PHYSICS

BOOKS - SAI PHYSICS (TELUGU ENGLISH)

RAY OPTICS

MCQ

1. Three thin lenses are combined by placing them in contact with each other to get more

magnification in an optical instrement. Each lens has a focal length of 3 cm. If the least distance of distinct vision is taken as 25 cm, the total magnification of the lens combination in normal adjustment is

A. 9

B. 26

C. 300

D. 3

Answer: B

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2. A convex lens of glass $\left(\mu_g = 1.45\right)$ has a focal length f in air. The lens is immerseJ in a liquid Of refractive index (μ_I) 1.3. The ratio of the $\frac{F_{\text{“}liquid\text{”}}}{F_a}$ is is

A. 3.9

B. 0.23

C. 0.43

D. 0.39

Answer: A

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3. An image is formed at a distance of 100 cm from the glass surface when light from point source in air falls on a spherical glass surface with refractive index 1.5. The distance of the light source from the glass surface is 100 cm. The radius of curvature is

A. 20 cm

B. 40 cm

C. 30 cm

D. 50 cm

Answer: A

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4. A convex lens has its radii of curvature equal. The focal length of the lens is f. If it is divided vertically into two identical plano-convex lenses by cutting it, then the focal

length of the plano-convex lens (p = the refractive index of the material of the lens)

A. f

B. $\frac{f}{2}$

C. 2f

D. $(\mu - 1)f$

Answer: C

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5. A thin converging lens of focal length f= 25 cm forms the image of an object on a screen placed at a distance of 75 cm from the lens. The screen is moved closer to the lens by a distance of 25 cm. The distance through which the object has to be shifted, so that its image on the screen in sharp again is

A. 37.5 cm

B. 16.25 cm

C. 12.5 cm

D. 13.5 cm

Answer: C

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6. The two surfaces of a concave lens, made of glass of refractive index 1.5 have the same radii of curvature R. It is now immersed in a medium of refractive index 1.75, then the lens

A. Becomes a convergent lens of focal length 3.5 R

B. Becomes a convergent lens of focal length 3.0 R

C. Changes as a divergent lens of focal length 3.5 R

D. Changes as a divergent lens of focal length 3.5 R

Answer: A

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7. A microscope consists of an objective of focal length 1.9 cm and eyepiece of focal length 5 cm. The two lenses are kept at a distance of 10.5 cm. If the image is to be formed at the least distance of distinct vision, the distance at which the object is to be placed before the objective is (least distance of distinct vision is 25 cm)

A. 6.2 cm

B. 2. 7cm

C. 21.0 cm

D. 4.17 cm

Answer: B

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8. Fresnel diffraction is produced due to light rays falling on a small obstacle. The intensity of light at a point on a screen beyond an obstacle depends on

A. The focal length of lens used for observation

B. The number of half-period zones that superpose at the point

C. The square of the sum of the number of half period of zones

D. The thickness of the obstacle

Answer: B

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9. The objective and eyepiece of an astronomical telescope are double convex lenses with refractive index 1.5. When the telescope is adjusted to infinity, the separation between the two lenses is 16 cm. If the space between the lenses is now filled with water and again telescope is adjusted for infinity, then the present separation between the lenses is

A. 8 cm

B. 16 cm

C. 24 cm

D. 32 cm

Answer: D

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10. The dispersive powers of the materials of two lenses forming an achromatic combination are in the ratio of $4:3$. Effective focal length of the two lenses is + 60 cm then the focal lengths of the lenses should be

A. -20 cm, 25 cm

B. 20 cm,- 25 cm

C. -15 cm, 20 cm

D. 15 cm,- 20 cm

Answer: D

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11. The focal length of a lens of dispersive power 0.45 which should be placed in contact with a convex lens of focal length 84 cm and

dispersive power 0.21 to make the achromatic combination from the two lenses, in cm is

A. 45

B. 90

C. 180

D. -180

Answer: D

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12. Which of the following statements are true in the context of a Compound Microscope?

(A) Each lens produces a virtual and inverted image

(B) The objective has a very short focal length

(C) The eyepiece is used as a simple magnifying glass

(D) The objective and eyepiece are convex and concave lenses respectively

A. (A),(B)and(D)

B. (B)and(C)

C. (A),(C)and(D)

D. (B)and(D)

Answer: B

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13. A ray of light refracts from medium 1 into a thin layer of medium 2, crosses the layer and is incident at the critical angle on the interface between the medium 2 and 3 as shown in the figure. If the angle of incidence of ray is θ, the

value of θ is

A. $\sin^{-1}\left(\frac{8}{9}\right)$

B. $\sin^{-1}\left(\frac{13}{18}\right)$

C. $\sin^{-1}\left(\frac{13}{16}\right)$

D. $\sin^{-1}\left(\frac{8}{13}\right)$

Answer: C

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14. A ray of light passes through an equilateral prism such that the angle of incidence is equal to the angle of emergence and each one is equal to 3/4 times the angle of prism. The angle of deviation is

A. 45°

B. 39°

C. 20°

D. 30°

Answer: D

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15. The two lenses of an achromatic doublet should have

A. Equal powers

B. Equal dispersive powers

C. Equal ratio oftheir power and dispersive power

D. Sum of the product of their powers and dispersive power equal to zero

Answer: D

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16. The refractive index of a material of a plano-concave lens is $\frac{5}{3}$, the radius of curvature is 0.3 m. The focal length of the lens in air is

A. -0.45 m

B. -0.45 m

C. -0.75 m

D. -1.0 m

Answer: A

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17. Statement (S): Using Huygen's eyepiece measurement can be taken but are not correct.

Reason (R): The cross wires, scale and final image are not magnified proportionately because the image of the object is magnified

by two lenses, whereas the cross wire scale is magnified by one lens only.

A. Both S and R are true, R explains S

B. Both S and R are true, R explains S

C. Only S is correct, but R is wrong

D. Both S and R are wrong

Answer: A

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18. An achromatic combination of lenses produces

A. Images in black and white

B. Coloured images

C. images unaffected by variation of refractive index with wavelength

D. Highly enlarged images are formed

Answer: C

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19. Match the following columns.

A. I-(iii) 2-(i) 3-(ii) 4-(iv)

B. I-(iii) 2-(ii) 3-(i) 4-(iv)

C. I-(ii) 2-(iii) 3-(i) 4-(iv)

D. I-(ii) 2-(i) 3-(iii) 4-(iv)

Answer: D

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20. The refractive index of the material ofa double convex lens is 1.5 and its focal length is 5 cm. If the radii of curvature are equal, the value of the radius of curvature (in cm) is

A. 5

B. 6.5

C. 8

D. 9.5

Answer: A

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21. In Ramsden eyepiece, the two planoconvex lenses each of focal length f are separated by a distance 12 cm. The equivalent focal length (in cm) of the eyepiece is

A. 10.5

B. 12

C. 13.5

D. 15.5

Answer: C

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22. The two surfaces of a 1 biconvex lens has same radii of curvatures. This lens is made of glass of refractive index 1.5 and has a focal length 10 cm in air. The lens is cut into two equal halves along a plane perpendicular to its principal axis to yield two plano-convex lenses. The two pieces are glued such that combination lens is immersed in water

(refractive index = $\frac{4}{3}$), its focal length (in cm) is

A. 5

B. 10

C. 20

D. 40

Answer: D

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23. Dispersive power depends on the following

A. Material of the prism

B. Shape of the prism

C. Size of the prism

D. Size, shape and material of the prism

Answer: A

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24. Assertion (A): Propagation of light through an optical fibre is due to total internal reflection taking place at the core-clad interface. Reason (R): Refractive index of the material of the core of the optical fibre is greater than that of air.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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25. The focal length of an equi-convex lens is greater than the radius of curvature of any of the surfaces. Then, the refractive index of the material of the lens is

A. Greater than zero but less than 1.5

B. Greater than 1.5 but less than 2.0

C. Greater than 2.0 but less than 2.5

D. Greater than 2.5 but less than 2.0

Answer: A

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26. Assertion (A): Optical fibres are widely used in communication network.

Reason (R): Optical fibres are small in size, lite

weight, flexible and there is no scope for interference in them.

A. Both (A) and (R) are true and (R) is not the correct explanation of (A)

B. Both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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27. The refiracting angle of a prism is A and the refractive index of the material of the prism is $\cot\left(\frac{A}{2}\right)$. The angle of minimum deviation of the prism is .

A. $\pi + 2A$

B. $\pi - 2A$

C. $\frac{\pi}{2} + A$

D. $\frac{\pi}{2} - A$

Answer: B

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28. The principal section of a glass prism is an isosceles triangle ABC with AB = AC. The face AC is silvered. A ray of light is incident normally on the face AB and after two reflections, it emerges from the base BC perpendicular to the base. Angle BAC of the prism' is

A. 30°

B. 36°

C. 60°

D. 60°

Answer: B

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29. A ray of light is incident on the hypotenuse of a right angled prism after travelling parallel to the base inside the prism. If μ is the refractive index of the material of the prism, the maximum value of the base angle for

which light is totally reflected from the hypotenuse is

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

B. $\tan^{-1}\left(\frac{1}{\mu}\right)$

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

D. $\cos^{-1}\left(\frac{1}{\mu}\right)$

Answer: D

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

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

B. $\sin^{-1}\sqrt{\frac{\mu-1}{2}}$

C. $2\cos^{-1}\left(\frac{\mu}{2}\right)$

D. $\cos^{-1}\left(\frac{\mu}{2}\right)$

Answer: C

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31. Consider the following statements A and B. Identify the correct choice in the given answer

A. The refractive index of the extraordinary ray depends on the angle of incidence in the double refraction.

B. The vibration of light waves acquire one sided ness of both ordinary and extraordinary rays in double refraction.

A. A and B are wrong

B. A and B are correct

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: B

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32. A convex lens of focal length 0.15 m is made of material of refractive index $\frac{3}{2}$, When it is place4 in a liquid, its focal length is increased by 0.225 m. The refractive index of the liquid is

A. $\frac{7}{4}$

B. $\frac{5}{4}$

C. $\frac{9}{4}$

D. $\frac{3}{2}$

Answer: B

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33. A prism is made up of material of refractive index 'sqrt(3)' . The angle of the prism is A. If

the angle of minimum deviation is equal to angle of the prism, then the value of A is

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C

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34. The difference in the number of wavelengths, when yellow light propagates through air and vacuum columns of the same thickness is one. The thickness of the air column is

Refractive index of air $\mu_c = 1.0003$, wavelength of yellow light in vacuum = 6000 A

A. 2 mm

B. 2 mm

C. 2 cm

D. 2.2 cm

Answer: B

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35. When a glass prism of refracting angle 60° is immersed in a liquid its angle of minimum deviation is 30°. The critical angle of glass with respect to the liquid medium is

A. 42°

B. 45°

C. 50°

D. 52°

Answer: B

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36. One face of the glass prism is silver polished. A light ray falls at an angle of 45° on the other face. After reflection it is subsequently reflected from the silvered face

and then retraces its path. The refracting angle of prism is 30°. The refractive index of the prism is

A. $\frac{3}{2}$

B. $\sqrt{2}$

C. $\frac{\sqrt{3}}{2}$

D. $\sqrt{3}$

Answer: B

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37. In the visible region the dispersive powers and the mean angular deviations for crown and flint glass prisms are $\omega, \omega^{'}$ and d, $d^{'}$ respectively. The condition of getting dispersion with zero deviation, when the two prisms are combined is

A. $\sqrt{\omega d} + \sqrt{\omega^{'} d^{'}} = 0$

B. $\omega^{'} d + \omega d^{'} = 0$

C. $\omega d + \omega^{'} d^{'} = 0$

D. $\omega d + \omega^{'} d^{'} = 0$

Answer: C

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38. Under minimum deviation condition in a prism, if a ray is incident at an angle of 30°. The angle between the emergent ray and the second refracting surface of the prism is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: D

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39. Consider the following statements A and B, identify the correct choice in the given answers

A. Lines 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

Answer: D

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40. In a compound microscope cross wires are fixed at the point

A. Where the image is formed by the objective

B. Where the image is formed by the eye-piece

C. Where the focal point of objective lies

D. Where the focal point of eye-piece lies

Answer: A

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41. The focal length of the lenses of an astronomical telescope are 50 cm and 5 cm. The length of the telescope when the image is formed at the least distance of distinct vision is

A. 45 cm

B. 55 cm

C. $\frac{275}{6}$cm

D. $\frac{325}{6}cm$

Answer: D

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42. The final image in an astronomical telescope is

A. Real, erect

B. Virtual, inverted

C. Real, inverted

D. None of these

Answer: B

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43. The least distance of distinct vision is 25 cm. If the focal length of convex lens is 10 cm, it acts as a simple microscope of maximum magnification.

A. 2.5

B. 3

C. 3.5

D. 5

Answer: C

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44. In a Huygen's eye-piece, with an eye-piece of focal length F, the distance between the eye-piece and field lens should be

A. $\frac{2}{3}F$

B. F

C. 2F

D. 3F

Answer: C

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45. In a spectrometer experiment three prisms A, B and C with same angle of prism but of different 3F materials of refractive indices $\mu_A = 1.33, \mu_B = 1.55, \mu_C = 1.44$ are used. The corresponding angles of minimum deviation D_A, D_B, D_C measured will be such that

A. $D_A > D_B > D_C$

B. $D_A < D_B < D_C$

C. $D_A > D_C > D_B$

D. None of these

Answer: C

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46. An object is placed 40 cm in front of a convex mirror of radius of curvature 20 cm. The image

A. Is real and 8 cm behind the mirror

B. Is real and 8 cm in front of the mirror

C. Is virtual and 8 cm in front of the mirror

D. Is virtual and 8 cm behind the mirror

Answer: D

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47. A compound microscope has an objective of focal length 4 mm and an eye-piece of focal length 25 mm. The objective produces a real

image at a distance of 180 mm. If the eye-piece is in normal adjustment the magnification is

A. 45

B. 90

C. 225

D. 440

Answer: D

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48. In the achromatic prism, we have

A. Deviation without dispersion

B. Deviation without division

C. Refraction without deviation

D. Deviation and dispersion

Answer: A

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49. Fraunhofer lines are due to

A. Absorption by chromosphere of the light emitted by photosphere

B. Absorption by photosphere of the light emitted by chromosphere

C. Light emitted by photosphere

D. Light emitted by chromosphere

Answer: A

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50. Which of the following statements is not true in the case of Huygen's eye-piece?

A. It is achromatic

B. It satisfies condition for minimum spherical aberration

C. It has cross wires

D. It cannot be used for measurement

Answer: D

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51. The dark lines in the solar spectrum are due to

A. Absorption of certain wavelengths by elements present in the outer layer

B. Absence of certain elements in the sun

C. Black body radiation from the sun

D. Scattering of light

Answer: A

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52. An incandescent filament emits a spectrum which is a

A. Line spectrum

B. Band spectrum

C. Continuous spectrum

D.

Answer: C

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53. Reflection of a light wave at a fixed point results in a phase difference between the incident and reflected wave of

A. $\frac{3\pi}{2} rad$

B. $2\pi rad$

C. $2\pi rad$

D. $\frac{\pi}{2} rad$

Answer: C

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54. In a Huygen's eye-piece the eye lens has a focal length of f, the equivalent focal length of eye-piece is

A. $\frac{4}{3}f$

B. 4f

C. 2f

D. $\frac{3f}{2}$

Answer: D

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55. An astronomical telescope has a length of 310 cm and a magnifying power of 30. The focal length of its objective is

A. 310 cm

B. 300 cm

C. 155 cm

D. 150 cm

Answer: B

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56. If $\hat{i}$ denotes a unit vector along incident light ray, $\hat{i}$ a unit vector along refracted ray into medium of refracted ray into medium of refractive index p and n is vector normal to boundary of media directed towards incident medium, then the law of refraction can be written as

A. $\hat{i}.\hat{n} = \mu(\hat{r}.\hat{n})$

B. $\hat{i} \times \hat{n} = \mu(\hat{n} \times \hat{r})$

C. $\hat{i} \times \hat{n} = \mu(\hat{r} \times \hat{n})$

D. $\mu\left(\hat{i} \times \hat{n}\right) = \hat{r} \times \hat{n}$

Answer: C

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57. In- an equilateral triangular prism, the angle of minimum deviation for a certain wavelength is 40°. The corresponding angle of incidence is

A. 30°

B. 60°

C. 45°

D. 50°

Answer: D

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58. The least distance of distinct vision is 25 cm. The magnifying power of a simple microscope of focal length 5 cm is

A.) $\frac{1}{5}$

B. 5

C. $\frac{1}{6}$

D. 6

Answer: D

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59. Which of the following wavelength is in the infrared region?

A. 5460 $\overset{0}{A}$

B. 5893 $\overset{0}{A}$

C. 4320 $\overset{0}{A}$

D. 7000 $\overset{0}{A}$

Answer: D

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60. If Foucoult's method for determining the velocity of light in air, the distance between the concave mirror and the rotating mirror

was 5 km. The speed of rotation of the rotating mirror was $300 rev/s$. If the reflected ray is displaced through $\frac{\pi}{60}$ radian, the velocity of light in air

A. $3 \times 10^3 km/s$

B. $2.98 \times 10^3 km/s$

C. $3 \times 10^3 km/s$

D. None of these

Answer: D

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61. A hollow prism made of transparent glass is filled with a transparent liquid. The angle between the two refracting faces of the prism is 90°. If light incident on one of the faces at grazing angle comes out of the other also at a grazing angle, the refractive index of the liquid is

A. 1.414

B. 1.333

C. 1.35

D. 1.4

Answer: A

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62. In a Ramsden eyepiece of effective focal length 3 cm the focal length of eye lens, in cm, is

A. 1.5

B. $8/3$

C. 3

D. 4

Answer: D

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63. The angle of a prism is 60^{o} and the angle of minimum deviation of light passing through it is observed to be $40\hat{}\circ$. The angle of incidence of light is

A. 30 ^ ∘

B. 40 ^ ∘

C. 50 ^ ∘

D. 60 ^ ∘

Answer: C

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64. An astronomical telescope of magnifying power 12, has an objective of focal length 1.08 m. The focal length of its eyepiece will be

A. 0.08 m

B. 0.09 m

C. 0.07 m

D. 0.06 m

Answer: B

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65. Two lenses of focal lengths 75 cm and 25 cm will form a combination satisfying the conditions for no chromatic aberration and

minimum spherical aberration. When they are placed with a distance of separation

A. 100 cm

B. 50 cm

C. 25 cm

D. 12 cm

Answer: B

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66. If p for water is $4/3$ and the velocity of light in vacuum is $3 \times 10^8 m/s$, the time taken for light to travel a distance of 450 m in water will be

A. $2 \times 10^{-6} m/s$

B. $1 \times 10^{-6} m/s$

C. $0.5 \times 10^{-6} m/s$

D. $2 \times 10^{-4} m/s$

Answer: A

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67. In Foucoult's method of determining the velocity of light, the distance between the rotating mirror and the concave mirror is made to pass along a tube of water ($\mu = 1.33$) instead of air, the displacement is

A. $\frac{t}{1.33}$

B. 1.331

C. $(1.33)^2 t$

D. $1.33t^2$

Answer: B

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68. In an astronomical telescope the distance between the eye-piece and the objective is

A. f_0

B. 'f(e)'

C. $f_0 - f_e$

D. $f_0 + f_e$

Answer: D

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69. If c is velocity of light in free space, the time taken by the light to travel a distance x in a medium of refractive index μ is given by

A. $\mu x c$

B. $\frac{\mu x}{c}$

C. $\frac{\mu c}{x}$

D. $\frac{x}{\mu}$

Answer: B

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70. A double convex lens of f = 6 cm is made of glass of refractive index 1.5. The radius of curvature of the surface which is double that of other surface will be

A. 1.5 cm

B. 2.5 cm

C. 3.5 cm

D. 4.5 cm

Answer: D

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71. To minimize spherical aberration two lenses of focal lengths f_1 and f_2 are placed with a distance of separation equal to

A. f_2

B. f_1

C. $f_2 - f_1$

D. $f_2 + f_1$

Answer: C

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72. The distance between the eye lens and cross wire in a Ramsden eye-piece, which has a field lens of focal length 1.2 cm is

A. 0.3 cm

B. 0.6 cm

C. 0.7 cm

D. 0.9 cm

Answer: A

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