

PHY101, Assignment-2
Instructor: Goutam Sheet

Time Limit: None, Maximum points: 00

The assignments are only for your learning – they will not be evaluated for grading. The problems will be discussed in tutorial sessions. If you have questions regarding the assignment problems, write an email to iisergoutam@gmail.com

1. A car loaded with sand is acted on by a constant horizontal force \vec{F} . Sand spills at a constant rate α through a hole at the bottom of the car. Write down the differential equation of motion of the car and obtain expression for the velocity of the car if it starts from rest.
2. The kinetic energy of a particle moving along a circle of radius R depends on the distance covered s as $T = as^2$ where a is a constant. Find the force acting on the particle as a function of s .
3. Two men, each of mass m , stand on the edge of a stationary buggy of mass M . Neglecting friction, find the velocity of the buggy after both men jump off with the same horizontal velocity u relative to the buggy: (a) simultaneously, (b) one after the other. In which case will the velocity of the buggy be greater?
4. Two masses m_1 and m_2 , are connected by a spring and rests on a floor (coefficient of friction $= \mu$). A varying force F slightly larger than the restoring forces is continuously applied to m_1 . Find the minimum value of F for which the mass m_2 just starts moving.
5. A stick, of length l and mass M , initially upright on a frictionless table starts falling. Find the speed of the center of mass as a function of position.
6. A rod of mass M and length l is hinged at one end. Neglecting friction, determine the minimum angular velocity ω_0 that must be imparted to the rod so that it will swing into a horizontal position (despite the Earth's gravity).
7. A table of height h has a small hole at its middle and rests on a horizontal surface. A thin chain of length l and mass M is loosely coiled and placed close to the hole. One end of the chain is pulled a little through the hole and then released. There is no friction. After what time will the chain reach the floor for (a) $l = h$, (b) $l < h$ and (c) $l > h$?
8. A spherical container contains N number of particles each of mass m . The particles move with speed v in random directions and suffer elastic collision with the walls of the container. Find the pressure on the wall of the container.