

Physics 160 Written Homework - Chapter 10-11

1 Torque

Two blocks hang from either end of a massless rope that runs over a pulley, treated as a thin solid disk, (An Atwood's Machine), and are held in place. One block has a mass of $12kg$, the pulley has a mass of $4kg$ and radius $10cm$, and the other block's mass is unknown. The blocks are released from rest, and the block of known mass accelerates toward the ground at a rate of $1m/s^2$. The rope does not slip over the pulley, and the pulley spins on a frictionless axle. Find the unknown mass of the block.

2 Angular Momentum

A thin disk of uniform density, mass $5kg$ and radius $.25m$, rests on a frictionless table. A small lump of clay, which can be treated as a point particle of mass $1kg$, travels toward the disk at a velocity of $6m/s$, and impacts it tangentially at the very edge of the disk, where it sticks. Find the linear and angular speed of the disk clay system after the impact.

3 Equilibrium

A ladder of uniform density, length $4m$ and mass $20kg$, makes an angle $\theta = 65^\circ$ with the horizontal and its upper end rests against a wall. The two ends of the ladder each have a coefficient of static friction $\mu_s = .7$ between them and the wall or floor respectively. A man wishes to climb the ladder to a point $3m$ up the ladder's length. What is the maximum mass that he can have such that the ladder will not slip when he reaches this point?