This print-out should have 16 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001　10.0 points
A 5.7 kg bowling ball is lifted 2.5 m into a storage rack.

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

Calculate the increase in the ball's potential energy.

Answer in units of J.

002　10.0 points
A spring has a force constant of 90000 N/m.

How far must it be stretched for its potential energy to be 34 J?
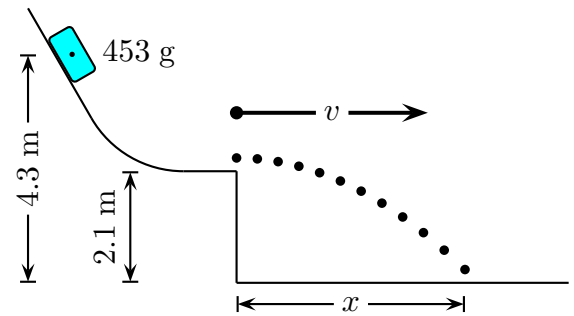
Answer in units of m.

003　10.0 points
In a certain region of space, a force $\mathbf{F}(r)$ has an associated potential energy of the form $U(r) = a\,r^2 - b\,r = c$, where a, b, and c are positive constants.

What are the points, if any, where the force $\mathbf{F}(r)$ goes to zero?

1. There is no point where the force is zero.

2. The force goes to zero only at $r = 0$.

3. The force is zero only at $r = \dfrac{c}{b}$.

4. The force is zero at the two values of r that satisfy $a\,r^2 - b\,r + c = 0$.

5. The force goes to zero as $r \to \infty$.

6. The force is zero only at $r = \dfrac{b}{2\,a}$.

004 (part 1 of 3) 10.0 points
A block starts at rest and slides down a frictionless track. It leaves the track horizontally, flies through the air, and subsequently strikes the ground.

What is the speed of the ball when it leaves the track? The acceleration of gravity is 9.81 m/s^2 .

Answer in units of m/s.

005 (part 2 of 3) 10.0 points
What horizontal distance does the block travel in the air?

Answer in units of m.
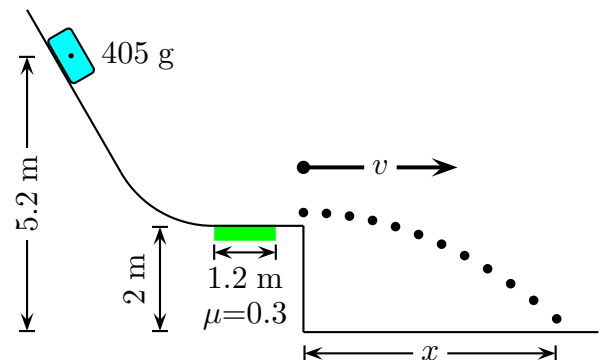
006 (part 3 of 3) 10.0 points
What is the speed of the block when it hits the ground?

Answer in units of m/s.

007 (part 1 of 3) 10.0 points
A block starts at rest and slides down 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 9.8 m/s^2 .

What is the speed v of the block when it leaves the track?

Answer in units of m/s.

008 (part 2 of 3) 10.0 points
What is the horizontal distance x the block travels in the air?

Answer in units of m.

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009 (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.

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010   10.0 points
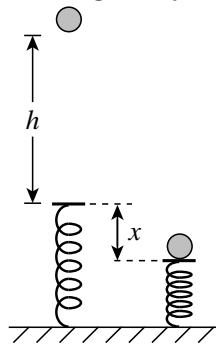You drop a 150 g baseball from a window 15 m above the ground.
What is the kinetic energy of the baseball when it hits the ground? The acceleration due to gravity is 10 m/s^2.

1. 0 J

2. 2.25×10^4 J

3. 1.125 J

4. 1.125×10^5 J

5. 22.5 J

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011   10.0 points
A(n) 89.3 g ball is dropped from a height of 63.5 cm above a spring of negligible mass. The ball compresses the spring to a maximum displacement of 4.71132 cm.
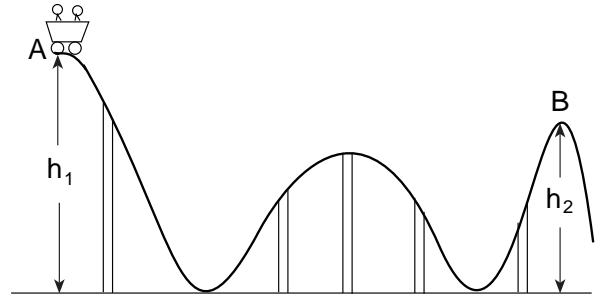The acceleration of gravity is 9.8 m/s^2.

Calculate the spring force constant k.
Answer in units of N/m.

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012 (part 1 of 2) 10.0 points
A roller coaster cart of mass $m = 394$ kg starts stationary at point A, where $h_1 = 25.9$ m and a while later is at B, where $h_2 = 6.4$ m.
The acceleration of gravity is 9.8 m/s^2.

What is the potential energy of the cart relative to the ground at A?
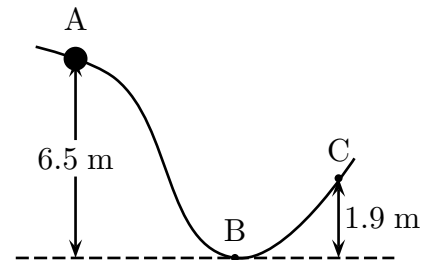Answer in units of J.

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013 (part 2 of 2) 10.0 points
What is the speed of the cart at B, ignoring the effect of friction?
Answer in units of m/s.

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014 (part 1 of 2) 10.0 points
A 0.3 kg bead slides on a curved wire, starting from rest at point A as shown in the figure. The segment from A to B is frictionless, and the segment from B to C is rough. The point A is at height 6.5 m and the point C is at height 1.9 m with respect to point B.
The acceleration of gravity is 9.8 m/s^2.

Find the speed of the bead at B.
Answer in units of m/s.

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015 (part 2 of 2) 10.0 points
If the bead comes to rest at C, find the change in mechanical energy due to friction as it moves from B to C.
Answer in units of J.

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016   10.0 points
A block of mass 1.6 kg is kept at rest as it compresses a horizontal massless spring ($k = 49.8$ N/m) by 4.27 cm. As the block is released, it travels 0.43 m on a rough horizontal surface before stopping.

The acceleration of gravity is 9.8 m/s^2 .
Calculate the coefficient of kinetic friction
between surface and block.