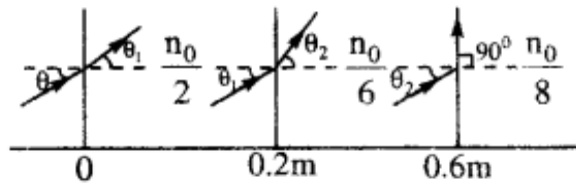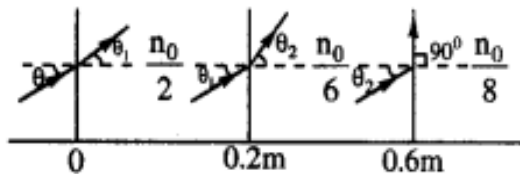A light beam is travelling from region I to region IV (Refer figure). The refractive index in regions I,II,III and IV are $n_0, \dfrac{n_0}{2}, \dfrac{n_0}{6}$ and $\dfrac{n_0}{8}$, respectively. The angle of incidence θ for which the beam just misses entering region IV is [2008]

a) $\sin^{-1}\left(\dfrac{3}{4}\right)$

b) $\sin^{-1}\left(\dfrac{1}{8}\right)$

c) $\sin^{-1}\left(\dfrac{1}{4}\right)$

d) $\sin^{-1}\left(\dfrac{1}{3}\right)$

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(b) As the beam just misses entering the region IV, the angle of refraction in the region IV must be 90^0.

Application of Snell's law successively at different interfaces gives

$$n_0 \sin\theta = \frac{n_0}{2}\sin\theta_1 = \frac{n_0}{6}\sin\theta_2 = \frac{n_0}{8}\sin 90^0$$

$$\Rightarrow \sin\theta = \frac{1}{8} \text{ or } \theta = \sin^{-1}\frac{1}{8}$$