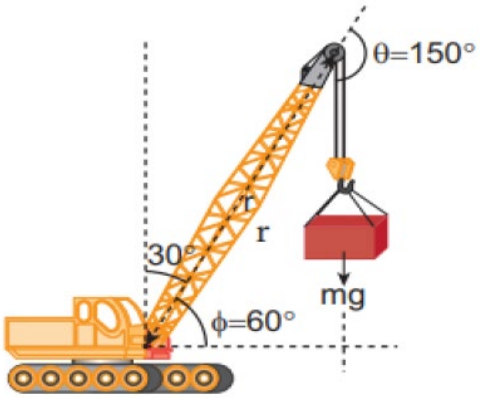
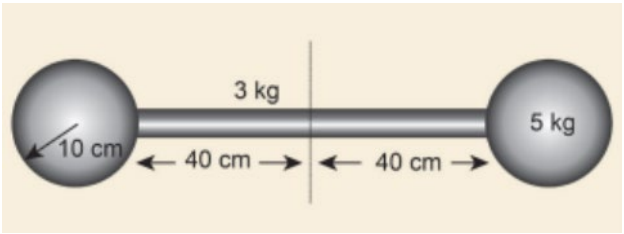
Tutorial 10

PHY 101

Q1. A crane has an arm length of 20 m inclined at 30_o with the vertical. It carries a container of mass of 2 ton suspended from the top end of the arm. Find the torque produced by the gravitational force on the container about the point where the arm is fixed to the crane. [Given: 1 ton = 1000 kg; neglect the weight of the arm. g = 10 ms^{-2}]

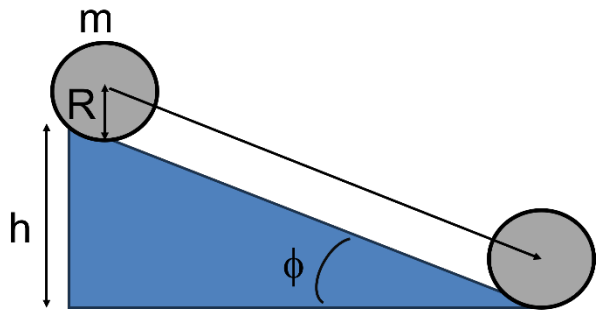


Q2. Find the moment of inertia about the geometric centre of the given structure made up of one thin rod connecting two similar solid spheres as shown in Figure.

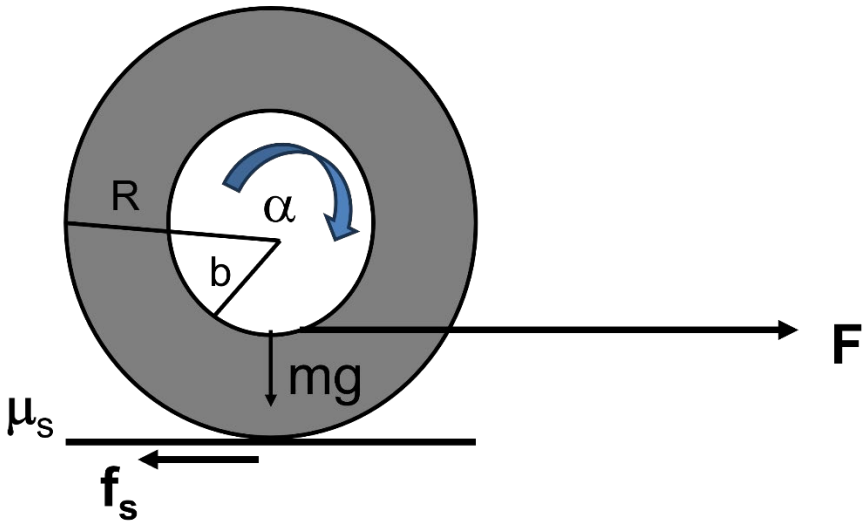


Q3.A wheel is rolling down a inclined plane with coefficient of friction f_s and angle ϕ without slipping as shown in the figure. If I_{CM} is the moment of inertia , R the radius of the wheel, m the mass of the wheel and h the distance it dropped from its initial position in the vertical direction and v_{CM} is the translational velocity of the centre of mass, then show using the kinematics of rotational and translational motion

$$v_{CM} = \sqrt[2]{\frac{2mgh}{(m + \frac{I_{CM}}{R^2})}}$$



Q4.A YoYo of mass m is pulled along the plane with a string in the horizontal direction. It experiences a frictional force $\mathbf{f_s}$ (coefficient of static friction of the surface being μ_s)when it is being pulled with force **F.** It has a inner radius b and a outer radius R shown in the figure. What is the maximum magnitude of pulling force F for which the YoYo will roll without slipping. (assume g=acceleration due to gravity and I_{CM} is the moment of inertia of the YoYo.


R
α
b
F
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