

Phys 321, Theoretical Mechanics I, Spring 2006

Homework #5

Due Date: Friday May 5, 10am

1. Find the centers of mass of (a) a hemispherical shell of constant density, inner radius r_1 , and outer radius r_2 , (b) a uniform solid cone of base diameter 2α and height h .
2. A particle of mass m_1 and velocity u_1 collides with a particle of mass m_2 at rest. The two particles stick together. What fraction of the initial kinetic energy is "lost" in the collision?
3. A particle of mass m strikes a wall at angle θ from the normal. The coefficient of restitution is ϵ . Find the velocity and the rebounds angle of the particle after leaving the wall. Neglect any external forces, such as gravity, in solving this problem.
4. A car driver drives at an instantaneous velocity u and acceleration a . The tires, of radius r_0 are not slipping. Find the point on the tire that has the greatest acceleration relative to the ground. How large is that acceleration?
5. Assume that the Earth is spherical and determine how much greater is the effective gravitational field at the the pole than at the equator.
6. Find the Coriolis force on a car of mass 1300 kg driving north near Fairbanks, Alaska (latitude 65N) at a speed of 100 kph.