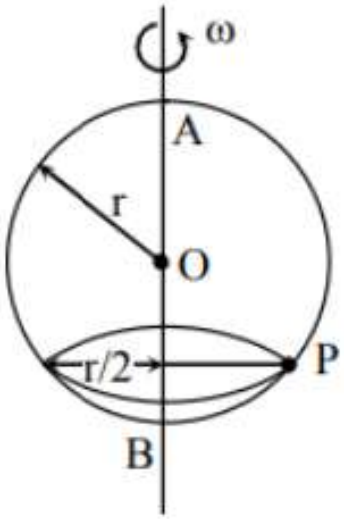
A smooth wire of length $2\pi r$ is bent into a circle and kept in a vertical plane.
A bead can slide smoothly on the wire. When the circle is rotating with angular speed ω about the vertical diameter AB, as shown in figure, the bead is at rest with respect to the circular ring at position P as shown. Then the value of ω^2 is equal to -



(1) $(g\sqrt{3})/r$

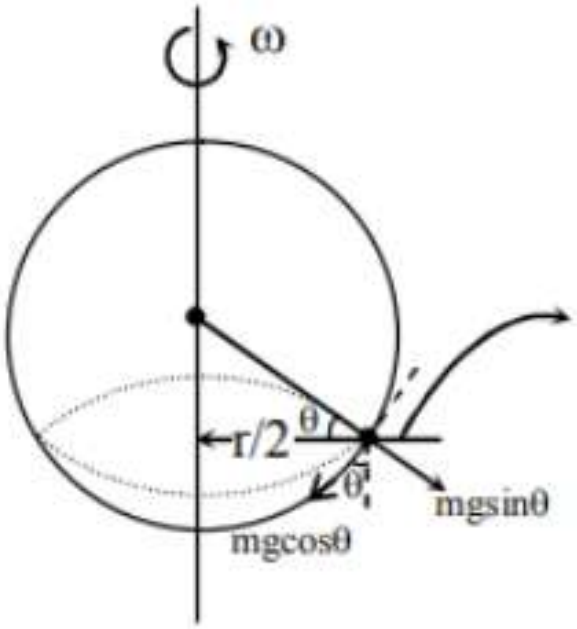
(2) $2g/r$

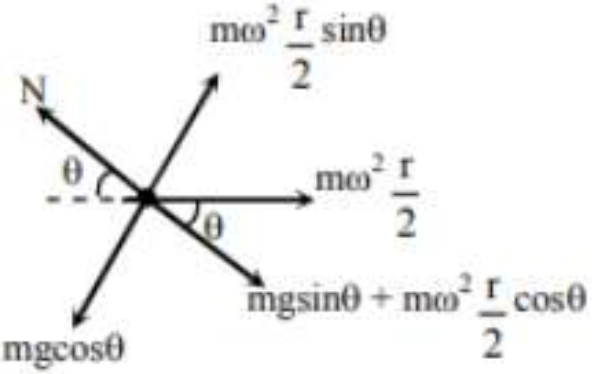
(3) $\sqrt{3}g/2r$

(4) $2g/(r\sqrt{3})$

Correct option (4) $2g/(r\sqrt{3})$

Explanation:





$$m\omega^2 \frac{r}{2}\sin\theta = mg\cos\theta$$

$$\omega^2 = \frac{2g}{r\tan\theta}$$

$$\tan\theta = \frac{\sqrt{r^2 - r^2/4}}{r/2}$$

$$= \frac{\frac{\sqrt{3r^2}}{4}}{\frac{r}{2}} = \sqrt{3} \Rightarrow \omega^2 = \frac{2g}{\sqrt{3}r}$$