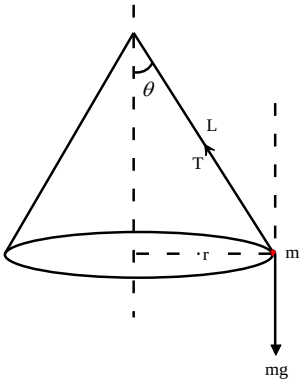
A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r such that $r = \frac{L}{\sqrt{2}}$. The speed of the particle will be:

(A) $\sqrt{rg}$ (B) $\sqrt{\frac{rg}{2}}$ (C) $2\sqrt{rg}$ (D) $\sqrt{2rg}$

Solution



We have, $T\cos\theta = mg$ & $T\sin\theta = \frac{mv^2}{r}$

So, $\tan\theta = \frac{v^2}{rg}$

$\therefore v = \sqrt{rg\tan\theta}$

Further, $\sin\theta = \frac{r}{L} = \frac{L/\sqrt{2}}{L} = \frac{1}{\sqrt{2}}$

$\therefore \theta = 45^\circ$

$\therefore v = \sqrt{rg\tan\theta} = \sqrt{rg}$

Hence, (A)