Udupi

CET25P9 RAY OPTICS AND OPTICAL INSTRUMENTS

Class 12 - Physics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 75**

1. When a ray of light enters a glass slab from air, **[1]**

   a) its wavelength decreases
   b) neither wavelength nor frequency changes
   c) its wavelength increases
   d) its frequency increases

2. If the focal length of objective lens is increased then magnifying power of **[1]**

   a) Microscope will decrease but that of telescope will increase.
   b) Microscope and telescope both will decrease.
   c) Microscope and telescope both will increase.
   d) Microscope will increase but that of telescope decrease.

3. To print a photograph from a negative, the time of exposure to light from a lamp placed 60 cm away is 2.5 s. What exposure time is required if the lamp is placed 1.2 m away? **[1]**

   a) 5 s
   b) 10 s
   c) 15 s
   d) 20 s

4. Which of the following pairs of media has the least value of critical angle? **[1]**

   a) Glass to air
   b) Glass to water
   c) Diamond to water
   d) Diamond to air

5. The focal length (f) of spherical mirror of radius curvature R is: **[1]**

   a) $\frac{3}{2R}$
   b) 2R
   c) R
   d) $\frac{R}{2}$

6. A lamp and a screen are set up 100 cm apart and a convex lens is placed between them. The two positions of the lens forming real images on the screen are 40 cm apart. What is the focal length of the lens? **[1]**

   a) 15 cm
   b) 21 cm
   c) 18 cm
   d) 12 cm

7. According to Cartesian sign convention, distances measured in the same direction as the **[1]**

   a) incident light is taken as negative
   b) reflected/refracted ray is taken as negative
   c) incident light is taken as positive
   d) reflected/refracted ray is taken as positive

8. An equi-convex crown glass lens has a focal length 20 cm for violet rays. Here $\mu_v = 1.5$ & $\mu_r = 1.47$. Its focal length for red rays is **[1]**

   a) 24.85 cm
   b) 20.82 cm
   c) 21.28 cm
   d) 22.85 cm

9. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its **[1]**

focal length will:

a) Become infinite
b) Become zero
c) Reduce
d) Remain same as in air

10. A convex crown glass lens (μ_g = 1.5) has a focal length of 8 cm when placed in air. What is the focal length of the lens when it is immersed in water ($\mu_w = 4/3$)? **[1]**

a) 32 cm
b) 16 cm
c) 8 cm
d) 4 cm

11. A telescope has an objective of focal length 100 cm and an eye-piece of focal length 5 cm. What is the magnifying power of the telescope when it is in normal adjustment? **[1]**

a) 20.0
b) 2.0
c) 0.2
d) 200

12. If an object is placed unsymmetrically between two plane mirrors inclined at 70°, then the total number of images formed is **[1]**

a) 1
b) 5
c) 4
d) 3

13. The wavelength of light in air is 6000 $\mathring{A}$ and in medium its value is 4000 $\mathring{A}$. It means that the refractive index of that medium with respect to air is **[1]**

a) 1.2
b) 2.4
c) 0.66
d) 1.5

14. A biconvex lens of glass having refractive index 1.47 is immersed in a liquid. It becomes invisible and behaves as a plane glass plate. The refractive index of the liquid is **[1]**

a) 1.33
b) 1.62
c) 1.51
d) 1.47

15. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5, the angle of incidence is **[1]**

a) 7.5°
b) 2.5°
c) 5°
d) 15°

16. Magnifying power of a microscope depends on **[1]**

a) focal length of eyepiece and objective.
b) colour of light.
c) focal length of objective and color of light.
d) focal length of eyepiece and color of light.

17. Magnifying power of a compound microscope is high if **[1]**

a) the objective has a short focal length and the eye-piece has a long focal
b) the objective has a long focal length and eye-piece has a short focal
c) both objective and eye-piece have long focal lengths
d) both objective and eye-piece have short focal lengths

18. A ray of light travels a distance of 12.0 m in a transparent sheet in 60 ns. The refractive index of the sheet is **[1]**

a) 1.33 b) 1.75

c) 1.50 d) 1.65

19. Which of the following principle is used in optical fibre? **[1]**

a) Total internal reflection b) Scattering

c) Interference d) Diffraction

20. The focal length of a concave mirror is f. An object is placed at a distance x from the focus. The magnification is **[1]**

a) $\frac{f}{(f+x)}$ b) $\frac{(f+x)}{f}$

c) $\frac{f}{x}$ d) $\frac{x}{f}$

21. For a glass prism, the angle of minimum deviation will be smallest for the light of **[1]**

a) blue colour b) yellow colour

c) green colour d) red colour.

22. The frequency of light in a material is 2×10^{14} Hz and wavelength is 5,000 $\mathring{A}$. The refractive index of the material will be **[1]**

a) $1 \cdot 40$ b) $3 \cdot 00$

c) $1 \cdot 50$ d) $1 \cdot 33$

23. The largest telescope in the world has a reflector with an aperture of 200 inches in order to achieve **[1]**

a) low dispersive power b) least spherical aberration

c) high resolving power d) high accommodation power

24. The magnifying power of the telescope can be increased by **[1]**

a) fitting eye-piece of high power b) fitting eye-piece of low power

c) increasing the focal length of eyepiece d) increasing the distance of an object

25. For a concave mirror of focal length **f**, the minimum distance between the object and its real image is: **[1]**

a) f b) 2f

c) zero d) 4f

26. Reflecting telescope utilizes **[1]**

a) Convex mirror b) Concave mirror

c) Prism d) Both Convex mirror and Concave mirror

27. A microscope is focused on a mark. Then a glass slab of refractive index 1.5 and thickness 6 cm is placed on the mark. To get the mark again in focus the microscope should be moved **[1]**

a) 9 cm upward b) 2 cm downward

c) 4 cm upward d) 2 cm upward

28. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen, then **[1]**

a) no image will be formed b) complete image will be formed

c) intensity of the image will increase d) half the image will disappear

29. The minimum distance between an object and its real image formed by a convex lens of focal length f is: **[1]**

a) 4f

b) f

c) 2f

d) 3f

30. A biconvex lens of focal length f is cut into two identical plano convex lenses. The focal length of each part will be **[1]**

a) 2f

b) $\frac{f}{2}$

c) 4f

d) f

31. The phenomena involved in the reflection of radiowaves by ionosphere is similar to **[1]**

a) total internal reflection of light in the air during a mirage

b) dispersion of light by water molecules during the formation of a rainbow

c) scattering of light by the particles of air

d) reflection of light by a plane mirror

32. A beam of monochromatic light is refracted from vacuum into a medium of refractive index $1 \cdot 5$. The wavelength of refracted light will be **[1]**

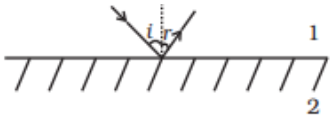
a) smaller

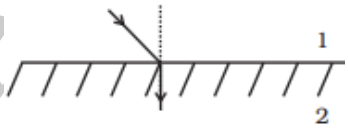
b) same

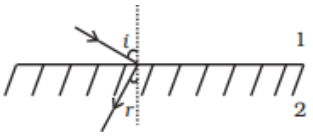
c) dependent on intensity of refracted light

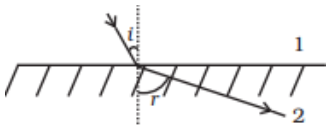
d) larger

33. There are certain material developed in laboratories which have a negative refractive index Figure. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by **[1]**

a) 

b) 

c) 

d) 

34. The diameter of a plano-convex lens is 6 cm and the thickness at the centre is 3 mm. If the speed of light in the material of the lens is $2 \times 10^8 \text{ms}^{-1}$, the focal length of the lens is **[1]**

a) 15 cm

b) 30 cm

c) 20 cm

d) 10 cm

35. To get three images of a single object, one should have two plain mirrors at an angle of **[1]**

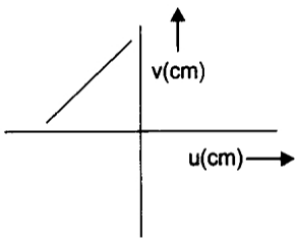
a) 90°

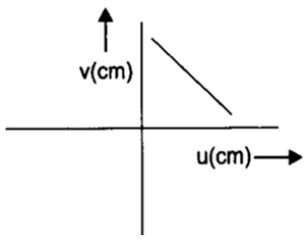
b) 120°

c) 30°

d) 60°

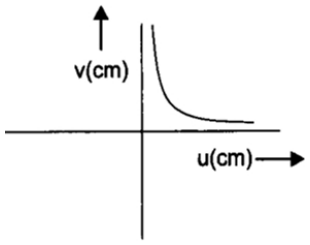
36. A student measures the focal length of a convex lens by putting an object pin at a distance **u** from the lens and measuring the distance **v** of the image pin. The graph between **u** and **v** plotted by the student should look like **[1]**

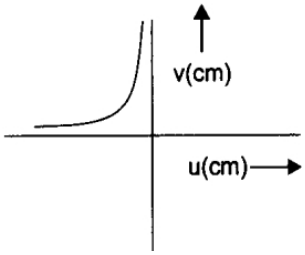
a) 

b) 

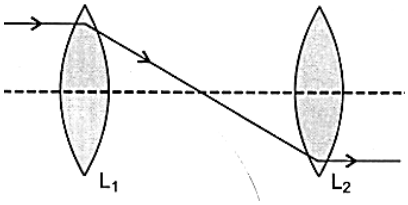
c)

d)





37. In the figure given below there are two convex lenses L_1 and L_2 having focal lengths F_1 and F_2 respectively. The distance between L_1 and L_2 will be: **[1]**



a) F_1

b) $F_1 + F_2$

c) $F_1 - F_2$

d) F_2

38. The magnifying power of telescope is high if **[1]**

a) the objective has a long focal length and the eye-piece has a short focal length

b) both objective and eye-piece have short focal lengths

c) the objective has a short focal length and the eye-piece has a long focal length

d) both objective and eye-piece have long focal length

39. The relationship between angle of incidence i, prism of angle A and angle of minimum deviation for a triangular prism is **[1]**

a) $A + \delta_m = 2i$

b) $A + \frac{\delta_m}{2} = i$

c) $A + \delta_m = i$

d) $2A + \delta_m = i$

40. The objective of a telescope has a focal length of 1.2 m. It is used to view a 10.0 m tall tower 2 km away. What is the height of the image of the tower formed by the objective? **[1]**

a) 4 mm

b) 2 mm

c) 6 mm

d) 8 mm

41. The radius of curvature of the curved surface of a plano-convex lens is 20 cm. If the refractive index of the material of the lens be 1.5, it will **[1]**

a) act as a concave lens irrespective of side on which the object lies

b) act as a convex lens only for the objects that lie on its curved side

c) act as a concave lens for the objects that lie on its curved side

d) act as a convex lens irrespective of the side on which the object lies

42. The ratio of angle of minimum deviation for a thin prism with respect to air and when dipped in water will be: **[1]**
$\left(a\mu_g = \frac{3}{2}; a\mu_w = \frac{4}{3}\right)$

a) $\frac{1}{4}$

b) $\frac{1}{2}$

c) $\frac{1}{3}$

d) $\frac{1}{8}$

43. Green light of wavelength 5,460 $\mathring{A}$ is incident on an air-glass interface. If the refractive index of glass is $1 \cdot 5$, **[1]**

the wavelength of light in glass would be (Given that the velocity of light in air, $c = 3 \times 10^8$ m s^{-1})

a) 6731 $\mathring{A}$

b) 3,640 $\mathring{A}$

c) 5,460 $\mathring{A}$

d) 4,861 $\mathring{A}$

44. Which of the following is not due to total internal reflection? **[1]**

a) Difference between apparent and real depth of a pond

b) Mirage on hot summer days

c) Brilliance of diamond

d) Working of optical fibre

45. An observer looks at a tree of height 15 metre with a telescope of magnifying power 10. To him, the tree appears **[1]**

a) 10 times taller

b) 15 times nearer

c) 10 times nearer

d) 15 times taller

46. Radius of curvature of human eye is 0.78 cm. For an object at infinity, image is formed at 3 cm behind the refracting surface. The refractive index of eye is **[1]**

a) 6.2

b) 3

c) 1.35

d) 1

47. An astronomical telescope of ten fold angular magnification has a length of 44 cm. The focal length of the objective is **[1]**

a) 44 cm

b) 440 cm

c) 4 cm

d) 40 cm

48. When a wave undergoes reflection at an interface from rarer to denser medium, change in its phase is: **[1]**

a) π

b) $\frac{\pi}{4}$

c) 0

d) $\frac{\pi}{2}$

49. When an object is placed between f and 2f of a concave mirror, the image formed is **[1]**

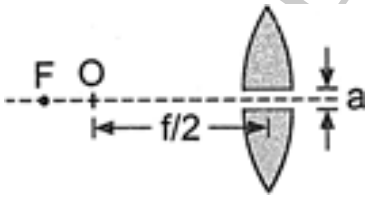
a) Real, diminished

b) Virtual, magnified

c) Real, magnified

d) Virtual, diminished

50. A split lens has its two parts separated by a and its focal length is f. An object O is placed at a distance $\frac{f}{2}$ on the axis of the undivided lens. The distance between the virtual source is: **[1]**



a) a

b) $\frac{a}{f}$

c) $\frac{1}{2}$af

d) $\frac{2a}{f}$

51. The layered lens is made of two kinds of glass. A point source of light is placed on its principal axis. If the reflections from the boundaries between layers are ignored, the lens will form **[1]**

a) no image at all

b) two images

c) infinite images

d) only one image

52. Refractive index of water is $\frac{b}{3}$. A light source is placed in water at a depth of 4 m. Then what must be the minimum radius of disc placed at water surface so that the light of source can be stopped **[1]**

a) 3 m
b) 4 m
c) 5 m
d) infinite

53. A bird flies down vertically towards a water surface. To a fish inside the water, vertically below the bird, the bird will appear to **[1]**

a) move faster than its actual speed
b) be at its actual distance
c) move slower than its actual speed
d) be closer than its actual distance

54. In two positions concave mirror produces magnified image of given object The positions are **[1]**

a) (i) Beyond C, (ii) Between P and F
b) (i) At C, (ii) at F
c) (i) At C, (ii) between P and F
d) (i) Between F and C, (ii) Between P and F

55. A diver in a swimming pool wants to signal his distress to a person lying on the edge of the pool by flashing his waterproof flash light. **[1]**

a) He must direct the beam vertically upward
b) He has to direct the beam at an angle to the vertical which is slightly less than the critical angle of incidence for total internal reflection
c) He has to direct the beam at an angle to the vertical which is slightly more than the critical angle of incidence for total internal reflection.
d) He has to direct the beam horizontally

56. A concave lens of glass, refractive index 1.5, has both surfaces of the same radius of curvature R. On immersion in a medium of refractive index 1.75, it will behave as a **[1]**

a) divergent lens of focal length 3.5 R
b) divergent lens of focal length 3.0 R
c) convergent lens of focal length 3.0 R
d) convergent lens of focal length 3.5 R

57. An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus. The image **[1]**

a) moves away from the lens with a uniform acceleration
b) moves away from the lens with a uniform speed 5 m/s
c) moves towards the lens with a non-uniform acceleration
d) moves away from the lens with a non-uniform acceleration

58. In a compound microscope, the intermediate image is: **[1]**

a) Virtual, inverted and magnified
b) Real, erect and magnified
c) Virtual, erect and magnified
d) Real, inverted and magnified

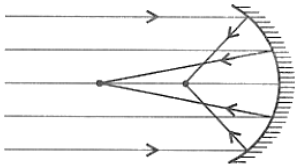
59. The principal behind optical fibre is: **[1]**

a) Total internal reflection
b) Both Total external reflection and Total internal reflection

c) Diffraction

d) Total external reflection

60. The disease in the mirror shown where paraxial and marginal rays do not meet at one point is called: **[1]**



a) coma

b) spherical aberration

c) astigmatism

d) chromatic aberration

61. A plano-convex lens is made of glass of refractive index 1.5.The focal length f of the lens and radius of curvature R of its curved face are related as **[1]**

a) $f = \frac{R}{2}$

b) f = R

c) f = 2R

d) $f = \frac{3}{2R}$

62. A telescope, when in normal adjustment, has a magnifying power of 6 and the objective and the eye-piece are 14 cm apart The focal lengths of the eye-piece and the objective respectively are **[1]**

a) 2 cm and 14 cm

b) 3 cm and 12 cm

c) 2 cm and 12 cm

d) 3 cm and 14 cm

63. The focal length of the objective of a compound microscope is **[1]**

a) greater than the focal length of eyepiece

b) equal to the length of its tube

c) equal to the focal length of eyepiece

d) lesser than the focal length of eyepiece

64. How will the image formed by a convex lens be affected if the central portion of the lens is wrapped in a black paper? **[1]**

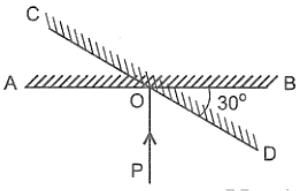
a) No image is formed by the remaining portion of the lens

b) Full image will be formed but will be less bright

c) Two images will be formed

d) Central portion of the image will be absent

65. Figure shows PO as the ray of light incident normally on the mirror AB. The mirror is then turned through 30° to the position CD. What will be the angle between the incident ray and the reflected ray? **[1]**



a) 120°

b) 30°

c) 15°

d) 60°

66. An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment, distances are measured by **[1]**

a) a metre scale provided on the microscope

b) a screw gauge provided on the microscope

c) a vernier scale provided on the microscope

d) a standard laboratory scale

67. A lens of power +2.0 D is placed in contact with another lens of power -1.0 D. The combination will behave like **[1]**

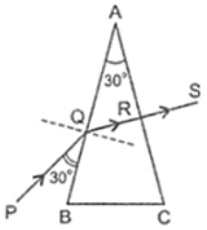
a) a converging lens of focal length 100 cm

b) a diverging lens of focal length 50 cm

c) a converging lens of focal length 50 cm

d) a diverging lens of focal length 100 cm

68. In the diagram, a prism of angle 30° is used. A ray PQ is incident as shown. An emergent ray RS emerges perpendicular to the second face. The angle of deviation is: **[1]**



a) 60^o

b) 0^o

c) 30^o

d) 45^o

69. The refractive index of glass is $1 \cdot 520$ for red light and $1 \cdot 525$ for blue light. $\delta_1 \; and \; \delta_2$ be angles of minimum deviation for red and blue light respectively in a prism of this glass, then **[1]**

a) $\delta_1 = \delta_2$

b) $\delta_1 < \delta_2$

c) δ_1 can be less than or greater than δ_2, depending upon the values of $\delta_1 \; and \; \delta_2$.

d) $\delta_1 > \delta_2$

70. A fish looking up through the water sees the outside world, contained in a circular horizon. If the refractive index of water is 4/3 and the fish is 12 cm below the water surface, the radius of this circle (in cm) is: **[1]**

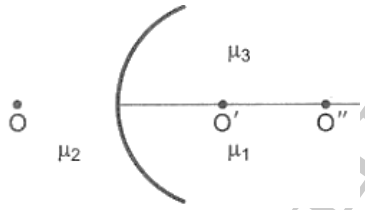
a) $36/\sqrt{7}$

b) $36\sqrt{5}$

c) $4\sqrt{5}$

d) $36\sqrt{7}$

71. Figure shows three transparent media of refractive indices μ_1, μ_2 and μ_3. A point object O is placed in the medium μ_2. If the entire medium on the right of the spherical surface has refractive index μ_1, the image forms at O'. If this entire medium has refractive index μ_3, the image forms at O''. In the situation shown in the figure given ahead: **[1]**



a) the image forms to the left of O'

b) two images form, one at O' and the other at O''

c) the image forms to the right of O''

d) the image forms between O' and O''

72. The graph drawn with object distance along abscissa & image as ordinate for a convex lens is **[1]**

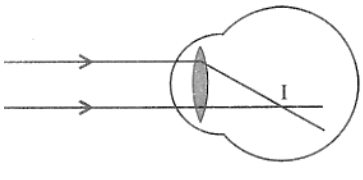
a) straight

b) circle

c) rectangular hyperbola

d) parabola

73. In the figure, the image is formed of retina. The eye has: **[1]**



Human eye

a) myopia

b) colour blindness

c) hypermetropia

d) astigmatism

74. Binoculars is preferred to a terrestrial telescope to observe a cricket match, because **[1]**

a) telescope has chromatic aberration

b) binoculars gives three dimensional view

c) telescope does not give erect image

d) binocular has shorter focal length

75. A thin convergent glass lens (μ_g = 1.5) has a power of +5.0 D. When this lens is immersed in a liquid of refractive index μ_1 it acts as a divergent lens of focal length 100 cm. The value of $\mu_1$must be **[1]**

a) $\frac{4}{3}$

b) $\frac{5}{3}$

c) $\frac{5}{4}$

d) $\frac{6}{5}$