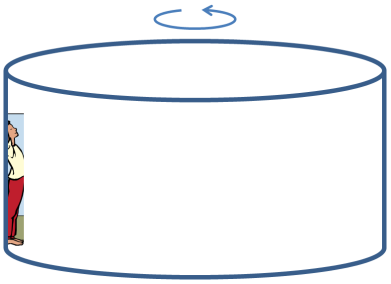


Figure 6.31: Problem 6.7.1.

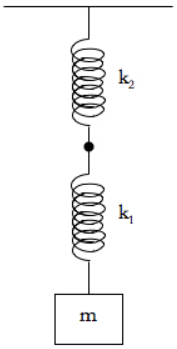


Figure 6.32: Problem 6.7.2.

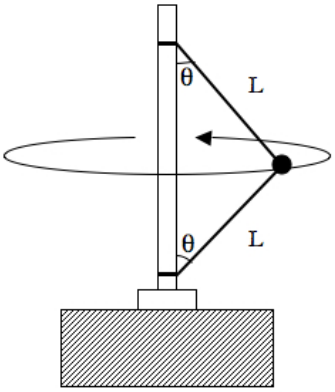
6.7 PROBLEMS

Problem 6.7.1. Many amusement parks have a ride called antigravity where riders are lined up against a wall of a large cylindrical drum, which is spun to some final angular speed when the bottom of the floor is removed. The riders however remain stuck to the wall without falling in the pit. If the final angular speed is ω and the radius of the drum R, what must be the minimum static frictional coefficient μ_s so that a rider does not slide vertically?

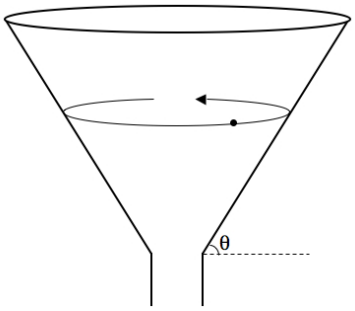
Problem 6.7.2. A block of mass m is hung from two springs of spring constant k_1 and k_2 attached as shown in the figure. Each spring stretches to different amounts with the total stretch equal to L. Find the stretch of each spring in terms of m, k_1, k_2, L and g. Assume the mass to be at rest when hanging.

Problem 6.7.3. Roads are usually banked at the curves to prevent car from sliding out. If the coefficient of static friction between the road surface and the tires is 1.5, what must be the minimum angle of banking for a bend in a road of radius of curvature of 75 m so that a car traveling at 65 km/h can safely make the turn if maximum static friction acts on the tires.

Problem 6.7.4. A ball of mass m is tied to a vertical revolving bar by two strings of equal length L so that it revolves with a uniform speed of v in a horizontal circle as shown in the figure. Find tensions in the two strings.



Problem 6.7.5. A particle of mass 50 grams slides in a circle without friction inside a funnel as shown in the figure at a constant speed of 10 m/s. Find the radius of the circle.



Problem 6.7.6. A bead of mass m slides on a ring of radius R meter without any friction. When the ring rotates about a vertical axis at a rate of ω radians per sec, the bead is found to be stable in a circular motion of non-zero radius. Find the radius of the circle for the motion

of the bead when it is not sliding in the ring in terms of the given quantities and g.

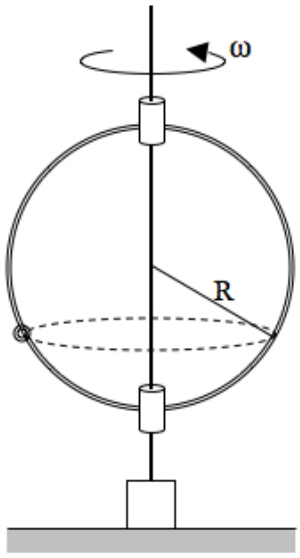
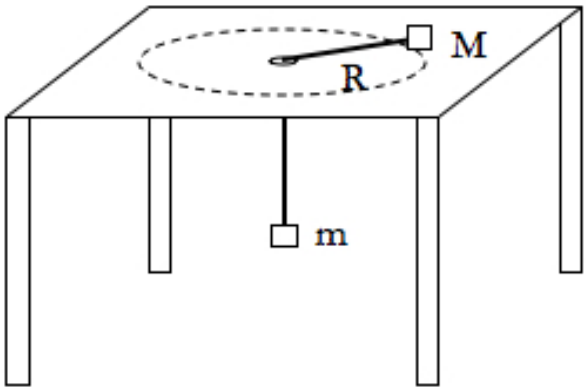
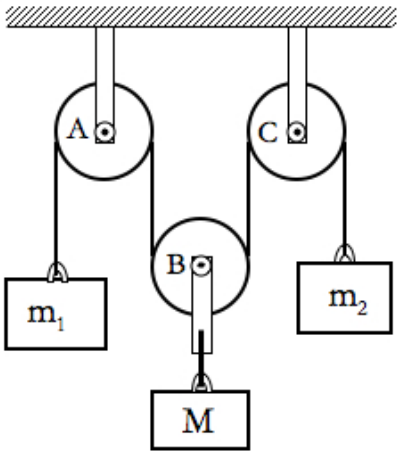


Figure 6.33: Exercise 6.7.6.

Problem 6.7.7. A block of mass M is tied to a massless string which is passed through a small hole in a smooth table. A pebble of mass m is attached to the other end of the string. When block moves in a circle of radius R on the surface of the table at a particular speed v the pebble does not move. Assuming the table to be frictionless find the speed v of the block.



Problem 6.7.8. Three masses are connected to two fixed pulleys and a moving pulley as shown in the figure. Assume all pulleys massless and frictionless and all strings massless. Find the accelerations of the three masses.



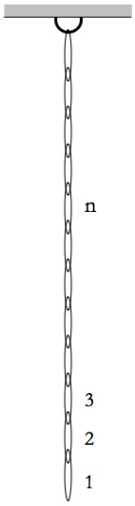


Figure 6.34: Problem 6.7.9.

Problem 6.7.9. A long chain consists of links of mass m each. The chain is hung from a tower. What is the tension in the chain at the n^{th} link from the bottom?

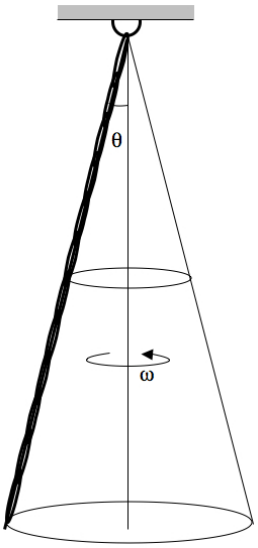


Figure 6.35: Problem 6.7.10.

Problem 6.7.10. A rope of mass M and length L is swung uniformly with the angular speed ω in a circle that makes an angle θ with the vertical. What is the tension in the rope at a distance b from the top? Note: each element of the rope moves in a horizontal circle with uniform circular motion.