate. The refractive index of the medium, will be
(a) equal to refractive index of air
(b) more than the refractive index of glass
(c) equal to the refractive index of glass
(d) less than the refractive index of glass

10. The astronomical telescope consists of objective and eye-piece. The focal length of the objective, is
(a) shorter than that of the eye-piece
(b) greater than that of the eye-piece
(c) equal to that of the eye-piece
(d) five times shorter than that of the eye-piece

11. Light appears to travel in a straight line, because
(a) its wavelength is very small
(b) it is not absorbed by surrounding
(c) its velocity is very large
(d) it is reflected by surrounding

12. A person using a lens as a simple microscope sees an
(a) upright virtual image
(b) inverted real magnified image
(c) inverted virtual image
(d) upright real magnified image

13. 'Mirage' is a phenomenon due to
(a) total internal reflection of light
(b) refraction of light
(c) reflection of light
(d) diffraction of light

14. Sky appears to be blue in clear atmosphere due to light's
(a) scattering (b) diffraction
(c) dispersion (d) all of these

15. Match the elements of table I and table II

Table I	Table II
1. Myopia	(i) Bifocal lens
2. Hypermetropia	(ii) Cylindrical lens
3. Presbyopia	(ii) Concave lens
4. Astigmatism	(iv) Convex lens

(a) 1 - iii, 2 - iv, 3 - i, 4 - ii
(b) 1 - iv, 2 - iii, 3 - i, 4 - ii
(c) 1 - i, 2 - ii, 3 - iii, 4 - iv
(d) 1 - ii, 2 - iv, 3 - i, 4 - iii

16. A doctor advices a patient to use spectacles with a convex lens of focal length 40 cm in contact with a concave lens of focal length 25 cm. What is the power of the resultant combination?
(a) 1.5 D (b) – 1.5 D (c) 6.5 D (d) – 6.5 D

17. Brilliance of diamond is due to
(a) shape (b) reflection
(c) cutting (d) total internal reflection.

18. An endoscope is employed by a physician to view the internal parts of a body organ. It is based on the principle of
(a) refraction (b) reflection
(c) total internal reflection (d) dispersion.

19. 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 the height of the image of the building formed by the objective lens?
(a) 5 cm (b) 10 cm (c) 1 cm (d) 2 cm

20. The apparent depth of water in cylindrical water tank of diameter $2R$ cm is reducing at the rate of x cm/minute when water is being drained out at a constant rate. The amount of water drained in c.c per minute is (n_1 = refractive index of air, n_2 = refractive index of water).
(a) $\frac{x\pi R^2 n_1}{n_2}$ (b) $\frac{x\pi R^2 n_2}{n_1}$
(c) $\frac{2\pi R n_1}{n_2}$ (d) $\pi R^2 x$

21. In refraction, light waves are bent on passing from one medium to the second medium, because in the second medium
(a) the frequency is different
(b) the coefficient of elasticity is different
(c) the speed is different
(d) the amplitude is smaller.

22. 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
(a) 5 (b) 8 (c) 10 (d) 20

23. A lens is made of flint glass (refractive index = 1.5). When the lens is immersed in a liquid of refractive index 1.25, the focal length
(a) increases by a factor of 1.25
(b) increases by a factor of 2.5
(c) increases by a factor of 1.2
(d) decreases by a factor of 1.2

24. The camera lens has an aperture of f and the exposure time is (1/60) s. What will be the new exposure time if the aperture become $1.4f$?
(a) $\frac{1}{42}$ (b) $\frac{1}{56}$
(c) $\frac{1}{72}$ (d) $\frac{1}{31}$

25. The focal length of the objective and eye lenses of a microscope are 1.6 cm and 2.5 cm respectively. The distance between the two lenses is 21.7 cm. If the final image is formed at infinity. What is the linear magnification?
(a) 11 (b) 110
(c) 1.1 (d) 44

26. A converging lens forms a real image I of an object on its principle axis. A rectangular slab of refractive index μ and thickness x is introduced between I and the lens, I will move
(a) towards the lens $(\mu - 1)x$
(b) towards the lens by $\left(1 - \frac{1}{\mu}\right)x$
(c) away from the lens by $(\mu - 1)x$
(d) away from the lens by $\left(1 - \frac{1}{\mu}\right)x$

27. An object 5 cm tall is placed 1 m from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is
(a) 0.11 cm (b) 0.50 cm
(c) 0.55 cm (d) 0.60 cm

28. The magnifying power of a compound microscope increase with
(a) the focal length of objective lens is increased and that of eye lens is decreased
(b) the focal length of eye lens is increased and that of objective lens is decreased
(c) focal lengths of both objects and eye-piece are increased.
(d) focal lengths of both objects and eye-piece are decreased.

29. A convex lens of refractive index $\frac{3}{2}$ has a power of 2.5 D in air. If it is placed in a liquid of refractive index 2, then the new power of the lens is
(a) – 1.25 D (b) – 1.5 D (c) 1.25 D (d) 1.5 D

30. In a concave mirror, an object is placed at a distance d_1 from the focus and the image is formed at a distance d_2 from the focus. Then the focal length of the mirror is
(a) $\sqrt{d_1 d_2}$ (b) $d_1 d_2$
(c) $(d_1 + d_2)/2$ (d) $\sqrt{d_1 / d_2}$

31. A short linear object, of length l, lies along the axis of a concave mirror, of focal length f, at a distance d from the pole of the mirror. The size of the image is then (nearly)
(a) $\frac{lf}{d-f}$ (b) $\frac{d-f}{lf}$
(c) $l\frac{f^2}{(d-f)^2}$ (d) $\frac{(d-f)^2}{f^2}l$

32. For a person near point of vision is 100 cm. Then the power of lens he must wear so as to have normal vision, should be
(a) + 1 D (b) – 1 D
(c) + 3 D (d) – 3 D

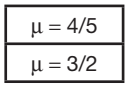
33. Two lens of focal lengths – 20 cm and + 10 cm are put in combination, find the the power of the combination.
(a) – 1 D (b) – 2 D
(c) + 5 D (d) + 2 D

34. A far sighted person has his near point 50 cm, find the power of lens he should use to see at 25 cm, clearly.
(a) + 1 D (b) + 2 D
(c) – 2 D (d) – 1 D

35. In a convex lens of focal length F, the minimum distance between an object and its real image must be
(a) $3F$ (b) $4F$
(c) $\frac{3}{2}F$ (d) $2F$

36. A light ray is incident on a glass slab, it is partially reflected and partially transmitted. Then the reflected ray is
(a) completely polarised and highly intense.
(b) partially polarised and poorly intense.
(c) partially polarised and highly intense.
(d) completely polarised and poorly intense.

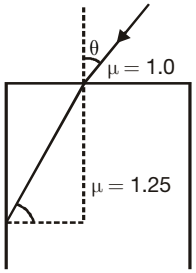
37. Considering normal incidence of ray, the equivalent refractive index of combination of two slabs shown in figure is



(a) 1.8 (b) 1.43
(c) 2 (d) None of the above

38. A source of light lies on the angle bisector of two plane mirrors inclined at angle θ. The values of θ, so that the light reflected from one mirror does not reach the other mirror will be
(a) $\theta \leq 120^\circ$ (b) $\theta \leq 90^\circ$
(c) $\theta \geq 120^\circ$ (d) None of the above

39. Consider the ray diagram for the refraction given below. The maximum value of angle θ for which the light suffers total internal reflection at the vertical surface, is



(a) $\cos^{-1}\left(\frac{3}{4}\right)$ (b) $\sin^{-1}\left(\frac{3}{4}\right)$
(c) $\tan^{-1}\left(\frac{4}{3}\right)$ (d) $\cos^{-1}\left(\frac{4}{3}\right)$

40. The near point and far point of a person are 40 cm and 250 cm respectively. Determine the power of the lens he/she should use while reading a book kept at distance 25 cm from the eye.
(a) 2.5 D (b) 5.0 D (c) 1.5 D (d) 3.5 D

41. 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 the end closer to the pole is 20 cm away from it. Find the length of the image.
(a) 2 cm (b) 4 cm (c) 5 cm (d) 6 cm

42. A ray of light travelling in water is incident on its surface open to air. The angel of incidence is θ, which is less than the critical angle. Then there will be
(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 $(180^\circ - 2\theta)$
(d) a reflected ray and a refracted ray and the angle between them would be greater than $(180^\circ - 2\theta)$

43. What is the refraction index of the material of a plano-convex lens, if the radius of focal length of the lens is 30 cm?
(a) $\frac{1}{3}$ (b) 1 (c) $\frac{4}{3}$ (d) $\frac{2}{3}$

44. A simple telescope, consisting of an objective of focal length 60 cm and a single eye lens of focal length 5 cm is focused on a distant object in such a way that parallel rays emerge from the eye lens. If the object makes an angle of 2º at the objective, then the angular width of the image is
(a) 10º (b) 24º
(c) 50º (d) 48º

Answer Key

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

Solutions:

1. Given : Angle of prism (A) = 6º. We know that deviation (δ) = (μ – 1)A = (1.5 – 1)6 = 0.5 × 6 = 3º.

Hence, the correct answer is option (a).

2. Given : Power of first lens (P_1) = + D and power of second lens (P_2) = $P_1 + P_2$ = 12 + (– 2) = + 10 D.

$\therefore$ Equivalent focal length (F) = $\frac{1}{P} = \frac{1}{10}$

= 10 cm.

Hence, the correct answer is option (b).

3. Given : Power of first lens (P_1) = + 1.5 D and power of second lens (P_2) = + 1.0 D. We know that power of the combination (P) = + 1.0 D. We know that power of the combination (P) = $P_1 + P_2$

= 1.5 + 1.0 = 2.5 D.

Hence, the correct answer is option (b).

4. Given : Wavelength λ_o = 720 nm and refractive index μ = 1.5. Since the velocity of light in a medium is given by $C = n\lambda$ and n remaining same for different media we have,

$$n = \frac{c}{\lambda} = \frac{c'}{\lambda'} \qquad \therefore \lambda' = \frac{c'\lambda}{c}$$

Again c' = $\frac{c}{\mu}$ Hence $\lambda' = \frac{\lambda}{\mu}$

c = speed in vacuum; c' = speed in medium

μ = refractive index of the medium

Therefore, wavelength of the ray in glass

$$\lambda = \frac{\lambda_o}{\mu} = \frac{720}{1.5} = 480 \text{ nm.}$$

Hence, the correct answer is option (d).

5. Given : Focal length of a convex lens f_1 = 40 cm = 0.4 m and focal length of a concave lens f_2 = – 25 cm = – 0.25 m (minus sign due to concave lens). We know that relation for the focal length of the combination of lenses

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$= \frac{1}{0.4} + \frac{1}{-0.25} = 2.5 - 4 = -1.5 \text{ D}$$

or power (P) = – 1.5 D.

Hence, the correct answer is option (c).

6. The chromatic aberration formed by a convex lens is considered positive and that by a concave lens is considered negative, as they have got exactly opposite characteristics. So the chromatic aberration formed by one lens can be nullified by the suitable use of the second lens.

Hence, the correct answer is option (c).

7. Objective of large aperture is used in a telescope, so that it may collect sufficient light and form a bright image.

Hence, the correct answer is option (b).

8. Since the angle of inclination θ = 60º

$\therefore$ $n = \frac{360^\circ}{60^\circ} = 6$ which is even

$\therefore$ no. of images formed for any position of the object in between the mirrors = 6 – 1 = 5

$$n = \frac{360^\circ}{\theta} - 1 \Rightarrow \frac{360^\circ}{60^\circ} - 1 \Rightarrow 6 - 1 \Rightarrow 5$$

Hence, the correct answer is option (b).

9. We know from the lens maker's formula the focal length,

$$\frac{1}{f} = \left(\frac{\mu_2 - \mu_1}{\mu_1}\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Now for the lens to behave like a glass plate its focal length will be infinity ($f = \infty$)

$\therefore$ $\mu_2 - \mu_1 = 0 \qquad \Rightarrow \mu_2 = \mu_1$

That is, the refractive index of the medium should be equal to the refractive index of glass.

Hence, the correct answer is option (c).

10. The focal length of the objective is greater than that of the eye piece so that the image formed by the objective lie in the focal plane of the eye piece. Then the eye piece forms a magnified virtual image of this image.

Hence, the correct answer is option (b).

12. A simple microscope produces an enlarged and exact but virtual image of the object.

Hence, the correct answer is option (a).

13. Mirage is a phenomenon observed due to the total internal reflection of light when light travels from a denser medium to a rarer medium. When the angle of incidence of light is more than the critical angle for the two adjacent media, the light gets totally internally reflected.

Hence, the correct answer is option (a).

14. On a clear atmosphere, the scattering centres are mainly the air molecules whose dimension is of the order of the wavelength of light. We know that amount of scattering is proportional to $\frac{1}{\lambda_4}$. Hence red light is the least scattered and more scattering occurs towards the blue end of the spectrum. And on a clear day, as light (blue end) is scattered uniformly, the sky appears blue.

Hence, the correct answer is option (a).

16. Power of the resultant combination is given by

$$P = P_1 + P_2$$

First lens is a convex lens with power

$$P_1 = +\frac{1}{0.40} = +2.5 \text{ D}$$

The second lens is a concave lens with power

$$P_2 = -\frac{1}{0.25} = -4 \text{ D}$$

$\therefore$ The total power of the combination

$$P = P_1 + P_2 = 2.5 - 4 = -1.5 \text{ D}$$

Hence, the correct answer is option (b).

17. Total internal reflection can occur only when a ray is incident on the surface of a medium whose refractive index is smaller than that of the medium in which the ray is travelling. Since the refractive index of air is 1.00029 and that of diamond is 2.42, therefore brilliance of diamond is due to total internal reflection.

Hence, the correct answer is option (d).

18. This is made of optical fibres whose interior is coated with a refractive index greater than that of the outer cover, glass.

Hence, the correct answer is option (c).

19. From the formula for convex lens,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \quad v = \frac{f \times u}{u - f}$$

$$= \frac{200 \times 200 \times 10^3}{[200 \times 10^3 - 200]} = \frac{200 \times 10^3}{999}.$$

Also, magnification,

$$m = \left|\frac{v}{u}\right| = \left|\frac{I}{O}\right| = \frac{200 \times 10^3}{999 \times 200 \times 10^3} = \frac{I}{50 \times 100}$$

$$I = \frac{5000}{999} \simeq 5 \text{ cm}$$

Hence, the correct answer is option (a).

20. $\frac{n_2}{n_1} = \frac{\text{real depth}}{\text{apparent depth}}$ or, $\frac{n_2}{n_1} = \frac{h}{x}$

differentiating with respect to time,

$$\frac{n_2}{n_1} = \frac{dh/dt}{dx/dt}$$

Change in real depth

$$= \frac{n_2}{n_1} \times \text{change in apparent depth}$$

$$\frac{dh}{dt} = \frac{n_2}{n_1} x \text{ cm/min.}$$

The amount of water drained in c.c. per minute

$$= \frac{dh}{dt} \times \pi R^2 = x\pi R^2 \frac{n_2}{n_1}.$$

Hence, the correct answer is option (b).

22. $u = -8$ cm, $f = 10$ cm As, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$,

$$\therefore \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{10} + \frac{1}{-8} = \frac{1}{10} - \frac{1}{8} = \frac{4-5}{40} = \frac{-1}{40}$$

or $v = -40$ cm.

Magnification produced by the lens,

$$m = \frac{v}{u} = \frac{-40}{-8} = 5$$

This is a virtual image, erect and on the same side as the object.

Hence, the correct answer is option (a).

23. Let f be focal length of lens.

$$\frac{1}{f} = ({}^a\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = (1.5 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

or, $$\frac{1}{f} = 0.5\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

or, $$\frac{1}{R_1} - \frac{1}{R_2} = \frac{1}{0.5f} \quad \text{(i)}$$

Let f' be focal length of the lens when immersed in a liquid.

$$\frac{1}{f'} = ({}^L\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$= \left(\frac{1.5}{1.25} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{0.25}{1.25}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$= \frac{0.25}{1.25} \times \frac{1}{0.5f} \quad \text{(using (i))}$$

$$\frac{1}{f'} = \frac{1}{2.5f} \quad \text{or,} \quad f' = 2.5f$$

i.e., focal length of lens when immersed in a liquid is increased by a factor of 2.5.

Hence, the correct answer is option (b).

24. Time of exposure $\propto f^2$

$$\frac{1}{60} \times \frac{1}{1} = \frac{t}{1.4^2} \quad \Rightarrow \quad t = 0.3266 \text{ s}$$

$$t = \frac{1}{31} \text{ s.}$$

Hence, the correct answer is option (d).

26. Due to insertion of slab, the optical path increases by x/μ, where x is thickness of slab.

Therefore the converging point will shift away by

$$\left[x-\frac{x}{\mu}\right]=x\left(1-\frac{1}{\mu}\right)$$

Hence, the correct answer is option (d).

27. $h_o = 5$ cm, h_i =?

$u = -100$ cm, $R = -20$ cm $\therefore$ $f = -10$ cm

Using mirror formula,

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f} \qquad \Rightarrow \frac{1}{v}-\frac{1}{100}=-\frac{1}{10}$$

$$\frac{1}{v}=\frac{1}{100}-\frac{1}{10}=\frac{1-10}{100}=-\frac{9}{100}$$

$$\therefore \quad v=-\frac{100}{9}\text{ cm}. \frac{h_i}{h_o}=\frac{v}{u}$$

$$\Rightarrow \quad \frac{h_i}{5\text{cm}}=\frac{(100/9)}{100}=\frac{1}{9}$$

$\therefore$ $h_i = 5/9 = 0.55$ cm.

Hence, the correct answer is option (c).

28. Magnifying power of compound microscope

$$M=\frac{v_n}{u_n}\left(1+\frac{D}{f_e}\right)=-\frac{L}{f_n}\left(1+\frac{D}{f_e}\right)$$

Hence, the correct answer is option (b).

29. Focal length of a convex lens having power 2.5

$$D=\frac{1}{2.5}\text{ m}$$

Also focal length of a lens in a medium of refractive index μ is given by

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$\Rightarrow 25=\frac{1}{f}\left(\frac{3}{2}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)= \qquad \text{(i) (in air)}$$

$$\Rightarrow \frac{1}{f'}=\left(\frac{3}{4}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right) \qquad \text{(ii)} \quad \left[\because l_{\mu_g}=\frac{3}{4}\right]$$

Dividing the two, $2.5 f' = \dfrac{0.5}{-0.25}$

$$\Rightarrow \qquad \frac{1}{f'}=\frac{-5}{25\times 0.25}=-1.25\text{ D}$$

Hence, the correct answer is option (a).

30. Using $\dfrac{1}{v}+\dfrac{1}{u}=\dfrac{1}{f}$ Given $u = f + d_1$

$$v = f + d_2$$

$$f=\frac{uv}{u+v}=\frac{(f+d_1)(f+d_2)}{(f+d_1)+(f+d_2)}$$

On solving $f = \sqrt{d_1 d_2}$

Hence, the correct answer is option (a).

31. Use $\dfrac{1}{v}+\dfrac{1}{u}=\dfrac{1}{f}$

Find v_1, when $u = d$ and v_2, when $u = d + 1$

Size of image $= v_1 - v_2 = l\left(\dfrac{f}{d-f}\right)^2$

Hence, the correct answer is option (c).

32. The power of lens

$$P=\frac{1}{f}=\frac{1}{v}-\frac{1}{u}=\left[\frac{1}{25}-\frac{1}{N.P}\right],$$

where N.P. = point of vision

$$P=\left[\frac{1}{25}-\frac{1}{100}\right]=\frac{4-1}{100}=\frac{3}{100\text{ cm}}=\frac{3}{1\text{ m}}=3\text{ D}$$

Hence, the correct answer is option (c).

33. Here $f_1 = -20$ cm, $f_2 = +10$ cm

Focal length of combination is,

$$\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}=\frac{1}{-20}+\frac{1}{10}$$

$$\frac{1}{F}=\frac{1}{20} \Rightarrow F = 20\text{ cm}$$

Power of the combination,

$$P=\frac{100}{F}=\frac{100}{20}=+5\text{ D}$$

Hence, the correct answer is option (c).

34. Here $u = -25$ cm, $v = -50$ cm

We have $\dfrac{1}{f}=\dfrac{1}{-u}+\dfrac{1}{v}=\dfrac{1}{25}-\dfrac{1}{50}$

or $f = 50$ cm

Power of lens he should use,

$$P=\frac{100}{f}=\frac{100}{50}=+2\text{ D}$$

Hence, the correct answer is option (b).

35. Let L is the distance between a real object and its real image formed by a convex lens, then as

$$L = \left(|u|+|v|\right)$$

$$= (\sqrt{2}-\sqrt{v})^2+2\sqrt{uv} \qquad \text{(i)}$$

L will be minimum, when

$$(\sqrt{2}-\sqrt{v})^2 = 0$$

i.e., $u = v$

Putting, $u = -u$ and $v = +u$ in lens formula,

$$\frac{1}{v}-\frac{1}{u} = \frac{1}{F} \quad u = 2F$$

$\therefore \quad (L)_{\min} = 2\sqrt{2F \times 2F} = 4F$ (Using (i))

Hence, the correct answer is option (b).

37. $\mu = \dfrac{\Sigma t_i}{\Sigma \dfrac{t_i}{\mu_i}}$; $\mu = \dfrac{t_1+t_2}{\dfrac{t_1}{\mu_i}+\dfrac{t_2}{\mu_2}} = \dfrac{10+15}{\dfrac{10}{4/3}+\dfrac{15}{3/2}}$

$$= \frac{25}{7.5+10} = \frac{25}{17.5} = 1.43$$

Hence, the correct answer is option (b).

38. For the given condition, no successive reflection takes place. So, the umber of images will be $n \le 2$

$$n-1 \le 2 \quad n \le 3 \quad \frac{360^\circ}{\theta} \le 3 \quad 120 \le \theta$$

$$\theta \ge 120^\circ$$

Hence, the correct answer is option (a).

39. The critical angle for this case is

$$\theta'' = \sin^{-1}\frac{1}{1.25} = \sin^{-1}\frac{4}{5} \quad \text{or} \quad \sin\theta'' = \frac{4}{5}$$

Since, $\theta'' = \dfrac{\pi}{2} - \theta'$, we have $\sin\theta' = \cos\theta'' = 3/5$.

From Snell's law, $\dfrac{\sin\theta}{\sin\theta'} = 1.25$

or $\sin\theta = 1.25 \times \sin\theta' = 1.25 \times \dfrac{3}{5}$

$\Rightarrow \quad \theta = \sin^{-1}(3/4)$

Hence, the correct answer is option (b).

40. If the object is placed at a distance 25 cm from the corrected lens, it should produce the virtual image at 40 cm.

Thus, $u = -25$ cm and $v = -40$ cm

The lens formula is $\dfrac{1}{f} = \dfrac{1}{v}-\dfrac{1}{u}$

$$\Rightarrow \quad \frac{1}{f} = -\frac{1}{40}+\frac{1}{25}$$

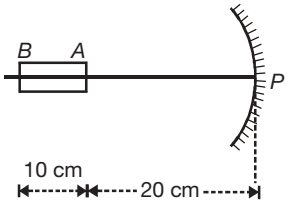
$$\Rightarrow \quad f = \frac{200}{3} \text{ cm}$$

$$= \frac{2}{3} \text{ cm} \qquad \therefore P = \frac{1}{f} = \frac{1}{2} = \frac{3}{2}$$

$$= +1.5 \text{ D}$$

Hence, the correct answer is option (c).

41.



Since, point A is centre of curvature, image of A is formed on A itself.

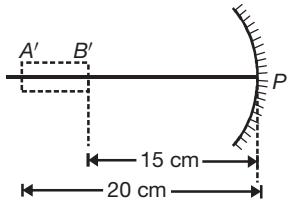
Image of B, $u = -30$ cm, $f = -10$ cm, $v = ?$

$$\frac{1}{v}+\frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{-30} = \frac{1}{-10}$$

$$\Rightarrow \quad \frac{1}{v} = -\frac{1}{10}+\frac{1}{30} = \frac{-3+1}{30}$$

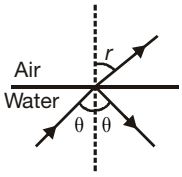
$$v = -15 \text{ cm}$$



Length of image $A'B' = 20 - 15 = 5$ cm

Hence, the correct answer is option (c).

42.



When light passes from one medium to another, both reflection and refraction take place.

$$r > \theta$$

Angle between reflected and refracted ray

$$= 180^\circ - (r + \theta) < (180 - 2\theta)$$

Hence, the correct answer is option (c).

44. $m = \dfrac{-f_o}{f_e} = \dfrac{-60}{5} = -12$

$$m = \frac{\theta}{\theta_o} \Rightarrow 12 = \frac{\theta}{2^\circ}$$

Hence, the correct answer is option (b).

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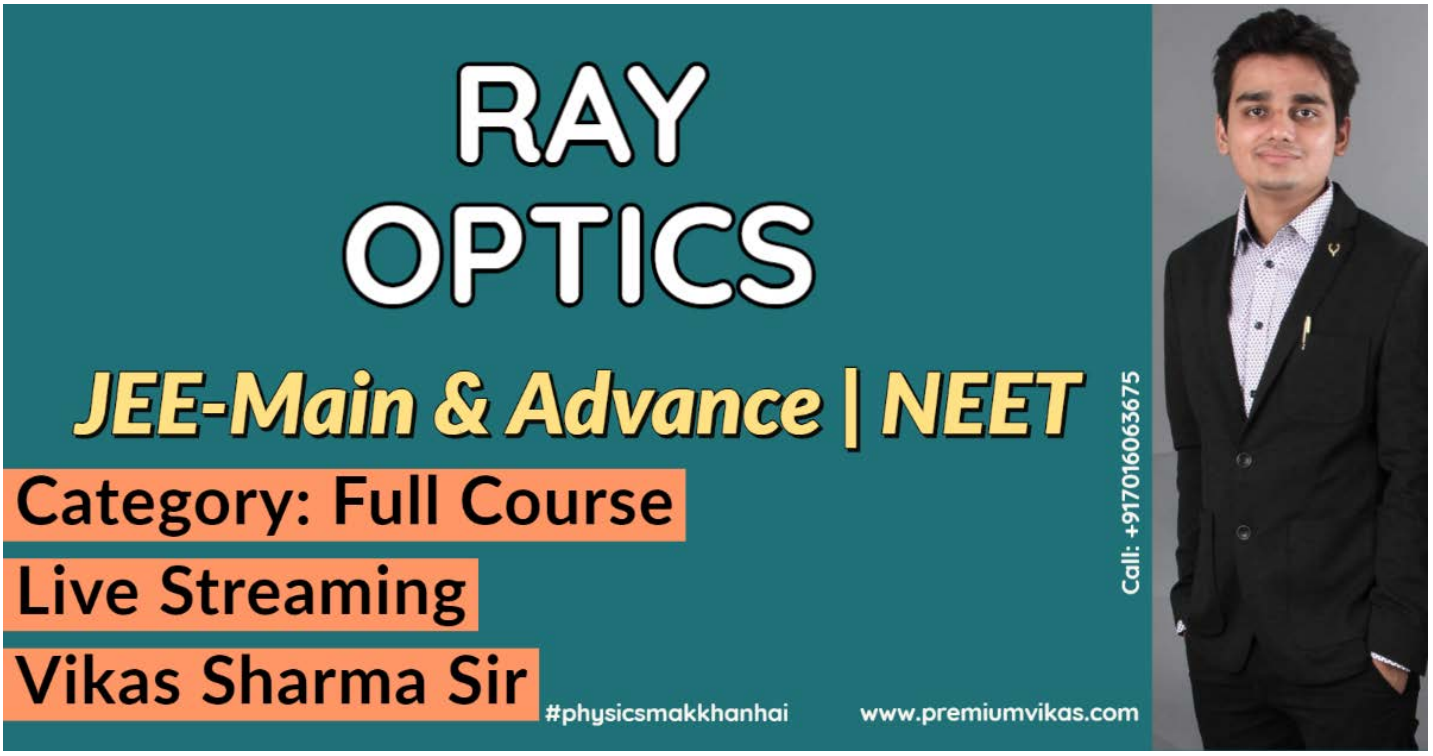

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