This print-out should have 10 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

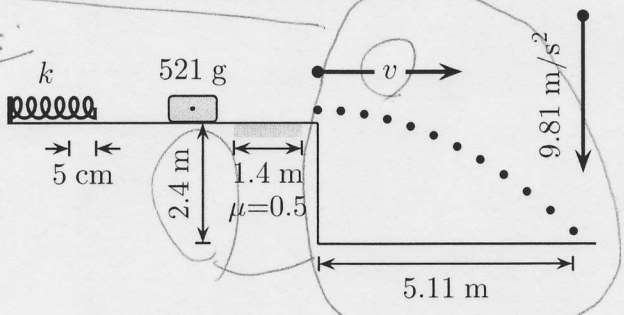
001 (part 1 of 3) 10.0 points

A block is pushed against the spring with spring constant k (located on the left-hand side of the track) and compresses the spring a distance 5 cm from its equilibrium position (as shown in the figure below).

The block starts at rest, is accelerated by the compressed spring, and slides across a frictionless track except for a small rough area on a horizontal section of the track (as shown in the figure below).

It leaves the track horizontally, flies through the air, and subsequently strikes the ground.

The acceleration of gravity is 9.81 m/s^2.



What is the spring constant k? Answer in units of N/m.

002 (part 2 of 3) 10.0 points

What is the speed v of the block when it leaves the track? Answer in units of m/s.

003 (part 3 of 3) 10.0 points

What is the total speed of the block when it hits the ground? Answer in units of m/s.

004 (part 1 of 3) 10.0 points

A 133 g arrow is shot straight up into the air with a speed of 25 m/s. It reaches a maximum height of 30.8878 m.

Find the initial kinetic energy. The acceleration of gravity is 9.8 m/s^2. Answer in units of J.

005 (part 2 of 3) 10.0 points

Find the potential energy at its highest position. Answer in units of J.

006 (part 3 of 3) 10.0 points

Find the magnitude of the energy lost due to air resistance. Answer in units of J.

007 (part 1 of 3) 10.0 points

A 3 kg block collides with a massless spring of spring constant 100 N/m attached to a wall. The speed of the block was observed to be 1.4 m/s at the moment of collision.

The acceleration of gravity is 9.8 m/s^2.

How far does the spring compress if the surface on which the mass moves is frictionless? Answer in units of cm.

008 (part 2 of 3) 10.0 points

The maximum distance to which the spring was compressed was observed to be 14.5492 cm.

What is the kinetic coefficient of friction between the block and the floor?

009 (part 3 of 3) 10.0 points

Given: The coefficient of static friction between the floor and the block is 0.659829.

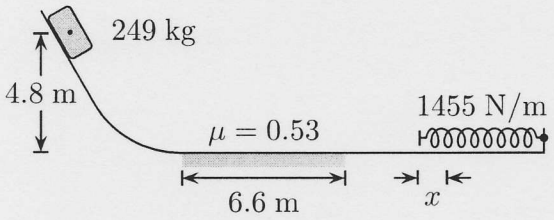
Does the block remain at rest or does it bounce back off the spring once the spring is fully compressed?

1. cannot be determined
2. stays at rest
3. bounces back

010 10.0 points

A 249 kg block is released at a 4.8 m height as shown. The track is frictionless except for a portion of length 6.6 m. The block travels down the track, hits a spring of force constant $k = 1455$ N/m. The coefficient of kinetic friction between surface and block over the 6.6 m track length is 0.53.

The acceleration of gravity is 9.8 m/s^2.



Determine the compression of the spring x from its equilibrium position before coming to rest momentarily. Answer in units of m.

$W_{nc} = (\text{work by friction})$

$= E_{m,f} - E_{m,i}$

$E_m = K + U_g + U_s$

$= \frac{1}{2}mv^2 + mgh + \frac{1}{2}kx^2$