Ball in Free Fall

Friday, 29 January, 2021 21:36

A ball of mass m is dropped from a height h above the ground.

- Determine the speed of the ball when it is at a height y above the ground.
- Determine the speed of the ball at y if at the instant of release it already has an initial upward speed v_i at the initial altitude h.

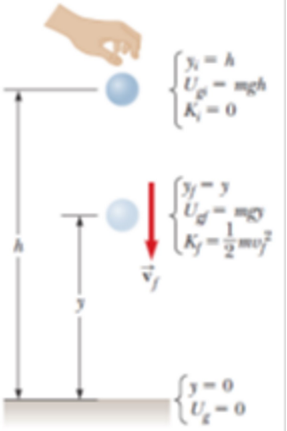


Figure 8.4 (Example 8.1) A ball is

The Pendulum

Saturday, 30 January, 2021 15:17

A pendulum consists of a sphere of mass m attached to a light cord of length L. The sphere is released from rest when the cord makes an angle θ_A with the vertical, and the pivot at P is frictionless.

- Find the speed of the sphere when it is at the lowest point B.
- What is the tension T_B in the cord at B?

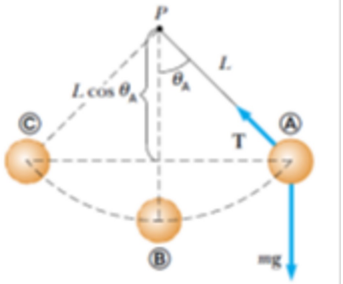


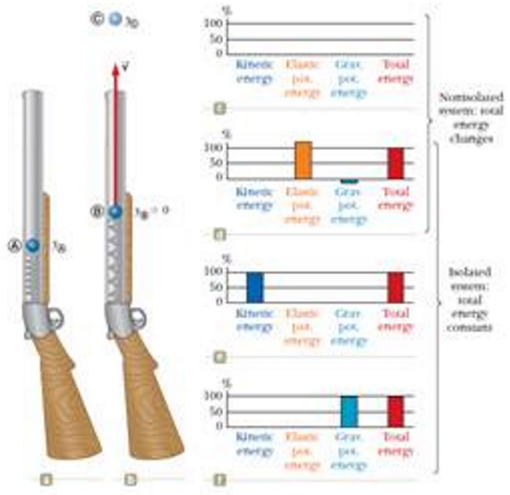
Figure 8.7 (Example 8.3) If the sphere is released

The Spring-Loaded Popgun

Saturday, 30 January, 2021 15:18

The launching mechanism of a popgun consists of a trigger-released spring. The spring is compressed to a position y_A, and the trigger is fired. The projectile of mass m rises to a position y_C above the position at which it leaves the spring, $y_B = 0$. Consider a firing of the gun for which $m = 35\ g$, $y_A = -0.12\ m$ and $y_C = 20\ m$.

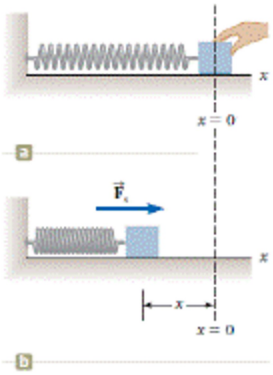
- Determine the spring constant.
- Find the speed of the projectile as it moves through the equilibrium position B of the spring.



A Block–Spring System

Saturday, 30 January, 2021 15:18

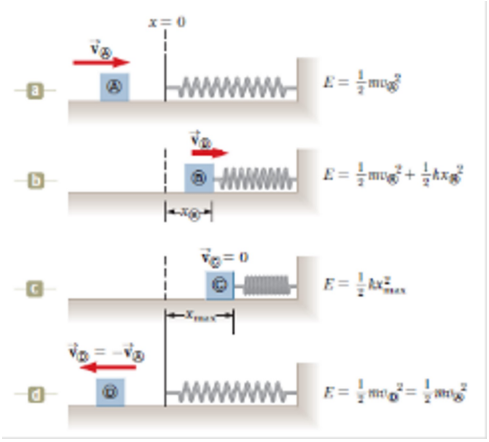
A block of mass $1.6\,kg$ is attached to a horizontal spring that has a force constant of $\kappa = 1000\ N/m$. The spring is compressed $2\,cm$ and is then released from rest. Calculate the speed of the block as it passes through the equilibrium position $(x = 0)$ if the surface is frictionless.



Block–Spring Collision

Saturday, 30 January, 2021 15:19

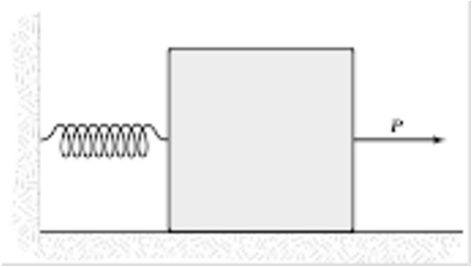
A block having a mass of $0.8\,kg$ is given an initial velocity $v_A = 1.2\ m/s$ to the right and collides with a spring whose mass is negligible and whose force constant is $\kappa = 50\ N/m$. Calculate the maximum compression of the spring after the collision.



Spring - Block and applied force

Saturday, 30 January, 2021 15:19

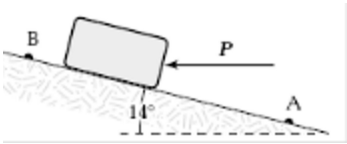
A $10\,kg$ block on a horizontal frictionless surface is attached to a light spring $\kappa = 0.8\ kN/m$. The block is initially at rest at its equilibrium position when a force $P = 80\,N$ acting parallel to the surface is applied to the block. What is the speed of the block when it is $13\,cm$ from its equilibrium position?



Work Done by a Constant Force

Saturday, 30 January, 2021 15:20

A $1.4\,kg$ block is pushed up a frictionless 14° incline from point A to point B by a force $P = 6\,N$. Points A and B are $1.2\,m$ apart. If the kinetic energies of the block at A and B are $3\,J$ and $4\,J$, respectively, how much work is done on the block by the force P between A and B?

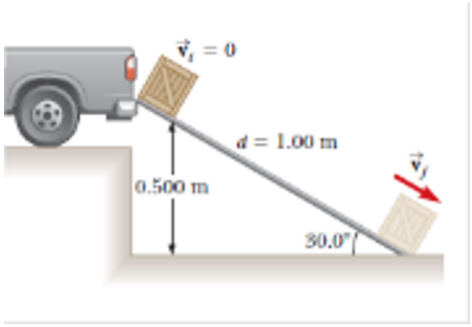


Crate Sliding Down a Ramp

Saturday, 30 January, 2021 15:20

A $3\,kg$ crate slides down a ramp. The ramp is $1\,m$ in length and inclined at an angle of $\theta = 30^{\circ}$. The crate starts from rest at the top, experiences a constant friction force of magnitude $5\,N$, and continues to move a short distance on the horizontal floor after it leaves the ramp.

- Determine the speed of the crate at the bottom of the ramp.
- How far does the crate slide on the horizontal floor if it continues to experience a friction force of magnitude $5\,N$?

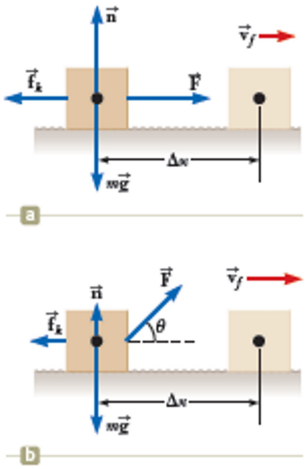


A Block Pulled on a Rough Surface

Saturday, 30 January, 2021 15:20

A $6\,kg$ block initially at rest is pulled to the right along a horizontal surface by a constant horizontal force of $12\,N$.

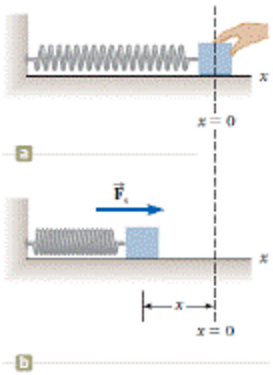
- Find the speed of the block after it has moved $3\,m$ if the surfaces in contact have a coefficient of kinetic friction of 0.15.
- Suppose the force $\vec{F}$ is applied at an angle θ. At what angle should the force be applied to achieve the largest possible speed after the block has moved $3\,m$ to the right?



A Block–Spring System

Saturday, 30 January, 2021 15:21

A block of mass $1.6\,kg$ is attached to a horizontal spring that has a force constant of $\kappa = 1000\ N/m$. The spring is compressed $2\,cm$ and is then released from rest. Calculate the speed of the block as it passes through the equilibrium position $(x = 0)$ if a constant friction force of $4\,N$ retards its motion from the moment it is released.



Block–Spring Collision

Saturday, 30 January, 2021 15:21

A block having a mass of $0.8\,kg$ is given an initial velocity $v_A = 1.2\ m/s$ to the right and collides with a spring whose mass is negligible and whose force constant is $\kappa = 50\ N/m$. Suppose a constant force of kinetic friction acts between the block and the surface, with $\mu_k = 0.5$. If the speed of the block at the moment it collides with the spring is $v_A = 1.2\ m/s$, what is the maximum compression x_C in the spring?