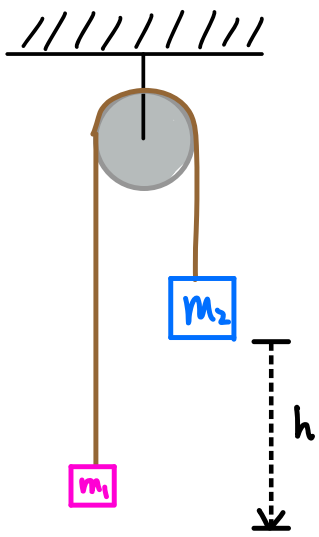
Physics 120

Worksheet 08 Work and Energy

Problem 1



The right figure shows two blocks connected by a cord (of negligible mass) that passes over a frictionless pulley (also of negligible mass). The arrangement is known as *Atwood's machine*. The blocks have mass m_1 and m_2 respectively with $m_1 < m_2$. The two blocks are initially at rest.

(a) If the block m_2 falls over a height h, assuming the length of the rope is long enough, what is work done on m_2 by the gravitational force?

(b) Continue from part (a), what is the work done on m_1 by the gravitational force?

(c) What is the net work done on the two-block system by gravity?

(d) According to the work-kinetic energy theorem, $W = \Delta K$. Is the kinetic energy gained by the block m_2 equal to your answer to part (a)?

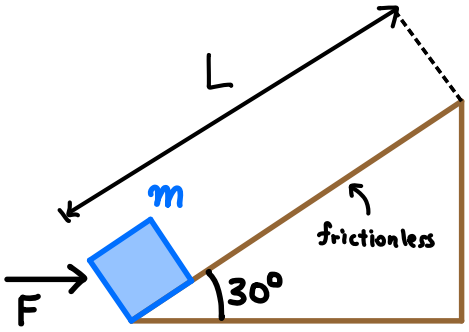
(e) Denote the tension force as T, find the work done on m_2 by the tension T when the block falls down by a height H.

(f) Find the work done on m_1 by the tension T.

(g) Find the final speed of the block m_2 after it falls over a height h. Express your answer in terms of m_1, m_2, g and h.

Problem 2

A block of mass m is placed on a ramp whose inclination angle is θ. A constant force F is applied horizontally on the block and accelerates the block until the block reaches the highest point of the ramp. The block is initially at rest and at the bottom of the ramp. The length of the ramp is L.



(a) Draw the free body diagram for the block.

(b) Find the work done by the normal force between the block and the ramp.

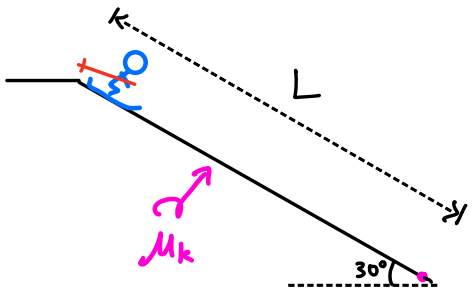
(c) Find the work done by the gravitational force.

(d) Find the work done by the constant force F.

(e) Using work-kinetic energy theorem, find the final speed of the block when it reaches the top.

Problem 3

Rita goes skiing. She starts from the top of the track, and slides down from rest. The track has an inclination angle θ, length L, and the coefficient of kinetic friction between the ski and the track is μ_k. Suppose Rita's mass is m.



(a) Draw the free body digram for Rita when she is on the inclined track.

(b) Find the normal force between Rita and the track.

(c) Find the kinetic friction between the ski and the track.

(d) Find the work done by kinetic friction between the ski and the track

(e) Using work-kinetic energy theorem, find Rita's speed when she reaches the bottom of the track.