Physics 2314, Homework #6 (due 3/7)

Multiple choice questions

M1 A particle is moving in a conservative force field from point a to point b. At point a the particle's potential energy is equal to its kinetic energy, and at point b the particle's potential energy is zero. If the velocity of the particle is v_a at point a and v_b at point b, then

    A. $v_a = v_b/4$

    B. $v_a = v_b/2$

    C. $v_a = v_b/\sqrt{2}$

    D. $v_a = v_b$

    E. $v_a = \sqrt{2}v_b$

    F. $v_a = 2v_b$

    G. $v_a = 4v_b$

M2 Two particles of the same mass collide elastically.

(a) If both particles have the same initial speed and collision is head-to-head, the angle between their final velocities is

    A. 0

    B. $60°$

    C. $90°$

    D. $180°$

(b) If one of the particles is at rest and collision is glancing, the angle between their final velocities is

    A. 0

    B. $60°$

    C. $90°$

    D. $180°$

Problems

P1 A block of mass $m = 2$ kg is attached to a spring of force constant $k = 500$ N/m. The coefficient of friction between block and surface is $\mu_k = 0.25$. The block is pulled to a position $x = 0.1$ m to the right of equilibrium and released from rest. FInd the speed the block has as it passes through equilibrium.
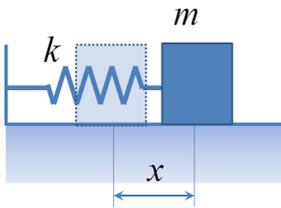
P2 A system consists of two light frictionless pulleys and two blocks of masses $m_1 = 3$ kg and $m_2 = 2$ kg connected by a light, inextensible cord. The system is originally held at rest so that block 1 is at height $H = 0.1$ m above the ground. The blocks are then released. Find the speed of block 1 as it hits the ground.
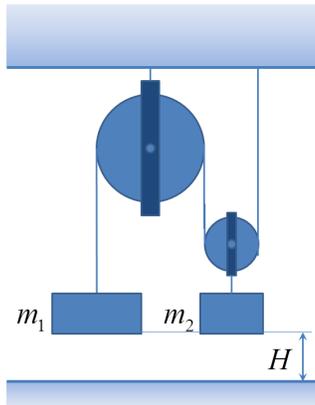
P3 A rain cloud at an altitude of 2 km contains 3×10^7 kg of water vapor. How long would it take a 2.70-kW pump to raise the same amount of water from the Earth surface to the cloud's position?

P4 Three carts of masses $m_1 = 1$ kg, $m_2 = 3$ kg, and $m_3 = 7$ kg move on a frictionless horizontal track. Initial velocity of cart 1 is 1 m/s and carts 2 and 3 are at rest. What are the final velocities of the carts if the collisions between them are (a) elastic; (b) perfectly inelastic?