HW due 2/28

Due: 11:59pm on Sunday, February 28, 2016

You will receive no credit for items you complete after the assignment is due. Grading Policy

Problem 6.78

One end of a horizontal spring with force constant 76.0 $\mathrm{N/m}$ is attached to a vertical post. A 5.00-kg can of beans is attached to the other end. The spring is initially neither stretched nor compressed. A constant horizontal force of 54.0 N is then applied to the can, in the direction away from the post.

Part A

What is the speed of the can when the spring is stretched 0.400 m?

Express your answer with the appropriate units.

ANSWER:

$v =$ 2.49 $\frac{\mathrm{m}}{\mathrm{s}}$

Correct

Part B

At the instant the spring is stretched 0.400 m, what is the magnitude of the acceleration of the block?

Express your answer with the appropriate units.

ANSWER:

$a =$ 4.72 $\frac{\mathrm{m}}{\mathrm{s^2}}$

Correct

Part C

At the instant the spring is stretched 0.400 m, what is the magnitude of the acceleration of the block?

ANSWER:

- ○ to the post
- ◉ away from the post

Correct

Problem 6.88

An object has several forces acting on it. One of these forces is $\vec{F} = \alpha x y \hat{i}$, a force in the *x*-direction whose magnitude depends on the position of the object, with $\alpha = 2.50\ \mathrm{N/m^2}$. Calculate the work done on the object by this force for the following displacements of the object.

Part A

The object starts at the point $x = 0$, $y = 3.00\ \mathrm{m}$ and moves parallel to the *x*-axis to the point $x = 2.00\ \mathrm{m}$, $y = 3.00\ \mathrm{m}$.

ANSWER:

W = 15.0 J

Correct

Part B

The object starts at the point $x = 2.00\ \mathrm{m}$,$y = 0$ and moves in the *y*-direction to the point $x = 2.00\ \mathrm{m}$,$y = 3.00\ \mathrm{m}$.

ANSWER:

W = 0 J

Correct

Part C

The object starts at the origin and moves on the line $y = 1.5x$ to the point $x = 2.00\ \mathrm{m}$, $y = 3.00\ \mathrm{m}$.

ANSWER:

W = 10.0 J

Correct

Problem 6.89

The human heart is a powerful and extremely reliable pump. Each day it takes in and discharges about 7500 L of blood. Assume that the work done by the heart is equal to the work required to lift this amount of blood a height equal to that of the average American female (1.63 m). The density (mass per unit volume) of blood is $1.05 \times 10^3\ \mathrm{kg/m^3}$.

Part A

How much work does the heart do in a day?

ANSWER:

W = 1.26×10^5 J

Correct

Part B

What is its power output in watts?

ANSWER:

P = 1.46 W

Correct

Exercise 7.20

A piece of cheese with a mass of 1.22 kg is placed on a vertical spring of negligible mass and a force constant k = 2500 $\mathrm{N/m}$ that is compressed by a distance of 15.4 cm .

Part A

When the spring is released, how high does the cheese rise from this initial position? (The cheese and the spring are *not* attached.)

Use 9.81 $\mathrm{m/s^2}$ for the acceleration due to gravity. Express your answer using two significant figures.

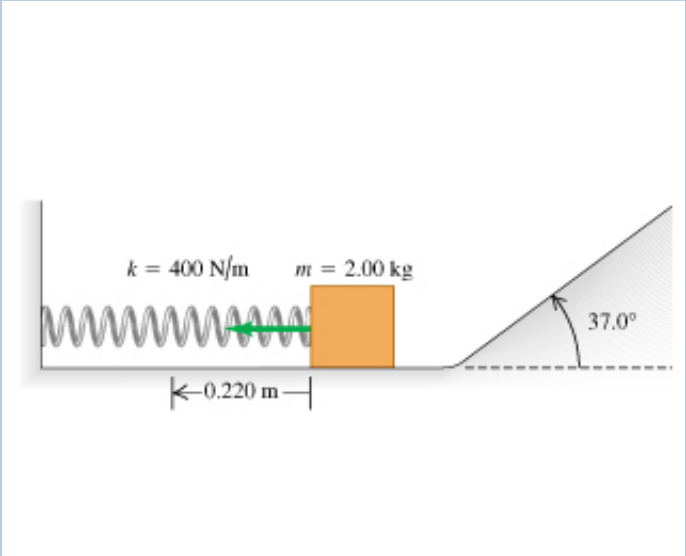
ANSWER:

h = 2.5 m

Correct

Problem 7.40

A 2.00-kg block is pushed against a spring with negligible mass and force constant k = 400 $\mathrm{N/m}$, compressing it 0.220 m. When the block is released, it moves along a frictionless, horizontal surface and then up a frictionless incline with slope 37.0°.



Part A

What is the speed of the block as it slides along the horizontal surface after having left the spring?

ANSWER:

v = 3.11 $\mathrm{m/s}$

Correct

Part B

How far does the block travel up the incline before starting to slide back down?

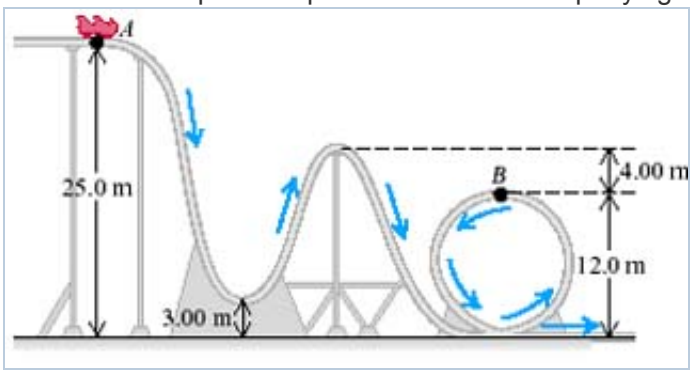
ANSWER:

L = 0.821 m

Correct

Problem 7.41

A 350 kg roller coaster starts from rest at point A and slides down the frictionless loop-the-loop shown in the accompanying figure.



Part A

How fast is this roller coaster moving at point B?

ANSWER:

v = 16.0 $\mathrm{m/s}$

Correct

Part B

How hard does it press against the track at point B?

ANSWER:

F = 1.14×10^4 N

Correct

Problem 7.48

You are designing a delivery ramp for crates containing exercise equipment. The 1410-N crates will move at 1.8 $\mathrm{m/s}$ at the top of a ramp that slopes downward at 22.0°. The ramp exerts a 515-N kinetic friction force on each crate, and the maximum static friction force also has this value. Each crate will compress a spring at the bottom of the ramp and will come to rest after traveling a total distance of 5.0 m along the ramp. Once stopped, a crate must not rebound back up the ramp.

Part A

Calculate the largest force constant of the spring that will be needed to meet the design criteria.

Express your answer with the appropriate units.

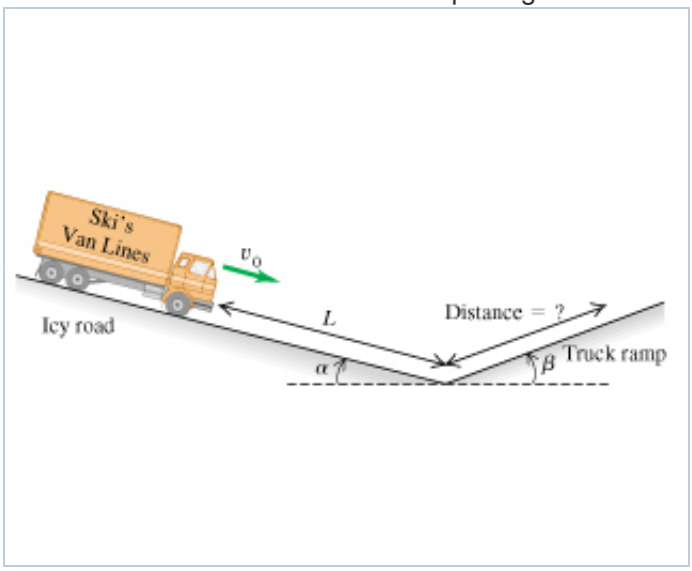
ANSWER:

k = 1800 $\frac{\text{N}}{\text{m}}$

Correct

Problem 7.58

A truck with mass m has a brake failure while going down an icy mountain road of constant downward slope angle α. Initially the truck is moving downhill at speed v_0. After careening downhill a distance L with negligible friction, the truck driver steers the runaway vehicle onto a runaway truck ramp of constant upward slope angle β. The truck ramp has a soft sand surface for which the coefficient of rolling friction is μ_r.



Part A

What is the distance that the truck moves up the ramp before coming to a halt? Solve using energy methods.

Express your answer in terms of m, α, v_0, L, g, β and μ_r.

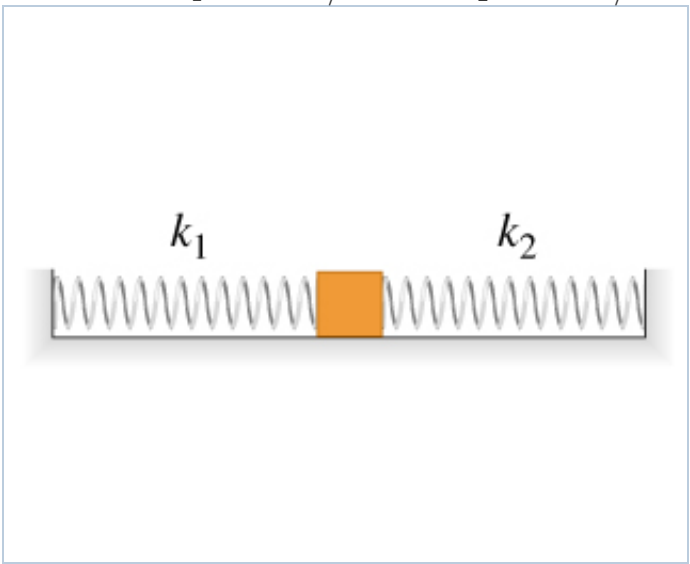
ANSWER:

$$x = \frac{\frac{{v_0}^2}{2g} + L\sin(\alpha)}{\sin(\beta) + \mu_r \cos(\beta)}$$

All attempts used; correct answer displayed

Problem 7.62 - Copy

A 3.00-kg block is connected to two ideal horizontal springs having force constants k_1 = 25.0 $\mathrm{N/cm}$ and k_2 = 18.0 $\mathrm{N/cm}$ (the figure). The system is initially in equilibrium on a horizontal, frictionless surface. The block is now pushed 15.0 cm to the right and released from rest.



Part A

What is the maximum speed of the block?

ANSWER:

$v_{\max}$ = 5.68 $\mathrm{m/s}$

Correct

Part B

What is the maximum compression of spring 1?

ANSWER:

$x_{1\,\max}$ = 15.0 cm

Correct

Score Summary:

Your score on this assignment is 88.9%.
You received 40 out of a possible total of 45 points.