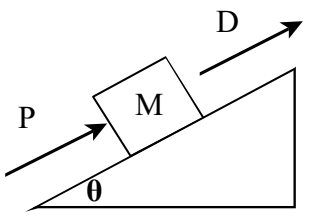
Physics 1145 Homework for week 12: Energy

1. A ball of mass 100g is placed on a vertical spring of spring constant 200N/m, and the spring is compressed by 5cm from its equilibrium length. The ball is released from rest. How high does it rise above its starting point on the compressed spring?

2. A force of 10N is exerted on an object as the object moves a distance D=5m along a horizontal surface. Find the work done by this force if
a) the force is parallel to the surface and in the same direction as the displacement.
b) the force is parallel to the surface and in the opposite direction as the displacement.
c) the force is perpendicular to the surface.
d) the force makes a 30° degree angle with the displacement vector.
e) the force makes a 150° degree angle with the displacement vector.

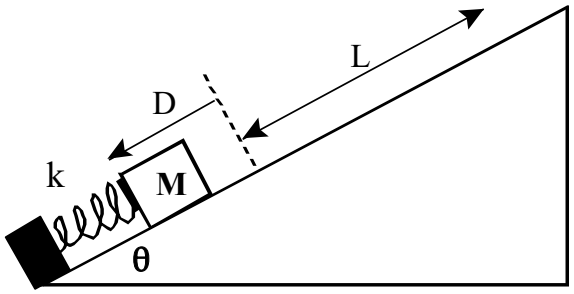
3. A block of mass 2kg is on a frictionless incline that makes an angle θ=20° with the horizontal. A constant pushing force of magnitude *P*=10N that is directed parallel to the incline pushes the block up the incline by a distance *D*=2m along the incline. The block starts from rest.



a) Find the work done by the pushing force.
b) Find the change in potential energy of gravity.
c) Find the change in kinetic energy and the final speed of the block.

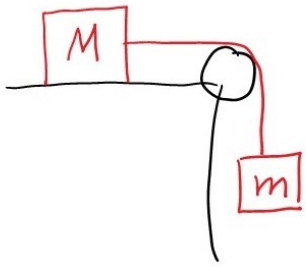
4. A block of mass M=3kg slides down an incline that makes an angle θ=10° with the horizontal. The incline is rough, with a coefficient of kinetic friction 0.2. Find the change in thermal energy when the block has moved 3.0m down the ramp.

5. A box of mass *M* is on a frictionless incline that makes an angle θ with the horizontal. The box is placed against a spring of spring constant *k* whose other end is secured to a wall at the lower end of the incline. The box is compressing the spring a distance *D,* is then released from rest and slides up the incline.



Use energy methods to derive an expression for the speed of the box when it has traveled a distance *L* beyond the equilibrium position of the spring, in terms of system parameters.

6. A block of mass M=3kg is on a rough horizontal surface (coefficient of kinetic friction 0.2). It is connected to a second block of mass m=1kg by a massless string that runs over a massless frictionless pulley. The system is released from rest.



Use energy methods to find the speed of the blocks when block m has descended a distance 1.0m..