Physics 7AW Homework 7 — Circular Motion

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Physics 7AW - WAT 2020 edition

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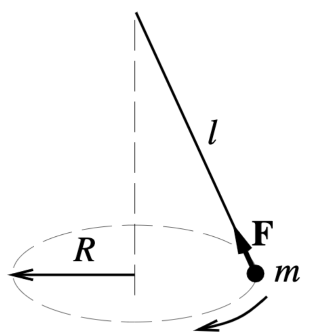
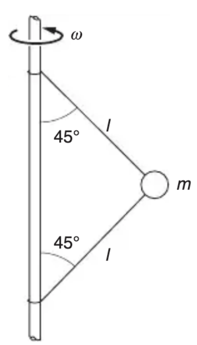
Exercise 1. A small ball of mass $m = 0.2$kg tied to a string of length $l = 3$m is moving around a circle of radius $R = 1$m in the horizontal plane.



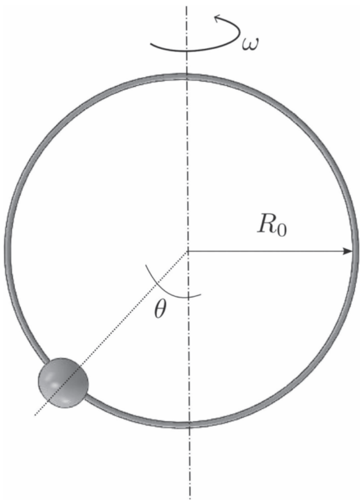
a) Find the rotation frequency f
b) Find string tension F

Exercise 2. A mass m is connected to a vertical revolving axle by two strings of length l each making an angle of 45° with the axle, as shown. Both the axle and mass are revolving with angular velocity ω. Gravity is directed downward.

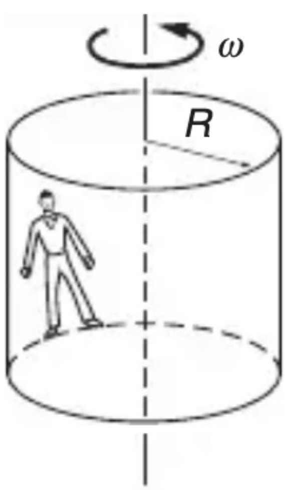


a) Draw force diagram for m
b) Find the tension for the upper string T_{upper} and lower string T_{lower}

Exercise 3. A small bead of mass m can slide without friction on a circular hoop that is in a vertical plane and has a radius R_0. The hoop rotates at a constant rate ω about a vertical diameter. Find the angle θ at which the bead is in vertical equilibrium.

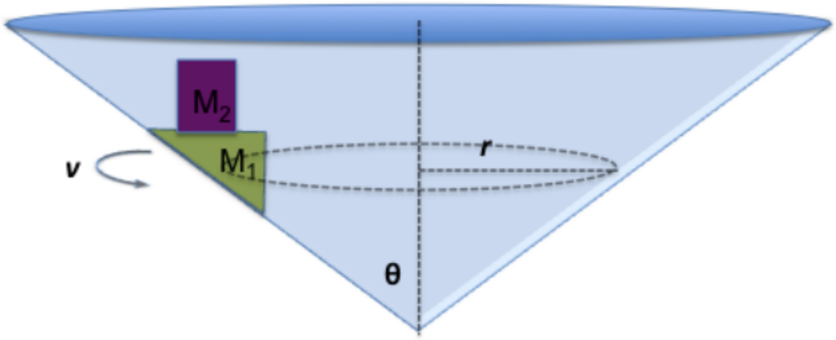


Exercise 4. he Spinning Terror is an amusement park ride—a large vertical drum that spins so fast that everyone inside stays pinned against the wall when the floor drops away. What is the minimum steady angular velocity ω that allows the floor to be dropped safely?



Hint: Think about M, μ, N

Exercise 5. (optional) A wedge of mass M_1 undergoes uniform circular motion at constant speed v inside a friction less conical surface, which makes angle θ about a vertical axis, as shown in the figure.



a) Determine the radius of rotation r at which the wedge will be in equilibrium, that is where it will have no tendency to move up or down along the conical surface. (Ignore mass M_2 in the figure for part (a). Size of M_1 is negligibly small compared to the radius of rotation.)

b) Another small box of mass M_2 is placed on top of M_1, with a coefficient of static friction of μ_s. If the velocity of M_1 remains unchanged upon the addition of M_2, and M_2 moves with M_1 without sliding, does the equilibrium radius change? Explain

c) What is the minimum value of μ_s to allow M_2 to move with M_1 without sliding? The top surface of M_1 is horizontal