Chapter 7: Work and Energy

1. A small object of mass m is suspended from a string of length L. The object is pulled sideways by a force **F** that is always horizontal, until the string finally makes an angle Φm with the vertical. The displacement is accomplished at a small constant speed. Find the work done by F on the object.

2. Three forces applied to a trunk that moves leftward by 3.00 m over a frictionless floor. F1 = 5.00 N, F2 = 9.00 N , F3 = 3.00 N and angle θ = 60°. During the displacement, (a) what is the net work done on the trunk by the three forces and (b) does the kinetic energy of the trunk increase or decrease?

3. A simple Atwood's machine uses two masses m_1 and m_2 . Starting from rest, the speed of the masses is 4.0 m/s at the end of 3.0 s. At that time, the kinetic energy of the system is 80 J and each mass has moved a distance of 6.0 m. Determine the values of m_1 and m_2 .

4. A system of two paint buckets connected by a lightweight rope is released from rest with the m_1 bucket h meters above the floor. Find the speed with which this bucket strikes the floor. You can ignore friction and the mass of the pulley.

5. A box of mass M is at rest at the bottom of an inclined plane, the coefficient of kinetic friction between the box and the plane is μk. The box is attached to a string that pulls with a constant tension T. (a) Find the work done by the tension as the box moves through a distance x along the plane. (b) Find the speed of the box as a function of x and θ. (c) Determine the power produced by the tension in the string as a function of x and θ.

6. A horizontal force acts on a cart of mass m such that the speed v of the cart increases with distance x as v = Cx, where C is a constant. (a) Find the force acting on the cart as a function of position. (b) What is the work done by the force in moving the cart from x = 0 to $x = x_1$?

7. A straight rod of negligible mass is mounted on a frictionless pivot. Mass m_1 and m_2 are attached to the rod at distance L_1 and L_2 . (a) Write an expression for the gravitational energy of the masses as a function of the angle θ. (b) For what angle θ is the potential energy a minimum? Show that if $m_1 * L_1 = m_2 * L_2$, the potential energy is the same for all the values of θ.