Answer on Question 68153, Physics, Other

Question:

An object of mass $0.30\ kg$ is attached to the end of a string and supported by a smooth horizontal surface. The object moves in a horizontal circle of radius $0.50\ m$ with a uniform speed of $2.0\ m/s$. Calculate:

(i) the centripetal acceleration

(ii) the tension in the string

Solution:

(i) We can find the centripetal acceleration from the formula:

$$a_c = \frac{v^2}{r},$$

here, a_c is the centripetal acceleration, v is the speed of the object and r is the radius of the circle.

Then, we get:

$$a_c = \frac{v^2}{r} = \frac{\left(2.0\ \frac{m}{s}\right)^2}{0.50\ m} = 8\ \frac{m}{s^2}.$$

(ii) The force of tension in the string provides the necessary centripetal force, so we can write:

$$T = F_c,$$

$$T = ma_c = m\frac{v^2}{r} = 0.30\ kg \cdot \frac{\left(2.0\ \frac{m}{s}\right)^2}{0.50\ m} = 2.4\ N.$$

Answer:

(i) $a_c = 8\ \frac{m}{s^2}.$

(ii) $T = 2.4\ N.$