
1. A crate of mass 5kg is pushed up a rough incline by means of a horizontal pushing force of constant magnitude 50N. The incline makes an angle 30° with respect to the horizontal and has a coefficient of kinetic friction 0.2 with the surface of the crate. The crate moves a distance 3m along the incline. Find
   a) the work done on the crate by gravity.
   b) the work done on the crate by the pushing force.
   c) the work done on the crate by the normal force.
   d) the work done on the crate by friction.
   e) the final speed of the crate if the crate started from rest.

2. A block of mass 2kg is moving along the x-axis under the influence of a force whose x-component varies as shown in the graph. The particle is at rest when it is at the origin. Determine the work done by the force as the block moves...
   a) …from \(x=0\) to \(x=4\)m    b) …from \(x=0\) to \(x=8\)m
   Find the speed of the block …
   c) …at \(x=4\)m.          d) …at \(x=8\)m.

3. A position dependent force acting on an object is given as \(\vec{F} = cxy\hat{i}\) where \(c\) is a positive constant. The object moves along the following path consisting of four steps: from the origin along the x-axis to the point (D,0); parallel to the y-axis to the point (D,D); parallel to the x-axis to the point (0, D); along the y-axis back to the origin. Calculate the work done by the force on the object for each of the steps.

4. A giant challenges a dwarf to a competition. Each has to move a block of mass \(M\) along a horizontal surface through a distance \(D\), starting from rest. The one whose block has the largest kinetic energy at the end will be the winner.
   The giant is strong. He will push his block with a constant pushing force of magnitude \(P\), directed at an angle \(\theta\) below the horizontal. He is also lazy and leaves the bottom of his block rough so that there will be a coefficient of kinetic friction \(\mu\) between his block and the surface.
   The dwarf is smart. He will launch his block from a spring of spring constant \(k\) that is compressed a distance \(L\). He also makes the bottom of his block smooth so that there is no kinetic friction between block and surface.
   The giant graciously lets the dwarf decide the distance of the race. Use the work-kinetic energy theorem to derive an expression for the maximum distance \(D\) for which the dwarf can be sure to win the competition.