1. A boy of height 1 m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is
   (a) 0.25 m (b) 0.33 m
   (c) 0.5 m (d) 0.67 m

2. A concave shaving mirror has a radius of curvature of 35.0 cm. It is positioned so that the (upright) image of a man's face is 2.50 times the size of the face. How far is the mirror from the face?
   (a) 5.25 cm (b) 21.0 cm
   (c) 10.5 cm (d) 42 cm

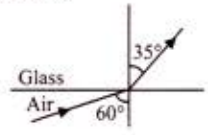
3. When an object is kept at a distance of 30 cm from a concave mirror, the image is formed at a distance of 10 cm. If the object is moved with a speed of 9 m s^{-1}, the speed with which image moves is
   (a) 10 m s^{-1} (b) 1 m s^{-1}
   (c) 9 m s^{-1} (d) 0.9 m s^{-1}

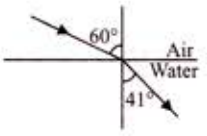
4. An object 2 cm high is placed at a distance of 16 cm from a concave mirror, which produces a real image 3 cm high. What is the focal length of the mirror?
   (a) –9.6 cm (b) –3.6 cm
   (c) –6.3 cm (d) –8.3 cm

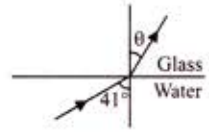
5. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is
   (a) 10 cm (b) 15 cm
   (c) 2.5 cm (d) 5 cm

6. The apparent depth of a needle lying at the bottom of the tank, which is filled with water of refractive index 1.33 to a height of 12.5 cm is measured by a microscope to be 9.4 cm. If water is replaced by a liquid of refractive index 1.63 upto the same height. What distance would the microscope have to be moved to focus on the needle again?
   (a) 1.73 cm (b) 2.13 cm
   (c) 1.5 cm (d) 2.9 cm

7. Refraction of light from air to glass and from air to water are shown in figure (i) and figure (ii) below. The value of the angle θ in the case of refraction as shown in figure (iii) will be

   (i) 

   (ii) 

   (iii) 

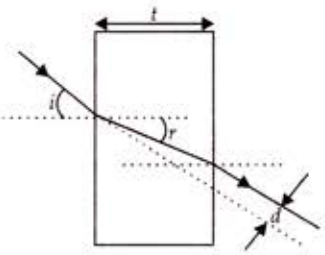
   (a) 30° (b) 35°
   (c) 60 (d) 41°

8. A vessel of depth x is half filled with oil of refractive index μ_1 and the other half is filled with water of refractive index μ_2. The apparent depth of the vessel when viewed from above is
   (a) $\frac{x(\mu_1+\mu_2)}{2\mu_1\mu_2}$ (b) $\frac{x\mu_1\mu_2}{2(\mu_1+\mu_2)}$
   (c) $\frac{x\mu_1\mu_2}{(\mu_1+\mu_2)}$ (d) $\frac{2x(\mu_1+\mu_2)}{\mu_1\mu_2}$

9. Three immiscible liquids of densities $d_1 > d_2 > d_3$ and refractive indices $\mu_1 > \mu_2 > \mu_3$ are put in a beaker. The height of each liquid column is $h/3$. A dot is made at the bottom of the beaker. For near normal vision, find the apparent depth of the dot.
   (a) $\frac{h}{6}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$ (b) $\frac{h}{6}\left(\frac{1}{\mu_1}-\frac{1}{\mu_2}-\frac{1}{\mu_3}\right)$
   (c) $\frac{h}{3}\left(\frac{1}{\mu_1}-\frac{1}{\mu_2}-\frac{1}{\mu_3}\right)$ (d) $\frac{h}{3}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

10. A ray of light strikes a transparent rectangular slab of refractive index $\sqrt{2}$ at an angle of incidence of 45°. The angle between the reflected and refracted rays is
    (a) 75° (b) 90°
    (c) 105° (d) 120°

11. A ray of light is incident on a thick slab of glass of thickness t as shown in the figure. The emergent ray is parallel to the incident ray but displaced sideways by a distance d. If the angles are small then d is,



    (a) $t\left(1-\frac{i}{r}\right)$ (b) $rt\left(1-\frac{i}{r}\right)$
    (c) $it\left(1-\frac{r}{i}\right)$ (d) $t\left(1-\frac{r}{i}\right)$

12. A tank is filled with water to a height of 12.5 cm. The apparent depth of a needle lying at the bottom of the tank is measured by a microscope to be 9.4 cm. If water is replaced by a liquid of refractive index 1.63 upto the same height, by what distance would the microscope have to be moved to focus on the needle again?
    (a) 1.00 cm (b) 2.37 cm
    (c) 1.73 cm (d) 3.93 cm

13. A ray incident at a point at an angle of incidence of 60° enters a glass sphere of refractive index $\sqrt{3}$ and is reflected and refracted at the farther surface of the sphere. The angle between the reflected and refracted rays at this surface is
    (a) 50° (b) 60°
    (c) 90° (d) 40°

14. A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45°. For which of the following value of μ the ray can undergo total internal reflection?
    (a) μ = 1.33 (b) μ = 1.40
    (c) μ = 1.50 (d) μ = 1.25

15. Critical angle of glass is θ_1 and that of water is θ_2. The critical angle for water and glass surface would be ($\mu_g = 3/2, \mu_w = 4/3$).
(a) less than θ_2 (b) between θ_1 and θ_2
(c) greater than θ_2 (d) less than θ_1

16. Light travels in two media *A* and *B* with speeds 1.8×10^8 m s^{-1} and 2.4×10^8 m s^{-1} respectively. Then the critical angle between them is
(a) $\sin^{-1}\left(\frac{2}{3}\right)$ (b) $\tan^{-1}\left(\frac{3}{4}\right)$
(c) $\tan^{-1}\left(\frac{2}{3}\right)$ (d) $\sin^{-1}\left(\frac{3}{4}\right)$

17. A point source of light is placed at a depth of *h* below the surface of water of refractive index μ. A floating opaque disc is placed on the surface of water so that light from the source is not visible from the surface. The minimum diameter of the disc is
(a) $\frac{2h}{(\mu^2 - 1)^{1/2}}$ (b) $2h(\mu^2 - 1)^{1/2}$
(c) $\frac{h}{2(\mu^2 - 1)^{1/2}}$ (d) $h(\mu^2 - 1)^{1/2}$

18. Critical angle for light going from medium (i) to (ii) is θ. The speed of light in medium (i) is *v*, then the speed of light in medium (ii) is
(a) $v(1 - \cos\theta)$ (b) $\frac{v}{\sin\theta}$
(c) $\frac{v}{\cos\theta}$ (d) $\frac{v}{(1 - \sin\theta)}$

19. An air bubble in a glass sphere (μ = 1.5) is situated at a distance 3 cm from a convex surface of diameter 10 cm. At what distance from the surface will the bubble appear?
(a) 2.5 cm (b) −2.5 cm
(c) 5 cm (d) −5 cm

20. Two lenses of power +10 D and −5 D are placed in contact. Where should an object be held from the lens, so as to obtain a virtual image of magnification 2?
(a) 5 cm (b) −5 m
(c) 10 cm (d) −10 cm

21. A biconvex lens has a focal length 2/3 times the radius of curvature of either surface. The refractive index of the lens material is
(a) 1.75 (b) 1.33
(c) 1.5 (d) 1.0

22. The far point of a near sighted person is 6.0 m from her eyes, and she wears contacts that enable her to see distant objects clearly. A tree is 18.0 m away and 2.0 m high. How high is the image formed by the contacts?
(a) 1.0 m (b) 1.5 m
(c) 0.75 m (d) 0.50 m

23. An eye specialist prescribes spectacles having a combination of a convex lens of focal length 40 cm in contact with a concave lens of focal length 25 cm. The power of this lens combination is
(a) + 1.5 D (b) − 1.5 D
(c) + 6.67 D (d) − 6.67 D

24. A square card of side length 1 mm is being seen through a magnifying lens of focal length 10 cm. The card is placed at a distance of 9 cm from the lens. The apparent area of the card through the lens is
(a) 1 cm^2 (b) 0.81 cm^2
(c) 0.27 cm^2 (d) 0.60 cm^2

25. Double convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of same radius of curvature. What is the radius of curvature required if the focal length is to be 20 cm?
(a) 11 cm (b) 22 cm
(c) 7 cm (d) 6 cm

26. A plano-convex lens (f = 20 cm) is silvered at plane surface. The focal length will be
(a) 20 cm (b) 40 cm
(c) 30 cm (d) 10 cm

27. What is the refractive index of material of a plano-convex lens, if the radius of curvature of the convex surface is 10 cm and focal length of the lens is 30 cm?
(a) $\frac{6}{5}$ (b) $\frac{7}{4}$
(c) $\frac{2}{3}$ (d) $\frac{4}{3}$

28. The radii of curvature of the surfaces of a double convex lens are 20 cm and 40 cm respectively, and its focal length is 20 cm. What is the refractive index of the material of the lens?
(a) $\frac{5}{2}$ (b) $\frac{4}{3}$
(c) $\frac{5}{3}$ (d) $\frac{4}{5}$

29. A convex lens of radii of curvature 20 cm and 30 cm respectively. It is silvered at the surface which has smaller radius of curvature. Then it will behave as ($\mu_g = 1.5$)
(a) concave mirror with equivalent focal length $\frac{30}{11}$ cm.
(b) concave mirror with equivalent focal length $\frac{60}{11}$ cm.
(c) convex mirror with equivalent focal length $\frac{30}{11}$ cm.
(d) convex mirror with equivalent focal length $\frac{60}{11}$ cm.

30. An object is placed at a distance of 1.5 m from a screen and a convex lens is interposed between them. The magnification produced is 4. The focal length of the lens is

(a) 1 m (b) 0.5 m
(c) 0.24 m (d) 2 m

31. A concave mirror of focal length f_1 is placed at a distance of d from a convex lens of focal length f_2. A beam of light coming from infinity and falling on this convex lens – concave mirror combination returns to infinity. The distance d must equal
(a) $f_1 + f_2$ (b) $-f_1 + f_2$
(c) $2f_1 + f_2$ (d) $-2f_1 + f_2$

32. A ray of light passes through an equilateral prism (refractive index 1.5) such that angle of incidence is equal to angle of emergence and the latter is equal to $3/4^{th}$ of the angle of prism. The angle of deviation is
(a) 60° (b) 30°
(c) 45° (d) 120°

33. A ray is incident at an angle of incidence i on one surface of a prism of small angle A and emerges normally from opposite surface. If the refractive index of the material of prism is μ, the angle of incidence i is nearly equal to
(a) $\frac{A}{\mu}$ (b) $\frac{A}{2\mu}$
(c) μA (d) $\frac{\mu A}{2}$

34. A compound microscope consists of an objective lens with focal length 1.0 cm and eye piece of focal length 2.0 cm and a tube length 20 cm the magnification will be
(a) 100 (b) 200
(c) 250 (d) 300

35. A giant telescope in an observatory has an objective of focal length 19 m and an eye-piece of focal length 1.0 cm. In normal adjustment, the telescope is used to view the moon. What is the diameter of the image of the moon formed by the objective ? The diameter of the moon is 3.5×10^6 m and the radius of the lunar orbit round the earth is 3.8×10^8 m.
(a) 10 cm (b) 12.5 cm
(c) 15 cm (d) 17.5 cm

36. In a compound microscope, the focal lengths of two lenses are 1.5 cm and 6.25 cm. If an object is placed at 2 cm from objective and the final image is formed at 25 cm from eye lens, the distance between the two lenses is
(a) 6.00 cm (b) 7.75 cm
(c) 9.25 cm (d) 11.0 cm

37. An astronomical refractive telescope has an objective of focal length 20 m and an eyepiece of focal length 2 cm. Then
(a) the magnification is 1000
(b) the length of the telescope tube is 20.02 m
(c) the image formed is inverted
(d) all of these

38. A giant refracting telescope at an observatory has an objective lens of focal length 15 m. If an eye piece of focal length 1.0 cm is used, what is the angular magnification of the telescope?
(a) 1000 (b) 1500
(c) 2000 (d) 3000

39. A microscope is focussed on a mark on a piece of paper and then a slab of glass of thickness 3 cm of refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?
(a) 4.5 cm downward (b) 1 cm downward
(c) 2 cm downward (d) 1 cm upward

40. A person with normal near point 25 cm using a compound microscope with objective of focal length 8.0 mm and an eye piece of focal length 2.5 cm can bring an object placed at 9.0 mm from the objective in sharp focus. The separation between two lenses and magnification respectively are
(a) 9.47 cm, 88 (b) 3.36 cm, 44
(c) 6.00 cm, 22 (d) 7.49 cm, 11