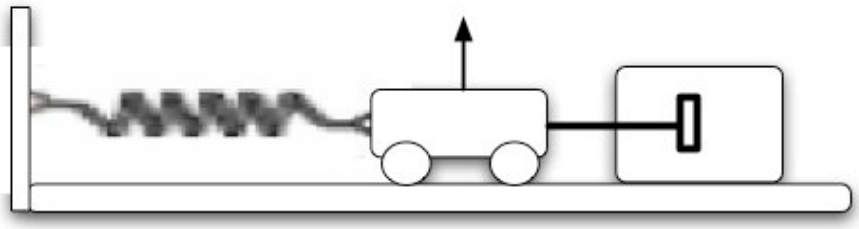
A cart attached to a spring on one side is connected to a disk that is enclosed in a box of air. The result is a Newton's drag law damping effect.



The equations of the motion of the cart may be approximated by:

$$m\frac{dv}{dt} = -kx - cv^2 \qquad \frac{dx}{dt} = v$$

(a) If the damping is negligible and the cart starts at $x(0) = x_0$, $v(0) = 0$, find the solution for $x(t)$, $v(t)$.

(b) Write an expression for the work done by the damping force on the cart for a general motion. Begin with a vector expression and evaluate the vector part so that you are left with an integral of functions only.

(c) Evaluate your expression over one period using the result you got for part (a). Is your result positive or negative? Can we get away with this? If we can, what conditions might make this an OK approximation?