Ch 6 Supplemental [Edit]

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Ch 6 Supplemental

Due: 6:59pm on Wednesday, October 26, 2016

To understand how points are awarded, read the Grading Policy for this assignment.

Exercise 6.28

Description: A soccer ball with mass m is initially moving with speed vi. A soccer player kicks the ball, exerting a constant force of magnitude F in the same direction as the ball's motion. (a) Over what distance must the player's foot be in contact with the...

A soccer ball with mass 0.410 kg is initially moving with speed 2.30 $\mathrm{m/s}$. A soccer player kicks the ball, exerting a constant force of magnitude 39.0 N in the same direction as the ball's motion.

Part A

Over what distance must the player's foot be in contact with the ball to increase the ball's speed to 6.00 $\mathrm{m/s}$?

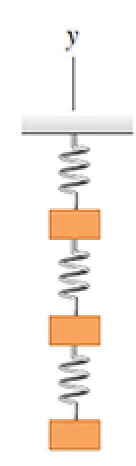
ANSWER:

$s = \dfrac{\frac{1}{2}m\left(36.0 - vi^2\right)}{F}$ = 0.161 m

Exercise 6.35

Description: Three identical ##-kg masses are hung by three identical springs . Each spring has a force constant of ## kN/m and was ## cm long before any masses were attached to it. (a) Draw a free-body diagram for the top mass. (b) Draw a...

Three identical 8.20-kg masses are hung by three identical springs . Each spring has a force constant of 7.10 $\mathrm{kN/m}$ and was 15.0 cm long before any masses were attached to it.



Part A

Draw a free-body diagram for the top mass.

Draw the vectors starting at the black dot. The location and orientation of the vectors will be graded. The length of the vectors will not be graded.

ANSWER:

Part B

Draw a free-body diagram for the middle mass.

Draw the vectors starting at the black dot. The location and orientation of the vectors will be graded. The length of the vectors will not be graded.

ANSWER:

Part C

Draw a free-body diagram for the bottom mass.

Draw the vectors starting at the black dot. The location and orientation of the vectors will be graded. The length of the vectors will not be graded.

ANSWER:

Part D

How long is the bottom spring when hanging as shown? (*Hint:* isolate only the bottom mass.)

Express your answer with the appropriate units.

ANSWER:

l_B = $l+\frac{m\cdot 9.8}{K}$ = 0.161m

Also accepted: $l+\frac{m\cdot 9.81}{K}$ = 0.161m, $l+\frac{m\cdot 9.8}{K}$ = 0.161m

Part E

How long is the middle spring when hanging as shown? (*Hint:* treat the bottom two masses as a system.)

Express your answer with the appropriate units.

ANSWER:

l_M = $l+\frac{2m\cdot 9.8}{K}$ = 0.173m

Also accepted: $l+\frac{2m\cdot 9.81}{K}$ = 0.173m, $l+\frac{2m\cdot 9.8}{K}$ = 0.173m

Part F

How long is the top spring when hanging as shown? (*Hint:* treat all three masses as a system.)

Express your answer with the appropriate units.

ANSWER:

l_T = $l+\frac{3m\cdot 9.8}{K}$ = 0.184m

Also accepted: $l+\frac{3m\cdot 9.81}{K}$ = 0.184m, $l+\frac{3m\cdot 9.8}{K}$ = 0.184m

Exercise 6.47

Description: A small glider is placed against a compressed spring at the bottom of an air track that slopes upward at an angle of alpha above the horizontal. The glider has mass m. The spring has k and negligible mass. When the spring is released, the glider...

A small glider is placed against a compressed spring at the bottom of an air track that slopes upward at an angle of 31.0 $^\circ$ above the horizontal. The glider has mass 8.00×10^{-2} kg . The spring has 680 $\mathrm{N/m}$ and negligible mass. When the spring is released, the glider travels a maximum distance of 1.90 m along the air track before sliding back down. Before reaching this maximum distance, the glider loses contact with the spring.

Part A

What distance was the spring originally compressed?

ANSWER:

$x = \sqrt{\frac{2m\cdot 9.8l\sin(\alpha)}{k}}$ = 4.75×10^{-2} m

Part B

When the glider has traveled along the air track 0.900 m from its initial position against the compressed spring, is it still in contact with the spring?

ANSWER:

- Yes
- No (selected)

Part C

What is the kinetic energy of the glider at this point?

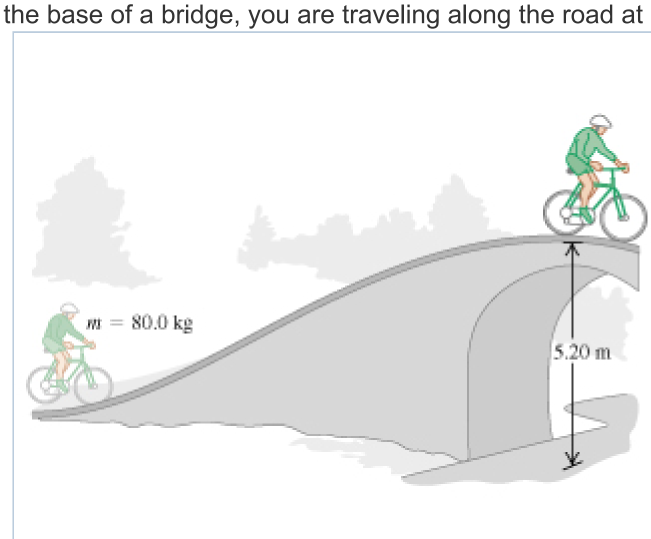
ANSWER:

$K = m\cdot 9.8\,(l-x)\sin(\alpha)$ = 0.404 J

Problem 6.74

Description: You and your bicycle have combined mass 80.0 kg. When you reach the base of a bridge, you are traveling along the road at v1 (the figure). At the top of the bridge, you have climbed a vertical distance of 5.20 m and have slowed to v2. You can ignore...

You and your bicycle have combined mass 80.0 kg. When you reach the base of a bridge, you are traveling along the road at 9.00 $\mathrm{m/s}$ (the figure). At the top of the bridge, you have climbed a vertical distance of 5.20 m and have slowed to 2.50 $\mathrm{m/s}$. You can ignore work done by friction and any inefficiency in the bike or your legs.



Part A

What is the total work done on you and your bicycle when you go from the base to the top of the bridge?

ANSWER:

W = $40.0\left(v2^2 - v1^2\right)$ = -2990 J

Part B

How much work have you done with the force you apply to the pedals?

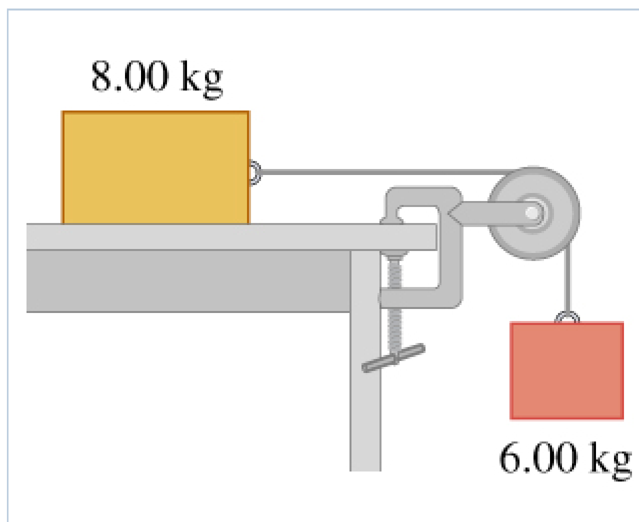
ANSWER:

W = $4080 + 40.0\left(v2^2 - v1^2\right)$ = 1090 J

Problem 6.81

Description: Consider the system shown in the figure . The rope and pulley have negligible mass, and the pulley is frictionless. Initially the 6.00-kg block is moving downward and the 8.00-kg block is moving to the right, both with a speed of v. The blocks come to ...

Consider the system shown in the figure . The rope and pulley have negligible mass, and the pulley is frictionless. Initially the 6.00-kg block is moving downward and the 8.00-kg block is moving to the right, both with a speed of 0.300 $\mathrm{m/s}$. The blocks come to rest after moving 5.00 m .



Part A

Use the work-energy theorem to calculate the coefficient of kinetic friction between the 8.00-kg block and the tabletop.

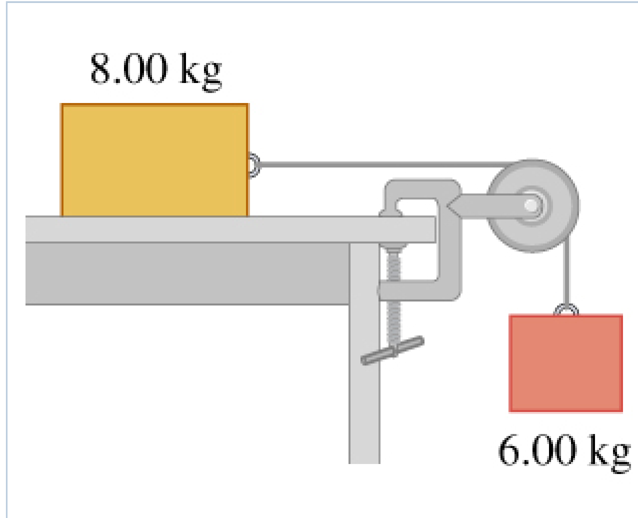
ANSWER:

μ_{k} = $\dfrac{6.00 + \frac{\frac{1}{2}(6.00+8.00)v^2}{9.8s}}{8.00}$ = 0.752

Problem 6.82

Description: Consider the system shown in the figure. The rope and pulley have negligible mass, and the pulley is frictionless. The coefficient of kinetic friction between the 8.00-kg block and the tabletop is mu_k=0.250. The blocks are released from rest. (a)...

Consider the system shown in the figure. The rope and pulley have negligible mass, and the pulley is frictionless. The coefficient of kinetic friction between the 8.00-kg block and the tabletop is $\mu_k = 0.250$. The blocks are released from rest.



Part A

Use energy methods to calculate the speed of the 6.00-kg block after it has descended 1.50 m.

ANSWER:

v = 2.90 $\mathrm{m/s}$

Problem 6.88

Description: An object has several forces acting on it. One of these forces is F_vec = alpha xy i_unit, a force in the x-direction whose magnitude depends on the position of the object, with alpha=2.50 N/m^2. Calculate the work done on the object by this force...

An object has several forces acting on it. One of these forces is $\vec{F} = \alpha x y \hat{\imath}$, 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

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

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