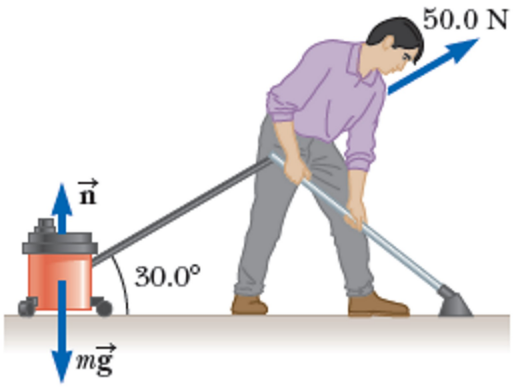
Mr. Clean

Friday, 29 January, 2021 21:35

A man cleaning a floor pulls a vacuum cleaner with a force of magnitude $F = 50\,N$ at an angle of 30° with the horizontal. Calculate the work done by the force on the vacuum cleaner as the vacuum cleaner is displaced (3 m) to the right.



Work Done by a Constant Force

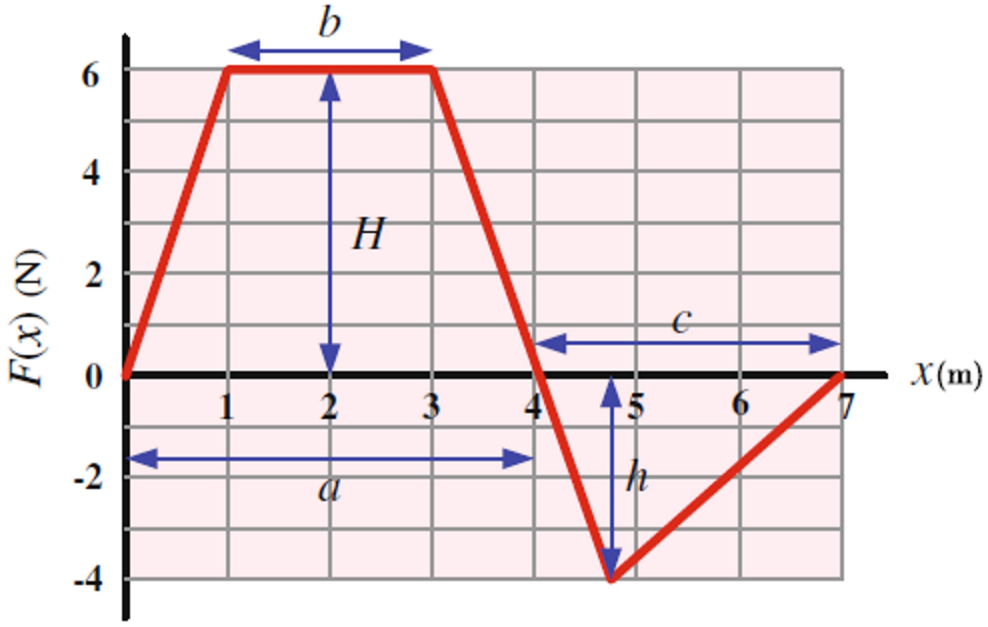
Saturday, 30 January, 2021 15:08

A particle moving in the xy plane undergoes a displacement given by $\Delta\vec{r} = (2\hat{\imath} + 3\hat{\jmath})\, m$ as a constant force $\vec{F} = (5\hat{\imath} + 2\hat{\jmath})\, N$ acts on the particle. Calculate the work done by $\vec{F}$ on the particle.

Work Done by a Varying Force - Area

Saturday, 30 January, 2021 15:08

A force acting on a particle varies with x as shown. Calculate the work done by the force on the particle as it moves from x = 1 m to x = 7 m.



Work Done by a Varying Force - Integration

Saturday, 30 January, 2021 15:08

Force $\vec{F} = (3x^2\hat{\imath} + 4\hat{\jmath})\ N$ with x in meters, acts on a particle, changing only the kinetic energy of the particle. How much work is done on the particle as it moves from coordinates (2 m, 3 m) to (3 m, 0m)?

Work done by two constant force

Saturday, 30 January, 2021 15:09

A $6\,kg$ block initially at rest is pulled to the right along a frictionless, horizontal surface by a constant horizontal force of $12\,N$. Find the block's speed after it has moved $3\,m$.

Work done by two constant forces, industrial spies

Saturday, 30 January, 2021 15:10

The Figure shows two industrial spies sliding an initially stationary 225 kg floor safe a displacement of magnitude 8.5 m, straight toward their truck. The push $\vec{F}_1$ of spy 001 is 12 N, directed at an angle of 30° downward from the horizontal; the pull $\vec{F}_2$ of spy 002 is 10 N, directed at 40° above the horizontal. The magnitudes and directions of these forces do not change as the safe moves, and the floor and safe make frictionless contact.

- What is the work done on the safe by applied force $\vec{F}_1$?
- What is the work done on the safe by applied force $\vec{F}_2$?
- What is the work done on the safe by the normal force?
- What is the work done on the safe by the gravitational force?
- What is the net work done on the safe?
- The safe is initially stationary. What is its speed at the end of the 8.50 m displacement?

Work done by a constant force in unit-vector notation

Saturday, 30 January, 2021 15:09

During a storm, a crate is sliding across a slick, oily parking lot through a displacement $\Delta\vec{r} = (-3\hat{\imath})\, m$ while a steady wind pushes against the crate with a force $\vec{F} = (2\hat{\imath} - 6\hat{\jmath})\, N$. If the crate has a kinetic energy of 10 J at the beginning of displacement , what is its kinetic energy at the end?

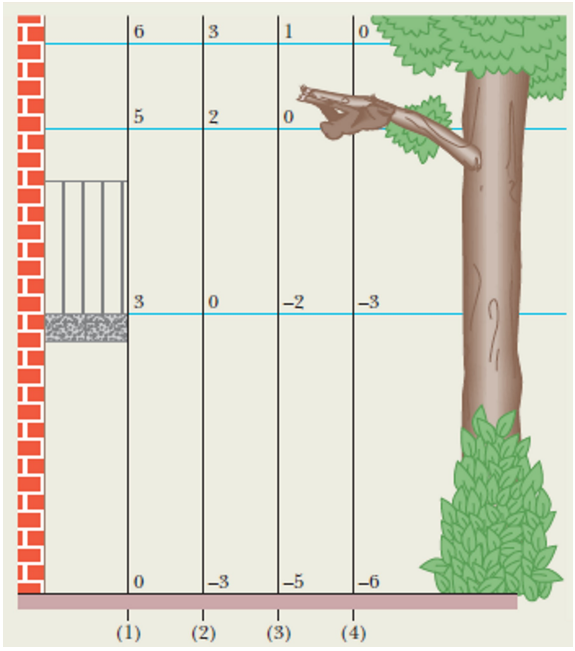
Choosing reference level for gravitational potential energy, sloth

Saturday, 30 January, 2021 15:10

A 2 kg sloth hangs 5 m above the ground.

- What is the gravitational potential energy of the sloth–Earth system if we take the reference point $y = 0$ to be:
  - at the ground,
  - at a balcony floor that is 3 m above the ground,
  - at the limb, and
  - 1 m above the limb?

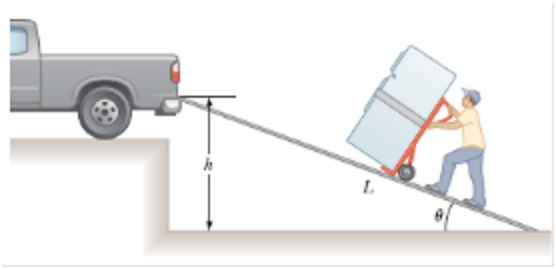
- The sloth drops to the ground. For each choice of reference point, what is the change in the potential energy of the sloth–Earth system due to the fall?



Does the Ramp Lessen the Work Required?

Saturday, 30 January, 2021 15:11

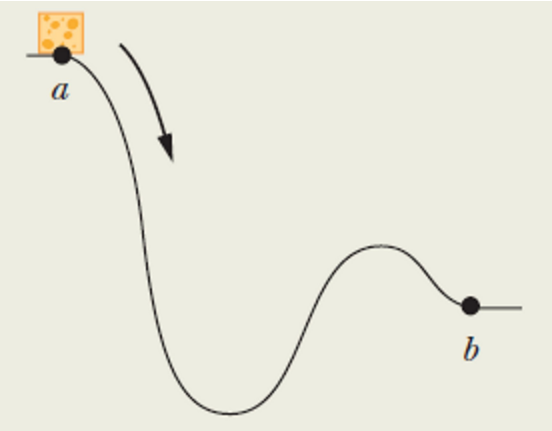
A man wishes to load a refrigerator onto a truck using a ramp at angle θ as shown. Suppose the refrigerator is wheeled on a hand truck up the ramp at constant speed. Determine the work done by the man.



Equivalent paths for calculating work, slippery cheese

Saturday, 30 January, 2021 15:11

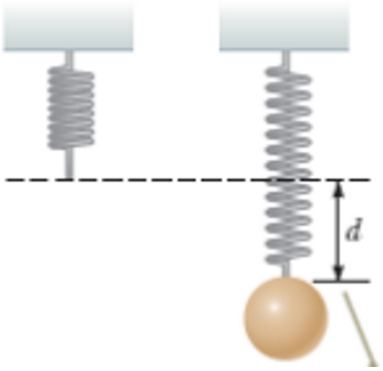
The figure shows a 2 kg block of slippery cheese that slides along a frictionless track from point (a) to point (b). The cheese travels through a total distance of 2 m along the track, and a net vertical distance of 0.8 m. How much work is done on the cheese by the gravitational force during the slide?



Measuring κ for a Spring

Saturday, 30 January, 2021 15:12

- If a spring is stretched $2\ cm$ by a suspended object having a mass of $0.55\ kg$, what is the force constant of the spring?
- How much work is done by the spring on the object as it stretches through this distance?



Work done by a spring

Saturday, 30 January, 2021 15:12

The force an ideal spring exerts on an object is given by: $F_s = -\kappa x$, where x measures the displacement of the object from its equilibrium position. If $\kappa = 60\ N/m$, how much work is done by this force as the object moves from $x = -0.2\ m$ to $x = 0\ m$?

Relationship Between Conservative Forces and Potential Energy-1

Saturday, 30 January, 2021 15:13

A single conservative force acts on a $5\,kg$ particle within a system due to its interaction with the rest of the system. The equation $F_x = 2x + 4$ describes the force, where F_x is in Newtons and x is in meters. As the particle moves along the x axis from $x = 1\,m$ to $x = 5\,m$, calculate:

- the work done by this force on the particle,
- the change in the potential energy of the system, and
- the kinetic energy the particle has at $x = 5\,m$ if its speed is $3\ m/s$ at $x = 1\,m$.

Relationship Between Conservative Forces and Potential Energy-2

Saturday, 30 January, 2021 15:13

A potential energy function for a system in which a three-dimensional force acts is of the form $U(x, y, z) = 3x^3y - 7xz$. Find the force that acts at the point (x, y, z).

Relationship Between Conservative Forces and Potential Energy-3

Saturday, 30 January, 2021 15:14

A small block with mass $0.04\,kg$ is moving in the xy-plane. The net force on the block is described by the potential energy function $U(x,y) = 15.8x^2 - 13.6y^3$. What are the magnitude and direction of the acceleration of the block when it is at the point $(x = 0.3\,m, y = 0.6\,m)$?

Power Delivered by an Elevator Motor

Saturday, 30 January, 2021 15:14

An elevator car has a mass of $1600\,kg$ and is carrying passengers having a combined mass of $200\,kg$. A constant friction force of $4000\,N$ retards its motion.

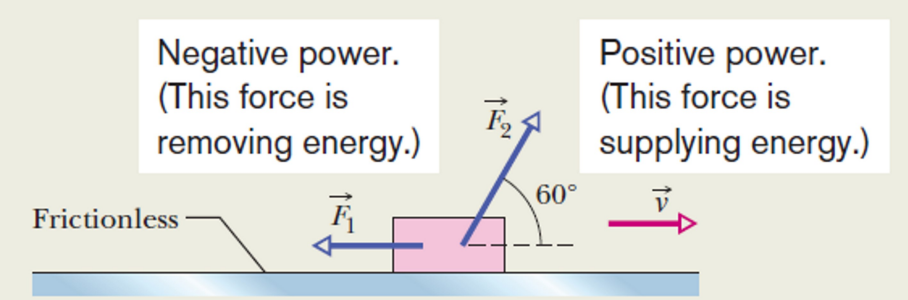
- How much power must a motor deliver to lift the elevator car and its passengers at a constant speed of $3\ m/s$?
- What power must the motor deliver at the instant the speed of the elevator is v if the motor is designed to provide the elevator car with an upward acceleration of $1\ m/s^2$?

Power, force, and velocity

Saturday, 30 January, 2021 15:15

The figure shows constant forces $\vec{F}_1$ and $\vec{F}_2$ acting on a box as the box slides rightward across a frictionless floor. Force $\vec{F}_1$ is horizontal, with magnitude 2 N; force $\vec{F}_2$ is angled upward by 60° to the floor and has magnitude 4 N. The speed of the box at a certain instant is 3 m/s.

- What is the power due to each force acting on the box at that instant, and
- What is the net power?



Average Power

Saturday, 30 January, 2021 15:15

The loaded cab of an elevator has a mass of $3 \times 10^3\ kg$ and moves 210 m up the shaft in 23 s at constant speed. At what average rate does the force from the cable do work on the cab?

Instantaneous power

Saturday, 30 January, 2021 15:15

At a certain instant, a particle-like object is acted on by a force $\vec{F} = 4(\hat{i} - 2\hat{j} + 9\hat{k})N$ while the object's velocity is $\vec{v} = -(2\hat{i} + 4\hat{k})m/s$. What is the instantaneous rate at which the force does work on the object?