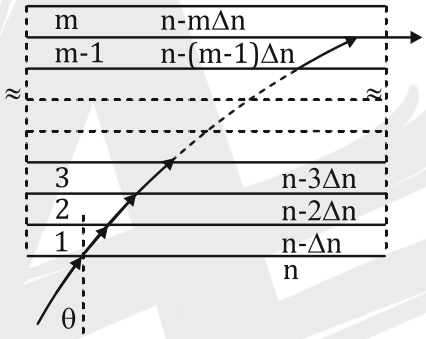
DPP 03

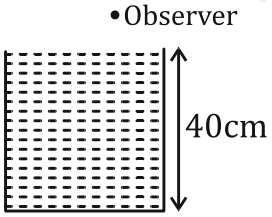
1. A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}$ cm. The thickness of the glass slab is _____ cm.

2. A monochromatic light is travelling in a medium of refractive index n = 1.6. It enters a stack of glass layers from the bottom side at an angle θ = 30°. The interfaces of the glass layers are parallel to each other. The refractive indices of different glass layers are monotonically decreasing as $n_m = n - m\Delta n$, where n_m is the refractive index of the m^{th} slab and $\Delta n = 0.1$ (see the figure). The ray is refracted out parallel to the interface between the $(m-1)^{th}$ and m^{th} slabs from the right side of the stack. What is the value of m?

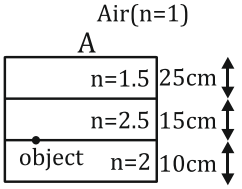


3. A light ray is incident at 45° on a glass slab. The slab is 3 cm thick, and the refractive index of the glass is 1.5. What will the lateral displacement of the ray be as a result of its passage through the slab? At what angle will the ray emerge from the slab?

4. In the given figure an observer in air (n = 1) sees the bottom of a beaker filled with water (n = 4/3) upto a height of 40 cm. What will be the depth felt by this observer.



5. Find the apparent depth of the object seen by observer A (in the figure shown)



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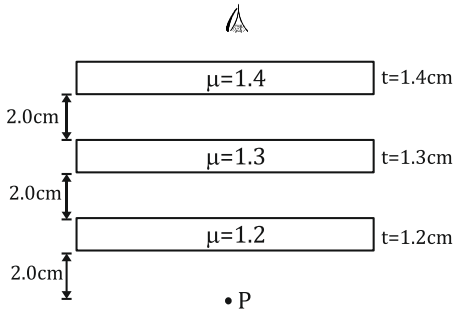
6. Locate the image of the point P as seen by the eye in the figure.



7. Time taken by light to travel in two different materials A and B of refractive indices μ_A and μ_B of same thickness is t_1 and t_2 respectively. If $t_2 - t_1 = 5 \times 10^{-10}$s and the ratio of μ_A to μ_B is 1:2. Then, the thickness of material, in metre is (Given v_A and v_B are velocities of light A and B materials respectively.)

(A) $5 \times 10^{-10} v_A$m (B) 5×10^{-10}m

(C) 1.5×10^{-10}m (D) $5 \times 10^{-10} v_B$m

8. Light enters from air into a given medium at an angle of 45° with interface of the air-medium surface. After refraction, the light ray is deviated through an angle of 15° from its original direction. The refractive index of the medium is

(A) 1.732 (B) 1.333 (C) 1.414 (D) 2.732

9. Consider a light travelling in air is incident into a medium of refractive index $\sqrt{2n}$. The incident angle is twice that of refracting angle. Then, the angle of incidence will be

(A) $\sin^{-1}(\sqrt{n})$ (B) $\cos^{-1}\left(\sqrt{\frac{n}{2}}\right)$ (C) $\sin^{-1}(\sqrt{2n})$ (D) $2\cos^{-1}\left(\sqrt{\frac{n}{2}}\right)$

10. If a wave gets refracted into a denser medium, then which of the following is true?

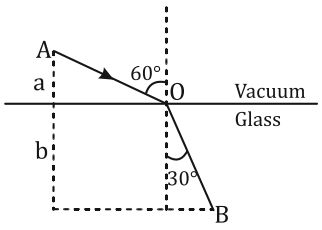
(A) wavelength, speed and frequency decreases.

(B) wavelength increases, speed decreases and frequency remains constant.

(C) wavelength and speed decreases but frequency remains constant.

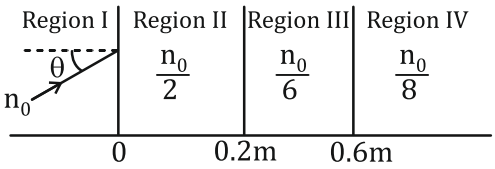
(D) wavelength, speed and frequency increases

11. A ray of light AO in vacuum is incident on a glass slab at angle 60° and refracted at angle 30° along OB as shown in figure. The optical path length of light ray from A to B is



(A) $2a + \frac{2b}{3}$ (B) $2a + 2b$ (C) $\frac{2\sqrt{3}}{a} + 2b$ (D) $2a + \frac{2b}{\sqrt{3}}$

12. A light beam is travelling from region I to region IV (Refer figure). The refractive index in regions I, II, III and IV are n_0, $\frac{n_0}{2}$, $\frac{n_0}{6}$ and $\frac{n_0}{8}$, respectively. The angle of incidence θ for which the beam just misses entering region IV is



(A) $\sin^{-1}\left(\frac{3}{4}\right)$ (B) $\sin^{-1}\left(\frac{1}{8}\right)$ (C) $\sin^{-1}\left(\frac{1}{4}\right)$ (D) $\sin^{-1}\left(\frac{1}{3}\right)$

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ANSWER KEY

1.	12	**2.**	8	**3.**	9.9mm, 45°	**4.**	30	**5.**	$\frac{68}{3}$ cm	**6.**	0.9cm
7.	(A)	**8.**	(C)	**9.**	(D)	**10.**	(C)	**11.**	(B)	**12.**	(B)

Home Work

Ex. 1	Q. 12,
Ex. 2	Q.
Ex.3	Q.21,22,23,25,
Ex.4	Q. 13,15,21
Ex.5	Q.