NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-8**
CHAPTER :- RAY OPTICS

ANSWER KEY

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

SOLUTIONS

SECTION-A

1. (C)

Sol. Ray after reflection from three mutually perpendicular mirrors becomes anti-parallel.

2. (C)

Sol. $n = \left(\frac{360}{\theta} - 1\right) \Rightarrow 3 = \left(\frac{360}{\theta} - 1\right) \Rightarrow \theta = 90°$

3. (A)

Sol. When a mirror is rotated by an angle θ, the reflected ray deviate from its original path by angle 2θ.

4. (B)

Sol. Given $u = (f + x_1)$ and $v = (f + x_2)$

The focal length $f = \frac{uv}{u+v} = \frac{(f+x_1)(f+x_2)}{(f+x_1)+(f+x_2)}$

On solving, we get $f^2 = x_1 x_2$ or $f = \sqrt{x_1 x_2}$

5. (A)

Sol. $< i = < r = 0°$

6. (B)

Sol. Diminished, erect image is formed by convex mirror.

7. (D)

Sol. $\delta = (360 - 2\theta) = (360 - 2 \times 60) = 240^o$

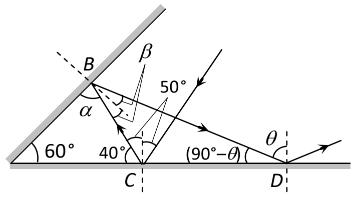
8. (C)

Sol.

$$\frac{I}{O} = \frac{f}{(f-u)} \Rightarrow \frac{I}{+5} = \frac{-10}{-10-(-100)} \Rightarrow I = 0.55\ cm$$

9. (C)

Sol. Let required angle be θ



From geometry of figure

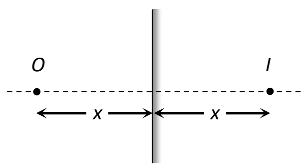
In Δ ABC; α = 180° – (60° + 40°) = 80°

$\Rightarrow \beta$ = 90° – 80° = 10°

In Δ ABD; $\angle A$ = 60°, $\angle B$ = (α + 2β)
= (80 + 2 × 10) = 100° and $\angle D$ = (90° – θ)
$\because$ $\angle A$ + $\angle B$ + $\angle D$ =180° $\Rightarrow$ 60° + 100° + (90° – θ) = 180° $\Rightarrow$ θ = 70°

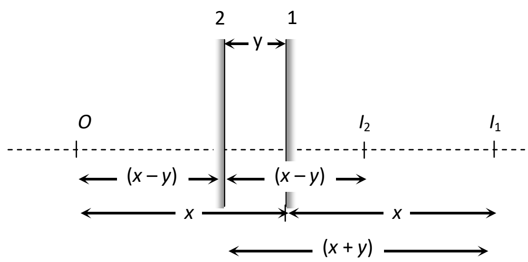
10. (C)

Sol. Suppose at any instant, plane mirror lies at a distance *x* from object. Image will be formed behind the mirror at the same distance *x*.



When the mirror shifts towards the object by distance '*y*' the image shifts $= x + y - (x - y) = 2y$

So speed of image = 2 × speed of mirror



11. (A)

Sol. Let distance $= u$. Now $\frac{v}{u} = 16$ and

$v = u + 120$

$\therefore \frac{120 + u}{u} = 16 \Rightarrow 15u = 120 \Rightarrow u = 8\ cm$.

12. (D)

Sol. Convex mirror always forms, virtual, erect and smaller image.

13. (B)

Sol. By using $\frac{I}{O} = \frac{f}{f - u}$

$$\Rightarrow \frac{I}{+(7.5)} = \frac{(25/2)}{\left(\frac{25}{2}\right) - (-40)} \Rightarrow I = 1.78\ cm$$

14. (D)

Sol. Image formed by convex mirror is always. Erect diminished and virtual.

15. (D)

Sol. $R = -30\ cm \Rightarrow f = -15\ cm$

$O = +2.5\ cm, \quad u = -10\ cm$

By mirror formula

$$\frac{1}{-15} = \frac{1}{v} + \frac{1}{(-10)} \Rightarrow v = 30\ cm.$$

Also $\frac{I}{O} = -\frac{v}{u} \Rightarrow \frac{I}{(+2.5)} = -\frac{30}{(-10)}$

$\Rightarrow I = +7.5\ cm.$

16. (A)

Sol. Focal length of the mirror remains unchanged.

17. (A)

Sol. $\lambda_{medium} = \frac{\lambda_{air}}{\mu} = \frac{6000}{1.5} = 4000\ \mathring{A}$

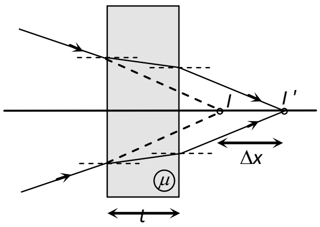
18. (B)

Sol. $\because \angle i > \angle r$, it means light ray is going from rarer medium (*A*) to denser medium.

So $v(A) > v(B)$ and $n(A) < n(B)$

19. (A)

Sol. Normal



shift $\Delta x = \left(1 - \frac{1}{\mu}\right) t$

and shift takes place in direction of ray.

20. (B)

Sol. ${}_a\mu_g = \frac{3}{2}, {}_a\mu_w = \frac{4}{3}$

$$\therefore {}_w\mu_g = \frac{{}_a\mu_g}{{}_a\mu_w} = \frac{3/2}{4/3} = \frac{9}{8}$$

21. (C)

Sol. Real depth = $1\ m$

Apparent depth = $1 - 0.1 = 0.9\ m$

Refractive index

$$\mu = \frac{\text{Real depth}}{\text{Apparent depth}} = \frac{1}{0.9} = \frac{10}{9}$$

22. (B)

Sol. $\mu = \frac{c}{v} = \frac{\sin i}{\sin r} = \frac{\sin 45^o}{\sin 30^o}$

$$\Rightarrow v = \frac{3 \times 10^8}{\sqrt{2}} = 2.12 \times 10^8\ m/s$$

23. (C)

Sol.

$$\mu \propto \frac{1}{v} \Rightarrow \frac{\mu_l}{\mu_g} = \frac{v_g}{v_l} \Rightarrow \frac{\mu_l}{1.5} = \frac{2 \times 10^8}{2.5 \times 10^8} \Rightarrow \mu_l = 1.2$$

24. (C)

Sol. In vacuum speed of light is constant and it is equal to 3 × 10^8 *m/sec*

25. (C)

Sol. ${}_D\mu_R = \frac{\sin i}{\sin r'} \Rightarrow {}_R\mu_D = \frac{\sin r'}{\sin i} = \frac{1}{\sin C}$

$\Rightarrow \sin C = \frac{\sin i}{\sin(90 - r)} = \frac{\sin i}{\cos r} = \frac{\sin i}{\cos i}$ (as $\angle i = \angle r$)

$\Rightarrow \sin C = \tan i \Rightarrow C = \sin^{-1}(\tan i)$

26. (C)

Sol. Critical angle = $\sin^{-1}\left(\frac{1}{\mu}\right)$

$\therefore \theta = \sin^{-1}\left(\frac{1}{\mu_{\lambda_1}}\right)$ and $\theta' = \sin^{-1}\left(\frac{1}{\mu_{\lambda_2}}\right)$

Since $\mu_{\lambda_2} > \mu_{\lambda_1}$, hence $\theta' < \theta$

27. (A)

Sol. $\mu_w < \mu_g \Rightarrow c_w > c_g$.

28. (A)

Sol. $\frac{\mu_2}{\mu_1}=\frac{v_1}{v_2}=\frac{1}{2}\Rightarrow\frac{\mu_1}{\mu_2}=2(\mu_1>\mu_2)$

For total internal reflection

$_2\mu_1=\frac{1}{\sin C}\Rightarrow\frac{\mu_1}{\mu_2}$

$=\frac{1}{\sin C}\Rightarrow 2=\frac{1}{\sin C}\Rightarrow C=30^o$

So, for total (Internal reflection angle of incidence must be greater than 30°.

29. (B)

Sol. $_2\mu_1=\frac{1}{\sin\theta}$ $\Rightarrow\frac{\mu_1}{\mu_2}=\frac{1}{\sin\theta}$ $\Rightarrow\frac{v_2}{v_1}=\frac{1}{\sin\theta}$

$\Rightarrow\frac{v_2}{v}=\frac{1}{\sin\theta}$

$\Rightarrow v_2=\frac{v}{\sin\theta}$

30. (C)

Sol. From the formula $\sin C=\frac{1}{_1\mu_2}\Rightarrow\sin C={}_2\mu_1$

$=\frac{u_1}{u_2}=\frac{v_2}{v_1}\Rightarrow\sin C=\frac{10x/t_2}{x/t_1}$

$\Rightarrow\sin C=\frac{10\,t_1}{t_2}\Rightarrow C=\sin^{-1}\left(\frac{10\,t_1}{t_2}\right)$

31. (B)

Sol. Critical angle C is equal to incident angle if ray reflected normally $\therefore C=90^o$

32. (B)

Sol. Here $\sin i=\frac{1}{\mu}=\frac{3}{5}$ and hence $\tan i=\frac{3}{4}=\frac{r}{4}$

This gives $r=3\,m$, hence diameter = $6m$

33. (A)

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

= $(1.5-1)\left(\frac{1}{40}+\frac{1}{40}\right)=0.5\times\frac{1}{20}=\frac{1}{40}$

$\therefore\ f=40\ cm$

34. (A)

Sol. Focal length of the combination can be calculated as

$\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}$ $\Rightarrow\frac{1}{F}=\frac{1}{(+40)}+\frac{1}{(-25)}$

$\Rightarrow F=-\frac{200}{3}cm$

$\therefore P=\frac{100}{F}=\frac{100}{-200/3}=-1.5\ D$

35. (A)

Sol. Power of the combination $P=P_1+P_2$

$=12-2=10\,D$

$\therefore$ Focal length of the combination

$F=\frac{100}{P}=\frac{100}{10}=10\ cm$

SECTION-B

36. (C)

Sol. If $n_l>n_g$ then the lens will be in more denser medium. Hence its nature will change and the convex lens will behave like a concave lens.

37. (C)

Sol. $m_1=\frac{A_1}{O}$ and $m_2=\frac{A_2}{O}$ $\Rightarrow m_1m_2=\frac{A_1A_2}{O_2}$

Also it can be proved that $m_1m_2=1$

So $O=\sqrt{A_1A_2}$

38. (A)

Sol. $\frac{1}{f}=\left({}_g\mu_a-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)=\left(\frac{2}{3}-1\right)\left(\frac{2}{10}\right)$

$\Rightarrow\ f=-15\ cm$, so behaves as concave lens.

39. (B)

Sol. According to lens makers formula

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

Since $\mu_{\text{Red}}<\mu_{\text{violet}}$ $\Rightarrow f_v<f_r$ and $F_v<F_r$

Always keep in mind that whenever you are asked to compare (greater than or less than) *u, v* or *f* you must not apply sign conventions for comparison.

40. (A)

Sol. By using formula $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$

$\Rightarrow\frac{1.5}{v}-\frac{1}{(-15)}=\frac{(1.5-1)}{+30}\Rightarrow v=-30\ cm$.

Negative sign shows that, image is obtained on the same side of object *i.e.* towards left.

41. (C)

Sol. $\delta\propto(\mu-1)\Rightarrow\mu_R$ is least so δ_R is least.

42. (C)

Sol. By prism formula

$$n = \frac{\sin\frac{A+A}{2}}{\sin\frac{A}{2}} = \frac{2\sin\frac{A}{2}\cos\frac{A}{2}}{\sin\frac{A}{2}}$$

$$\therefore \quad \cos\frac{A}{2} = \frac{n}{2} = \frac{1.5}{2} = 0.75 = \cos 41^o \quad \Rightarrow$$

$A = 82^o$

43. (A)

Sol. Since

$$A(\mu_y - 1) + A'(\mu_{y'} - 1) = 0 \Rightarrow \frac{A'}{A} = -\left(\frac{\mu_y - 1}{\mu_{y'} - 1}\right)$$

44. (B)

Sol. From symmetry the ray shall not suffer TIR at second interface, because the angle of incidence at first interface equals to angle of emergence at second interface. Hence statement 1 is false

45. (A)

Sol. Total deviation = 0

$$\delta_1 + \delta_2 + \delta_3 + \delta_4 + \delta_5 = (\mu_1 - 1)A_1 - (\mu_2 - 1)A_2$$

$$+(\mu_3 - 1)A_3 - (\mu_4 - 1)A_4 + (\mu_5 - 1)A_5 = 0$$

$$\Rightarrow \; 2 \times A_2(1.6 - 1) = 3(1.53 - 1)9$$

$$\Rightarrow \; A_2 = 3\left(\frac{0.53 \times 9}{1.2}\right) = 11.9^o$$

46. (C)

Sol. In minimum deviation condition $\angle i = \angle e$, $\angle r_1 = \angle r_2$

47. (C)

48. (B)

Sol. m = –2, so image is magnified and inverted. Which is possible only for concave mirror. since image is i inverted so it will be real.

(B) M = $-\frac{1}{2}$, so image is inverted and diminished. since image is inverted, so it will be real, and the mirror will be concave.

(C) M = +2, image is magnified so the mirror will be concave. Image is erect so it will be virtual.

(D) m = $+\frac{1}{2}$, image is erect so image will be virtual. Image is virtual and diminished, so the mirror should be convex.

Ans. will be (B)

49. (B)

Sol. Power of the lens is,

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

$$\Rightarrow P = (1.5 - 1)\left(\frac{1}{0.2} - \frac{1}{-0.2}\right) = 0.5 \times 10$$

$$\Rightarrow P = +5D$$

50. (A)

Sol. Refractive index (μ) in terms of speed of light (c) in vacuum and wave speed (v) in medium is given by, $\mu = \frac{c}{v}$

So, for medium $A, \mu_A = \frac{c}{v_A} = \frac{3 \times 10^8}{1.5 \times 10^8} = 2$

and for medium $B, \mu_B = \frac{c}{v_B} = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$

For critical angle, angle of refraction $r = 90°$

Using Snell's law,

$$\mu_1 \sin i = \mu_2 \sin r$$

$$\Rightarrow 2\sin i = 1.5 \sin 90°$$

$$\Rightarrow \sin i = \frac{1.5}{2} = 0.750$$

$$\Rightarrow i = \sin^{-1}(0.750)$$