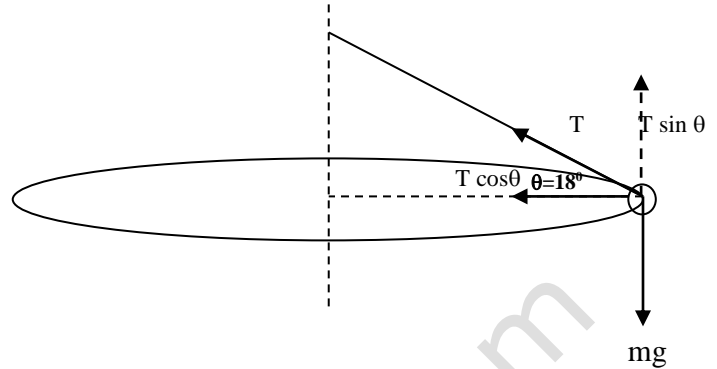


Q- A 63 g ball is whirled in a horizontal circle of radius 60 cm, on the end of a cord that makes an angle of 18° with the horizontal. Find

- (a) The tension in the string. And
- (b) The speed of the ball.



The forces acting on the ball are

Weight of the ball mg (vertically downwards) and tension in the cord T , along the point of suspension

As the ball is moving in horizontal circle of radius $R = 60$ cm with constant speed, the vertical forces must be balance and the horizontal forces must provide necessary centripetal force.

a) Resolving the tension in horizontal and vertical directions, the horizontal component of the tension will be $T \cos \theta$ and the vertical component will be $T \sin \theta$.

The vertical component is balancing the weight of the ball hence we get

$$T \sin \theta - mg = 0$$

$$\text{Gives } T = \frac{mg}{\sin \theta} = \frac{0.063 \cdot 9.8}{\sin 18^\circ} = \frac{0.617}{0.309} = 1.996 \text{ N}$$

b) the horizontal component of the tension provides the centripetal force to the ball and hence using the formula of the centripetal force we get

$$\frac{mv^2}{R} = F_{CP}$$

$$\text{Or } \frac{mv^2}{R} = T \cos \theta$$

$$\text{Or } v = \sqrt{\frac{T \cos \theta \cdot R}{m}}$$

Substituting the values, the speed v of the ball is given by

$$v = \sqrt{\frac{1.996 \cdot 0.951 \cdot 0.60}{0.063}} = \sqrt{18.08} = 4.25 \text{ m/s}$$