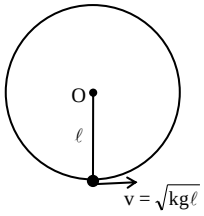
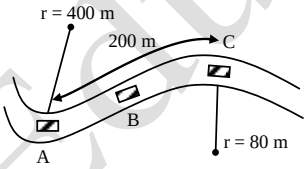
ASSIGNMENT-1

NUMERICAL QUESTIONS:

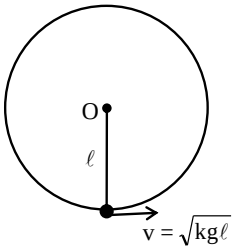
Q.1 A pendulum of length ℓ is given a horizontal velocity $\sqrt{kg\ell}$ at the lowest point of vertical circular path as shown. In the subsequent motion the string gets slag at a certain point and the pendulum bob strikes the point of suspensión then the value of k is –



Q.2 A 1500 kg car enters a section of curved road in the horizontal plane and slows down at a uniform rate from a speed of 100 km/hr at A to a speed of 50 km/hr as it passes C. The radius of curvature of the road at A is 400 m and at C is 80 m. The total horizontal force exerted by the road on tyres at position C is ..... N.



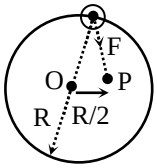
Q.3 A pendulum of length ℓ is given a horizontal velocity $\sqrt{kg\ell}$ at the lowest point of vertical circular path as shown. In the subsequent motion the string gets slag at a certain point and the pendulum bob strikes the point of suspensión then the value of k is -



Q.4 A sphere of mass m = 0.5 kg carrying positive charge q = 110 μC is connected with a light, flexible and inextensible spring of length r = 60cm and whirled in a vertical circle. If a vertically upwards electric field of strength $E = 10^5$ N/C exists in the space then the minimum velocity of sphere in m/s required at highest point so that it may just complete the circle is ($g = 10\ m/s^2$)

Q.5 A small bead of mass m can move on a smooth circular wire (radius R) under the action of a force $F = \frac{Km}{r^2}$ directed (r = position of bead from P & K = constant) towards a point P within the circle at a distance

R/2 from the centre. What should be the minimum velocity (in m/s) of bead at the point of the wire nearest the centre of force (P) so that bead will complete the circle (Take $\frac{k}{3R}$ = 8 unit)



Q.6 A highway curve with a radius of 750 m is banked properly for a car traveling 120 kph. If a 1590 kg car takes the turn at a speed of 230 kph, how much sideways force must the tires exert against the road if the car does not skid?

Q.7 What is the minimum radius of a circle along which a cyclist can ride with a velocity 18 km/hr if the coefficient of friction between the tyres and the road is $\mu = 0.5$ (take $g = 10\ m/s^2$)