PREVIOUS YEARS' QUESTIONS EXERCISE-II

1. Wavelength of light used in a optical instrument are $\lambda_1 = 4000$ Å and $\lambda_2 = 5000$ Å, then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is- **[AIEEE - 2002]**

(1) 16 : 25 (2) 9 : 1

(3) 4 : 5 (4) 5 : 4

2. An astronomical telescope has a large aperture to- **[AIEEE - 2002]**

(1) reduced spherical aberration

(2) have high resolution

(3) increase span of observation

(4) have low dispersion

3. If two mirrors are kept at 60° to each other, then the number of images formed by them is- **[AIEEE- 2002]**

(1) 5 (2) 6 (3) 7 (4) 8

4. Which of the following is used in optical fibres? **[AIEEE - 2002]**

(1) Total internal reflection

(2) Scattering

(3) Diffraction

(4) Refraction

5. The image formed by an objective of a compound microscope is- **[AIEEE - 2003]**

(1) virtual and diminished (2) real and diminished

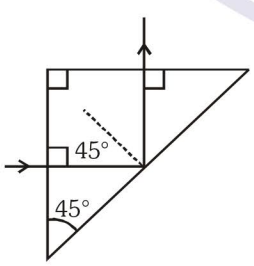
(3) real and enlarged (4) virtual and enlarged

6. To get three images of a single object, one should have two plane mirrors at an angle of- **[AIEEE - 2003]**

(1) 60° (2) 90°

(3) 120° (4) 30°

7. A light ray is incident perpendicular to one face of a 90° prism and is totally internally reflected at the glass-air interface. If the angle of reflection is 45°, we conclude that the refractive index n : **[AIEEE-2004]**



(1) $n < \frac{1}{\sqrt{2}}$ (2) $n > \sqrt{2}$

(3) $n > \frac{1}{\sqrt{2}}$ (4) $n < \sqrt{2}$

8. A plano-convex lens of refractive index 1.5 and radius of curvature 30 cm is silvered at the curved surface. Now, this lens has been used to form the image of an object. At what distance from this lens, an object be placed in order to have a real image of the size of the object? **[AIEEE-2004]**

(1) 20 cm (2) 30 cm

(3) 60 cm (4) 80 cm

9. A fish looking up through the water sees the outside world, contained in a circular horizon. If the refractive index of water is $\frac{4}{3}$ and the fish is 12 cm below the water surface, the radius of this circle in cm is- **[AIEEE-2005]**

(1) $36\sqrt{7}$ (2) $\frac{36}{\sqrt{7}}$

(3) $36\sqrt{5}$ (4) $4\sqrt{5}$

10. A thin glass (refractive index 1.5) lens has optical power of – 5D in air. Its optical power in a liquid medium with refractive index 1.6 will be- **[AIEEE-2005]**

(1) 1 D (2) – 1D

(3) 25 D (4) – 25 D

11. Two point white dots are 1 mm apart on a black paper. They are viewed by eye of pupil diameter 3 mm. Approximately, what is the maximum distance at which these dots can be resolved by the eye ? [Take wavelength of light = 500 nm] **[AIEEE-2005]**

(1) 5 m (2) 1 m

(3) 6 m (4) 3 m

12. The refractive index of glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be angles of minimum deviation for red and blue light respectively in a prism of this glass. Then- **[AIEEE-2006]**

(1) $D_1 < D_2$

(2) $D_1 = D_2$

(3) D_1 can be less than or greater than D_2 depending upon the angle of prism

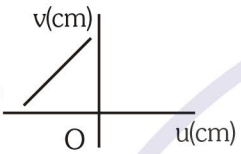
(4) $D_1 > D_2$

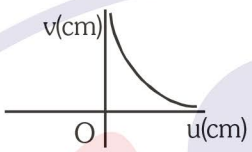
13. Two lenses of power – 15D and +5D are in contact with each other. The focal length of the combination is- **[AIEEE-2007]**

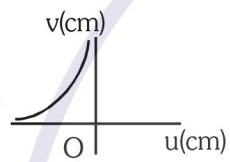
(1) – 20 cm (2) – 10 cm

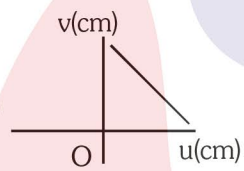
(3) + 20 cm (4) + 10 cm

14. A stuydent 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- **[AIEEE - 2008]**

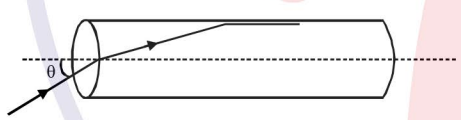
(1) 

(2) 

(3) 

(4) 

15. A transparent solid cyclindrical 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. **[AIEEE - 2009]**



The incident angle θ for which the light ray grazes along the wall of the rod is :-

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

(3) $\sin^{-1}\left(\frac{1}{2}\right)$ (4) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

16. A biconvex lens of focal length 15 cm is in front of a plane mirror. The distance between the lens and the mirror is 10 cm. A small object is kept at a distance of 30 cm from the lens. The final image is **[IIT-JEE 2010]**

(1) virtual and at a distance of 16 cm from the mirror

(2) real and at a distance of 16 cm from the mirror

(3) virtual and at a distance of 20 cm from the mirror

(4) real and at a distance of 20 cm from the mirror

17. The focal length of a thin biconvex lens is 20 cm. When an object is moved from a distance of 25 cm in front of it to 50 cm, the magnification of its image changes from m_{25} to m_{50}. The ratio $\frac{m_{25}}{m_{50}}$ is **[IIT-JEE 2010]**

(1) 2 (2) 4

(3) 6 (4) 8

18. Image of an object approaching a convex mirror of radius of curvature 20 m along its optical axis is observed to move from $\frac{25}{3}$ m to $\frac{50}{7}$ m in 30 seconds. What is the speed of the object in km per hour? **[IIT-JEE 2010]**

(1) 3 (2) 6

(3) 4 (4) 8

19. A large glass slab $\left(\mu = \frac{5}{3}\right)$ of thickness 8 cm is placed over a point source of light on a plane surface. It is seen that light emerges out of the top surface of the slab from a circular area of radius R cm. What is the value of R? **[IIT-JEE 2010]**

(1) 2 (2) 3

(3) 5 (4) 6

20. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at a relative speed of 15 m/s. The speed of the image of the second car as seen in the mirror of the first one is :- **[AIEEE - 2011]**

(1) 10 m/s (2) 15 m/s

(3) $\frac{1}{10}$ m/s (4) $\frac{1}{15}$ m/s

21. When monochromatic red light is used instead of blue light in a convex lens, its focal length will :- **[AIEEE - 2011]**

(1) Does not depend on colour of light

(2) Increase

(3) Decrease

(4) Remain same

22. A beaker contains water up to a height h_1 and kerosene of height h_2 above watger so that the total height of (water + kerosene) is $(h_1 + h_2)$. Refractive index of water is μ_1 and that of kerosene is μ_2. The apparent shift in the position of the bottom of the beaker when viewed from above is :-

[AIEEE - 2011]

(1) $\left(1-\frac{1}{\mu_1}\right)h_2+\left(1-\frac{1}{\mu_2}\right)h_1$

(2) $\left(1+\frac{1}{\mu_1}\right)h_1-\left(1+\frac{1}{\mu_2}\right)h_2$

(3) $\left(1-\frac{1}{\mu_1}\right)h_1+\left(1-\frac{1}{\mu_2}\right)h_2$

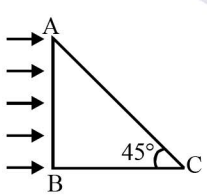
(4) $\left(1+\frac{1}{\mu_1}\right)h_2-\left(1+\frac{1}{\mu_2}\right)h_1$

23. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object be shifted to be in sharp focus on film? **[AIEEE- 2012]**

(1) 5.6 m (2) 7.2 m

(3) 2.4 m (4) 3.2 m

24. A beam of light consisting of red, green and blue colours is incident on a right-angled prism on face AB. The refractive indices of the material for the above red, green and blue wavelength are 1.39, 1.44 and 1.47 respectively. A person looking on surface AC of the prism will see :



[AIEEE - 2012 (Online)]

(1) red and green colours

(2) No light

(3) green and blue colours

(4) red colour only

25. Which of the following processes play a part in the formation of a rainbow ? **[AIEEE - 2012 (Online)]**

(a) refraction

(b) total internal reflection

(c) dispersion

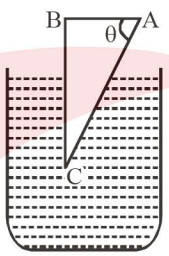
(d) interference

(1) a, b and c (2) a and b

(3) c and d (4) a, b and d

26. A glass prism of refractive index 1.5 is immersed in water (refractive index 4/3) as shown in the figure. A light beam incident normally on the face AB is totally reflected to reach the face BC, if:-

[AIEEE - 2012 (Online)]

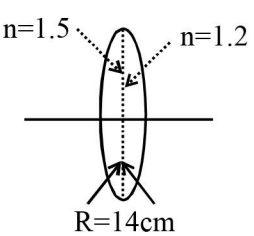


(1) $\sin\theta > \frac{5}{9}$ (2) $\sin\theta > \frac{1}{3}$

(3) $\sin\theta > \frac{2}{3}$ (4) $\sin\theta > \frac{8}{9}$

27. A biconvex lens is formed with two thin plano-convex lenses as shown in the figure, Refractive index n of the first lens is 1.5 and that of the second lens is 1.2. Both the curved surfaces are of the same radius of curvature R = 14 cm. For this biconvex lens, for an object distance of 40 cm, the image distance will be :-

[IIT - 2012]



(1) –280.0 cm (2) 40.0 cm

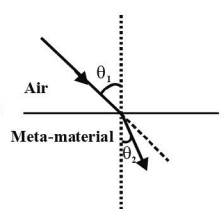
(3) 21.5 cm (4) 13.3 cm

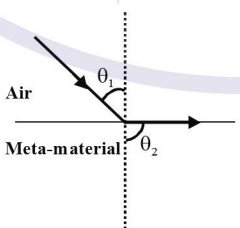
Paragraph for Questions 28 and 29

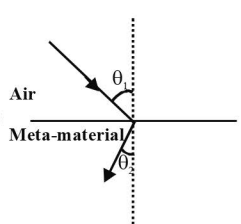
Most materials have the refractive index, n >1. So, when a light ray from air enters a naturally occurring material, then by Snell's law, $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$, it is understood that the refracted ray bends towards the normal. But it never emerges on the same side of the normal as the incident ray. According to electromagnetism, the refractive index of the medium is given by the relation, $n = \left(\frac{c}{v}\right) = \pm\sqrt{\varepsilon_r \mu_r}$, where c is the speed of electromagnetic waves in vacuum, v its speed in the medium, ε_r and μ_r are the relative permittivity and permeability of the medium respectively.

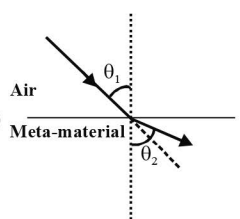
In normal materials, both ε_r and μ_r are positive, implying positive n for the medium. When both ε_r and μ_r are negative, one must choose the negative root of n. Such negative refractive index materials can now be artificially prepared and are called meta-materials. They exhibit significantly different optical behaviour, without violating any physical laws. Since n is negative, it results in a change in the direction of propagation of the refracted light. However, similar to normal materials, the frequency of light remains unchanged upon refraction even in meta-materials.

28. For light incident from air on a meta-material, the appropriate ray diagram is **[IIT-JEE 2012]**

(1)


(2)


(3)


(4)


29. Choose the correct statement. **[IIT-JEE 2012]**

(1) The speed of light in the meta-material is $v = c\,|n|$

(2) The speed of light in the meta-material is $v = \frac{c}{|n|}$

(3) The speed of light in the meta-material is v = c.

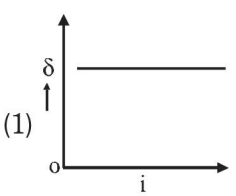
(4) The wavelength of the light in the meta-material (λ_m) is given by $\lambda_m = \lambda_{air}\,|n|$, where λ_{air} is the wavelength of the light in air.

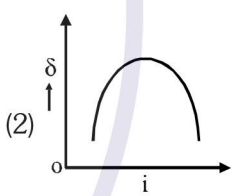
30. Diameter of a plano-convex lens is 6cm and thickness at the centre is 3 mm. If speed of light in material of lens is 2×10^8 m/s, the focal length of the lens is : **[JEE(Main)-2013]**

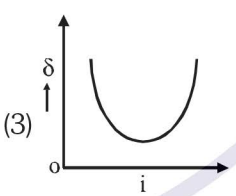
(1) 15 cm (2) 20 cm

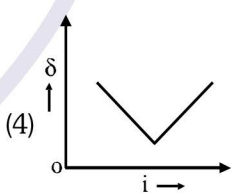
(3) 30 cm (4) 10 cm

31. The graph between angle of deviation (δ) and angle of incidence (i) for a triangular prism is represented by :- **[JEE(Main)-2013]**

(1)


(2)


(3)


(4)


32. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\frac{2}{3}$ times the wavelength in free space. The radius of the curved surface of the lens is :- **[IIT-JEE 2013]**

(1) 1 m (2) 2 m

(3) 3 m (4) 6 m

33. A thin convex lens made from crown glass $\left(\mu = \frac{3}{2}\right)$ has focal length f. When it is measured in two different liquids having refractive indices $\frac{4}{3}$ and $\frac{5}{3}$, it has the focal length f_1 and f_2 respectively. The correct relation between the focal lengths is : **[JEE(Main)-2014]**

(1) $f_2 > f$ and f_1 becomes negative

(2) f_1 and f_2 both become negative

(3) $f_1 = f_2 < f$

(4) $f_1 > f$ and f_2 become negative

34. A green light is incident from the water to the air - water interface at the critical angle (θ). Select the **correct** statement :- **[JEE(Main)-2014]**

(1) The spectrum of visible light whose frequency is more than that of green light will come out to the air medium.

(2) The entire spectrum of visible light will come out of the water at various angles to the normal

(3) The entire spectrum of visible light will come out of the water at an angle of 90° to the normal.

(4) The spectrum of visible light whose frequency is less than that of green light will come out to the air medium.

35. Assuming human pupil to have a radius of 0.25cm and a comfortable viewing distance of 25cm, the minimum separation between two objects that human eye can resolve at 500 nm wavelength is :- **[JEE(Main)-2015]**

(1) 100 μm (2) 300 μm (3) 1 μm (4) 30 μm

36. A diverging lens with magnitude of focal length 25 cm is placed at a distance of 15 cm from a converging lens of magnitude of focal length 20 cm. A beam of parallel light falls on the diverging lens. The final image formed is :**[JEE(Main)-2017]**

(1) real and at a distance of 40 cm from the divergent lens

(2) real and at a distance of 6 cm from the convergent lens

(3) real and at a distance of 40 cm from convergent lens

(4) virtual and at a distance of 40 cm from convergent lens.

PREVIOUS YEARS QUESTIONS — ANSWER KEY — Exercise-II

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**4**	**2**	**1**	**1**	**3**	**2**	**2**	**1**	**2**	**1**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**4**	**4**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**2**	**3**	**1**	**4**	**1**	**4**	**2**	**3**	**2**	**3**
Que.	31	32	33	34	35	36				
Ans.	**3**	**3**	**4**	**4**	**4**	**3**				