Problem Set 5 – Energy and Work

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Problem 1

A light car and a heavy truck have the same momentum. The truck weighs ten times as much as the car. What is the ratio of the kinetic energy of the truck to that of the car?

Problem 2

A ball is dropped at a height of $h = 10$m. Using conservation of energy, calculate the ball's velocity when it is at a height $h = 4$m.

Problem 3

A block with a mass of 10kg and slides across a surface with an initial velocity of $v_i = 20\frac{m}{s}$, where the coefficient of kinetic friction is $\mu_k = 0.1$.
a) How much work does friction do on the block before it stops?
b) At $t = 5s$, what is the kinetic energy of the block?

Problem 4

A spring has an equilibrium length of 2.0 meters and a spring constant of 10 newtons/meter. Alice is pulling on one end of the spring with a force of 3.0 newtons. Bob is pulling on the opposite end of the spring with a force of 3.0 newtons, in the opposite direction. What is the resulting length of the spring?

Problem 5

A block of mass $m = 3.0$kg is moving on a horizontal surface towards a massless spring with spring constant $k = 80.0$N/m. The coefficient of kinetic friction between the block and the surface is $_k = 0.50$. The block has a speed of 2.0 m/s when it first comes in contact with the spring. How far will the spring be compressed?

Problem 6

(Variation on the problem we ended with) A block of mass $m = 3.0$ kg slides down one ramp, and then up a second ramp. The coefficient of kinetic friction between the block and each ramp is $_k = 0.40$. The block begins at a height $h_1 = 1.0$m above the horizontal. Both ramps are at a 30° incline above the horizontal. To what height above the horizontal does the block rise on the second ramp?