JEE MAIN : CHAPTER WISE TEST PAPER-7

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 12th **NAME.....**
CHAPTER :- RAY OPTICS **SECTION.....**

(SECTION-A)

1. It is desired to photograph the image of an object placed at a distance of 3 m from a plane mirror. The camera, which is at a distance of 4.5 m from the mirror should be focused for a distance of-
(A) 3 m (B) 4.5 m
(C) 6 m (D) 7.5 m

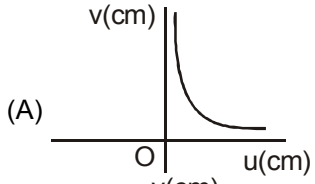
2. A convex lens of focal length f produces a virtual image n times the size of the object. Then the distance of the object from the lens is-
(A) $\frac{n-1}{n}f$ (B) $\frac{n+1}{n}f$
(C) $\frac{f}{n}$ (D) $\frac{n}{n-1}f$

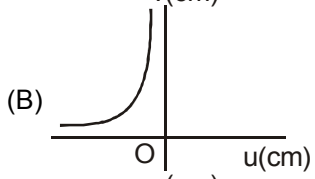
3. The focal length of a convex lens made from a material of refractive index 1.52 is 10 cm when placed in air. If it is immersed in carbon disulphide of refractive index 1.68, then its focal length and nature will be –
(A) + 36.4 cm, convex lens.
(B) – 36.4 cm, concave lens.
(C) + 54.6 cm, convex lens.
(D) – 54.6 cm, concave lens.

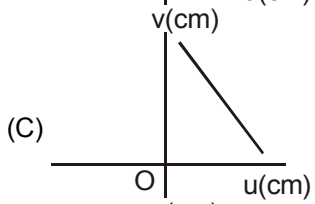
4. A point object is kept between a plane mirror and a concave mirror facing each other. The distance between the mirrors is 22.5 cm. Plane mirror is placed perpendicular to principal axis of concave mirror. The radius of curvature of the concave mirror is 20 cm. What should be the distance of the object from the concave mirror so that after two successive reflections the final image is formed on the object itself ?
(Consider first reflection from concave mirror)
(A) 5 cm (B) 15 cm
(C) 10 cm (D) 7.5 cm

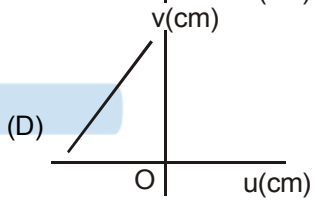
5. An achromatic convergent doublet of two lenses in contact has a power of + 2D. The convex lens has power + 5 D. What is the ratio of the dispersive powers of the convergent and divergent lenses ?
(A) 2 : 5 (B) 3 : 5 (C) 5 : 2 (D) 5 : 3

6. 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 -

(A)


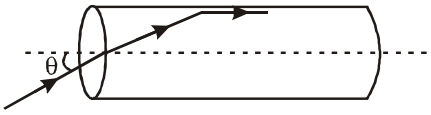
(B)


(C)


(D)


7. An astronomical telescope has a large aperture to
(A) reduce spherical aberration
(B) have high resolution
(C) increase span of observation
(D) have low dispersion

8. 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:
(A) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (B) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$
(C) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (D) $\sin^{-1}\left(\frac{1}{2}\right)$

9. 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:
(A) 10 times nearer (B) 20 times taller
(C) 20 times nearer (D) 10 times taller

10. In an experiment for determination of refractive index of glass of a prism by i – δ, 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 ?

(A) 1.6 (B) 1.7 (C) 1.8 (D) 1.5

11. Diameter of a plano - convex lens is 6 cm and thickness at the centre is 3 mm. If speed of light in material of lens is 2×10^8 m/s, the focal length of the lens is :

(A) 15 cm (B) 20 cm
(C) 30 cm (D) 10 cm

12. Light rays from a very distant source travel along the +x direction. Two identical thin lenses with focal length f > 0 and their optical axis along x. sit, one at x = 0 and the other at x =d < f. The rays focus at x is equals to-

(A) $d+\frac{f(f-d)}{2f-d}$ (B) $d+\frac{f(f-d)}{d}$

(C) $d+\frac{f(f-d)}{2(f+d)}$ (D) $d+\frac{f^2}{2(f-d)}$

13. It is necessary to illuminate the bottom of a well by reflected solar beam when the light is incident at an angle of α = 40° to the vertical. At what angle β to the horizontal should a plane mirror be placed?

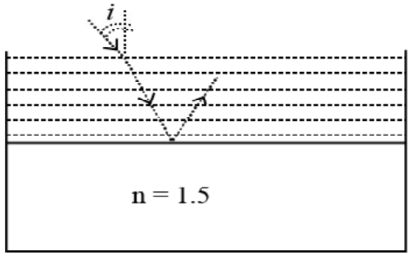
(A) 70° (B) 20° (C) 50° (D) 40°

14. In case of concave mirror, if the distance of object from the focus and distance of image from the focus are a and b respectively, then focal length of the mirror is.

(A) $\frac{a+b}{2}$ (B) $\frac{ab}{a-b}$

(C) $\frac{ab}{a+b}$ (D) $\sqrt{ab}$

15. Consider a tank made fo glass (refractive index 1.5) with a thick bottom. It is filled with a liquid of refractive index μ, A student finds that, irrespective of what the incident angle i (see figure) is for a beam of light entring the liquid, the light reflected from the liquid glass interface is never completely polarized. For this to happen. the minimum value of μ is:



(A) $\frac{3}{\sqrt{5}}$ (B) $\frac{5}{\sqrt{3}}$ (C) $\sqrt{\frac{5}{3}}$ (D) $\frac{4}{3}$

16. Calculate the limit of resolution of a telescope objective having a diameter of 200 cm, If it has to detect light of wavelength 500 nm coming from a star.

(A) 610×10^{-9} radian (B) 152.5×10^{-9} radian
(C) 457.5×10^{-9} radian (D) 305×10^{-9} radian

17. A real image is formed by a convex lens, then it is connected with a concave lens, again the real image is formed. This will -

(A) shift towards the lens system
(B) shift away from the lens system
(C) remain in its original position
(D) shift to infinity.

18. A plano - convex lens placed in air has curved surface having radius of curvature 60 cm and it is made of material of refractive index 1.5 When the convex surface is silvered, the system will work as a concave mirror of focal length.

(A) 20 cm (B) 24 cm
(C) 30 cm (D) 15 cm

19. A camera lens with a focal length of 5.5 cm is used to take the picture of a person 1.68 m tall. What is the person's distance from the lens, if the image just fills the 24 mm vertical dimension of the film?

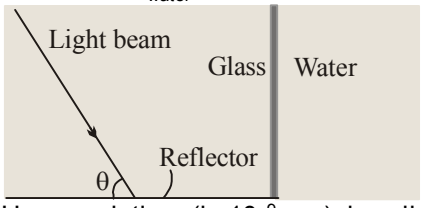
(A) 2.4 m (B) 5.6
(C) 3.9 m (D) 1.6 m

20. curvature of this surface is equal to that of the cornea (7.8 mm). This surgace separates two media of refractive indices 1 and 1.34. Calculate the distance from the refaracting surface at which a parallel beam of light will came to focus.

(A) 4.0 cm (B) 1 cm
(C) 3.1 cm (D) 2 cm

(SECTION-B)

21. A large cube of glass has a metal reflector on one face and water on an adjoining face figure. A light beam strikes the reflector, as shown. You observe that as you gradually increase the angle of the light beam, if $\theta \geq 60°$ no light enters the water. (n_{water} = 4/3)

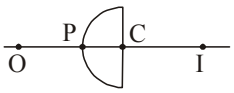


How much time (in 10^{-9} sec) does light take to travel $\frac{9\sqrt{3}}{10}$ m in this glass ?

22. The focal length of quartz lens for yellow color is 15.5 cm for which refractive index of quartz is 1.504. Find the focal length of same lens (in cm) for ultraviolet color for which refractive index is 1.434.

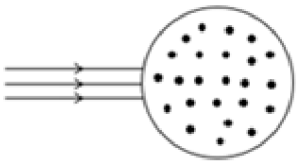
23. A convex lens is placed between a fixed object and a fixed screen. The distance between the object and screen is 1 m. The real images of the object are formed on the screen for two successive positions separated by a distance of 60 cm. Find the focal length of the lens.

24. A point object is placed at 6cm to the left of point P. The final image is formed at $\frac{32}{3}$ cm to right of point C. The hemisphere is made of glass (μ = 1.5). Find it's radius (in cm).



25. A glass cube is held just above a newspaper, which rests on a table. A person reads all of the words the cube covers, through one vertical side. Determine the maximum possible index of refraction of the glass. Fill n^2 in OMR sheet.

26. A parallel beam of light is allowed to fall on a transparent spherical globe of diameter 30 cm and refractive index 1.5. The distance from the center of the globe at which the beam of light can converge is _____mm.



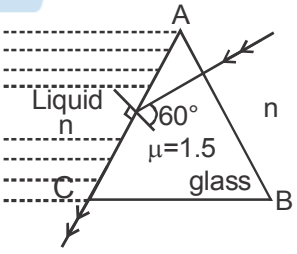
27. A fish rising vertically upward with a uniform velocity of 8 ms^{-1}, observes that a bird is diving vertically downward towards the fish with the velocity of 12 ms^{-1}. If the refractive index of water is $\frac{4}{3}$, then the actual velocity of the diving bird to pick the fish, will be _____ms^{-1}.

28. The refractive index of a transparent liquid filled in an equilateral hollow prism is $\sqrt{2}$. The angle of minimum deviation for the liquid will be_____°.

29. In the given figure, the face AC of the equilateral prism is immersed in a liquid of refractive index 'n'. For incident angle 60° at the side AC, the refracted light beam just grazes along face AC.

The refractive index of the liquid $n = \frac{\sqrt{x}}{4}$. The value 4 of x is _____.

(Given refractive index of glass = 1.5)



30. An object 'o' is placed at a distance of 100 cm in front of a concave mirror of radius of curvature 200 cm as shown in the figure. The object starts moving towards the mirror at a speed 2 cm/s. The position of the image from the mirror after 10s will be at..... cm.