RK VISION ACADEMY

PHYSICS

XII – RAY OPTICS

SECTION A

1. **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**

(1) $(n-1)f$

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

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

(4) $(n+1)f$

2. **A diminished virtual image can be formed only in**

(1) Plane mirror

(2) A concave mirror

(3) A convex mirror

(4) Concave-parabolic

3. **Which of the following could not produce a virtual image**

(1) Plane mirror

(2) Convex mirror

(3) Concave mirror

(4) All the above can produce a virtual image

4. **An object $5cm$ tall is placed $1m$ from a concave spherical mirror which has a radius of curvature of $20cm$ The size of the image is**

(1) $0.11cm$

(2) $0.50cm$

(3) $0.55cm$

(4) $0.60cm$

5. **The focal length of a concave mirror is $50cm$. Where an object be placed so that its image is two times and inverted**

(1) 75 cm

(2) 72 cm

(3) 63 cm

(4) 50 cm

6. **An object of size $7.5cm$ is placed in front of a convex mirror of radius of curvature $25cm$ at a distance of $40cm$. The size of the image should be**

(1) $2.3cm$

(2) $1.78cm$

(3) $1cm$

(4) $0.8cm$

7. **The field of view is maximum for**

(1) Plane mirror

(2) Concave mirror

(3) Convex mirror

(4) Cylindrical mirror

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

(1) $\frac{f+x}{f}$

(2) $\frac{f}{x}$

(3) $\sqrt{\frac{f}{x}}$

(4) $\frac{f^2}{x^2}$

9. **Image formed by a convex mirror is**

(1) Virtual

(2) Real

(3) Enlarged

(4) Inverted

10. **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

(1) $x_1 x_2$

(2) $\sqrt{x_1 x_2}$

(3) $\frac{x_1+x_2}{2}$

(4) $\sqrt{\frac{x_1}{x_2}}$

11. Refractive index for a material for infrared light is

(1) Equal to that of ultraviolet light

(2) Less than for ultraviolet light

(3) Equal to that for red colour of light

(4) Greater than that for ultraviolet light

12. The index of refraction of diamond is 2.0, velocity of light in diamond in cm/second is approximately

(1) 6×10^{10}

(2) 3.0×10^{10}

(3) 2×10^{10}

(4) 1.5×10^{10}

13. A beam of light propagating in medium *A* with index of refraction *n* (1) passes across an interface into medium *B* with index of refraction *n*(2). The angle of incidence is greater than the angle of refraction; *v*(1) and *v*(2) denotes the speed of light in *A* and *B*. Then which of the following is true

(1) $v(1) > v(2)$ and $n(1) > n(2)$

(2) $v(1) > v(2)$ and $n(1) < n(2)$

(3) $v(1) < v(2)$ and $n(1) > n(2)$

(4) $v(1) < v(2)$ and $n(1) < n(2)$

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

(1) 6 *m*

(2) 8/3 *m*

(3) 8 *cm*

(4) 10 *cm*

15. A vessel of depth 2d *cm* is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2. The apparent depth of the vessel seen perpendicularly is

(1) $d\left(\frac{\mu_1\mu_2}{\mu_1+\mu_2}\right)$

(2) $d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$

(3) $2d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$

(4) $2d\left(\frac{1}{\mu_1\mu_2}\right)$

16. A beam of light is converging towards a point *I* on a screen. A plane glass plate whose thickness in the direction of the beam = *t*, refractive index = μ, is introduced in the path of the beam. The convergence point is shifted by

(1) $t\left(1-\frac{1}{\mu}\right)$ away

(2) $t\left(1+\frac{1}{\mu}\right)$ away

(3) $t\left(1-\frac{1}{\mu}\right)$ nearer

(4) $t\left(1+\frac{1}{\mu}\right)$ nearer

17. 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

(1) $\frac{t}{nc}$

(2) tnc

(3) $\frac{nt}{c}$

(4) $\frac{tc}{n}$

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

(1) Speed

(2) Amplitude

(3) Frequency

(4) Wavelength

19. **Light takes 8 *min* 20 *sec* to reach from sun on the earth. If the whole atmosphere is filled with water, the light will take the time $(a\mu_w = 4/3)$**

(1) 8 *min* 20 *sec*

(2) 8 *min*

(3) 6 *min* 11 *sec*

(4) 11 *min* 6 *sec*

20. **The length of the optical path of two media in contact of length d_1 and d_2 of refractive indices μ_1 and μ_2 respectively, is**

(1) $\mu_1 d_1 + \mu_2 d_2$

(2) $\mu_1 d_2 + \mu_2 d_1$

(3) $\frac{d_1 d_2}{\mu_1 \mu_2}$

(4) $\frac{d_1 + d_2}{\mu_1 \mu_2}$

21. **Immiscible transparent liquids A, B, C, D and E are placed in a rectangular container of glass with the liquids making layers according to their densities. The refractive index of the liquids are shown in the adjoining diagram. The container is illuminated from the side and a small piece of glass having refractive index 1.61 is gently dropped into the liquid layer. The glass piece as it descends downwards will not be visible in**

(1) Liquid *A* and *B* o

(2) Liquid *C* only

(3) Liquid *D* and *E* on

(4) Liquid *A*, *B*, *D* and

A	1.51
B	1.53
C	1.61
D	1.52
E	1.65

22. **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**

(1) 8/9

(2) 9/8

(3) 7/6

(4) None of these

23. **If $i\mu_j$ represents refractive index when a light ray goes from medium *i* to medium *j*, then the product $2\mu_1 \times_3 \mu_2 \times_4 \mu_3$ is equal to**

(1) $3\mu_1$

(2) $3\mu_2$

(3) $\frac{1}{1\mu_4}$

(4) $4\mu_2$

24. **The wavelength of light diminishes μ times ($\mu = 1.33$ for water) in a medium. A diver from inside water looks at an object whose natural colour is green. He sees the object as**

(1) Green

(2) Blue

(3) Yellow

(4) Red

25. **Ray optics fails when**

(1) The size of the obstacle is 5 *cm*

(2) The size of the obstacle is 3 *cm*

(3) The size of the obstacle is less than the wavelength of light

(4) (1) and (2) both

26. **When light travels from air to water and from water to glass, again from glass to CO_2 gas and finally through air. The relation between their refractive indices will be given by**

(1) $an_w \times_w n_{gl} \times_{gl} n_{gas} \times_{gas} n_a = 1$

(2) $an_w \times_w n_{gl} \times_{gas} n_{gl} \times_{gl} n_a = 1$

(3) $an_w \times_w n_{gl} \times_{gl} n_{gas} = 1$

(4) There is no such relation

27. **For a colour of light the wavelength for air is 6000 *Å* and in water the wavelength is 4500 *Å*. Then the speed of light in water will be**

(1) $5.\times 10^{14} m/s$

(2) $2.25 \times 10^{8} m/s$

(3) $4.0 \times 10^8 m/s$

(4) Zero

28. A ray of light travelling inside a rectangular glass block of refractive index $\sqrt{2}$ is incident on the glass–air surface at an angle of incidence of 45°. The refractive index of air is 1. Under these conditions the ray

(1) Will emerge into the air without any deviation

(2) Will be reflected back into the glass

(3) Will be absorbed

(4) Will emerge into the air with an angle of refraction equal to 90°

29. 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

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

(2) $\frac{\mu\varepsilon}{\mu_0\varepsilon_0}$

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

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

30. A beam of monochromatic blue light of wavelength 4200Å in air travels in water ($\mu = 4/3$). Its wavelength in water will be

(1) 2800 $\mathring{A}$

(2) 5600 $\mathring{A}$

(3) 3150 $\mathring{A}$

(4) 4000 $\mathring{A}$

31. Light wave enters from medium 1 to medium 2. Its velocity in 2nd medium is double from 1st. For total internal reflection the angle of incidence must be greater than

(1) 30°

(2) 60°

(3) 45°

(4) 90°

32. Consider telecommunication through optical fibres. Which of the following statements is not true

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

(2) Optical fibres can be of graded refractive index

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

(4) Optical fibres have extremely low transmission loss

33. The critical angle for a medium is 60^o. The refractive index of the medium is

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

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

(3) $\sqrt{3}$

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

34. Glass has refractive index μ with respect to air and the critical angle for a ray of light going from glass to air is θ. If a ray of light is incident from air on the glass with angle of incidence θ, the corresponding angle of refraction is

(1) $sin^{-1}\left(\frac{1}{\sqrt{\mu}}\right)$

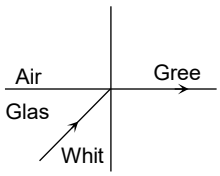
(2) 90^o

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

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

35. 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



(1) Yellow, orange, red
(2) Violet, indigo, blue
(3) All colours
(4) All colours except green

SECTION B

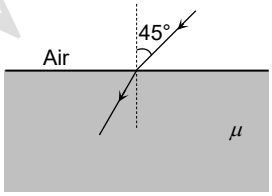
36. **Material A has critical angle i_A, and material B has critical angle $i_B (i_B > i_A)$. Then which of the following is true**

(i) **Light can be totally internally reflected when it passes from B to A**
(ii) **Light can be totally internally reflected when it passes from A to B**
(iii) **Critical angle for total internal reflection is $i_B - i_A$**
(iv) **Critical angle between A and B is $sin^{-1}\left(\frac{sin\, i_A}{sin\, i_B}\right)$**

(1) (i) and (iii)
(2) (i) and (iv)
(3) (ii) and (iii)
(4) (ii) and (iv)

37. **In the figure shown, for an angle of incidence 45^o, at the top surface, what is the minimum refractive index needed for total internal reflection at vertical face**

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



38. **Critical angle for light going from medium (i) to (ii) is θ. The speed of light in medium (i) is v then speed in medium (ii) is**

(1) $v(1 - cos\, \theta)$
(2) $v/\, sin\, \theta$
(3) $v/\, cos\, \theta$
(4) $v(1 - sin\, \theta)$

39. **If light travels a distance x in $t_1 sec$ in air and 10 x distance in $t_2 sec$ in a medium, the critical angle of the medium will be**

(1) $tan^{-1}\left(\frac{t_1}{t_2}\right)$
(2) $sin^{-1}\left(\frac{t_1}{t_2}\right)$
(3) $sin^{-1}\left(\frac{10t_1}{t_2}\right)$
(4) $tan^{-1}\left(\frac{10t_1}{t_2}\right)$

40. **The critical angle of a medium with respect to air is 45^o. The refractive index of medium is**

(1) 1.41
(2) 1.2
(3) 1.5
(4) 2

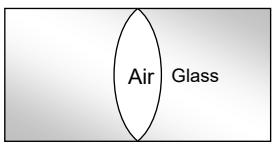
41. **The focal length of convex lens is 30 cm and the size of image is quarter of the object, then the object distance is**

(1) 150 cm
(2) 60 cm
(3) 30 cm
(4) 40 cm

42. **A convex lens forms a real image of a point object placed on its principal axis. If the upper half of the lens is painted black, the image will**

(1) Be shifted downwards
(2) Be shifted upwards
(3) Not be shifted
(4) Shift on the principal axis

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



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

44. **A lens (focal length 50 *cm*) forms the image of a distant object which subtends an angle of 1 *milliradian* at the lens. What is the size of the image**
(1) 5 *mm*
(2) 1 *mm*
(3) 0.5 *mm*
(4) 0.1 *mm*

45. **A convex lens of focal length 12 *cm* is made of glass of $\mu = \frac{3}{2}$. What will be its focal length when immersed in liquid of $\mu = \frac{5}{4}$**
(1) 6 *cm*
(2) 12 *cm*
(3) 24 *cm*
(4) 30 *cm*

46. **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**
(1) $f_1 + f_2$
(2) $\frac{f_1 f_2}{f_1 + f_2}$
(3) $\frac{1}{2}(f_1 + f_2)$
(4) $\frac{f_1 + f_2}{f_1 f_2}$

47. **A plano convex lens is made of glass of refractive index 1.5. The radius of curvature of its convex surface is *R*. Its focal length is**
(1) *R*/ 2
(2) *R*
(3) 2*R*
(4) 1.5 *R*

48. **Two lenses have focal lengths f_1 and f_2 and their dispersive powers are ω_1 and ω_2 respectively. They will together form an achromatic combination if**
(1) $\omega_1 f_1 = \omega_2 f_2$
(2) $\omega_1 f_2 + \omega_2 f_1 = 0$
(3) $\omega_1 + f_1 = \omega_2 + f_2$
(4) $\omega_1 - f_1 = \omega_2 - f_2$

49. **The dispersive powers of glasses of lenses used in an achromatic pair are in the ratio 5 : 3. If the focal length of the concave lens is 15 *cm*, then the nature and focal length of the other lens would be**
(1) Convex, 9 *cm*
(2) Concave, 9 *cm*
(3) Convex, 25 *cm*
(4) Concave, 25 *cm*

50. **A thin double convex lens has radii of curvature each of magnitude 40 *cm* and is made of glass with refractive index 1.65. Its focal length is nearly**
(1) 20 *cm*
(2) 31 *cm*
(3) 35 *cm*
(4) 50 *cm*

RK VISION ACADEMY

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