Topic 23: Exercises on Motion in a Horizontal Circle
Level 1

1. A mass of 2 kg is revolving at the end of a string 2 m long on a smooth horizontal table with uniform angular speed of 1 revolution per second. Find the tension in the string.

32 N

2. A particle of mass 0.5 kg is attached to one end of a light inextensible string of length 2 m. The other end is fixed to a point A on a smooth horizontal table. The particle is set in motion in a circular path. If the speed of the particle is 12 ms^{-1}, find the tension in the string.

36 N

3. A particle of mass $0.1\ kg$ moving on a smooth horizontal table with constant speed $v\ ms^{-1}$ describes a circle with center O and radius $r\ m$. The particle is attracted towards O by a force of magnitude $4v$ N and repelled from O by a force of magnitude $\frac{k}{r}$ N where k is a constant. Given that $v = 40$ and the time of one revolution is $\frac{\pi}{10}$ seconds, find the values of r and k.

$2\ m$; 160 N

4. A particle P of mass $0.2\ kg$ moving on a smooth horizontal table with constant speed $v\ ms^{-1}$ describes a circle with center O such that $OP = r\ m$. The particle is subject to two forces, one towards O with magnitude $8v$ N and one away from O with magnitude $\frac{k}{r^2}$ N, where k is a positive constant. Given that $k = 75$ and $r = 1$, find the possible values of v.

15, 25

5. An inextensible string of length $2\ m$ is fixed at one end A and carries at its other end B a particle of mass $6\ kg$ which is rotating in a horizontal circle whose center is $1\ m$ vertically below A. Find the tension in the string and the angular velocity of the particle.

$12\ g; \sqrt{g}$

6. A light inextensible string of length $3l$ is threaded through a smooth ring and carries a particle at each end. One particle A, of mass m, is at rest at a distance l below the ring while the other particle B, of mass μ, is rotating in a horizontal circle whose center is A. Find

(a) m in terms of μ;

2μ

(b) the angular velocity of B.

$\sqrt{\frac{g}{l}}$