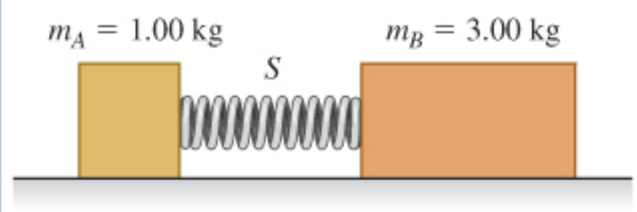
Exam 3 Practice

Due: 11:00am on Friday, November 9, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

Exercise 8.24

Block A in the figure has mass 1.00 kg, and block B has mass 3.00 kg. The blocks are forced together, compressing a spring S between them; then the system is released from rest on a level, frictionless surface. The spring, which has negligible mass, is not fastened to either block and drops to the surface after it has expanded. Block B acquires a speed of 1.50$\mathrm{m/s}$.



Part A

What is the final speed of block A?

ANSWER:

v = 4.50 $\mathrm{m/s}$

Correct

Part B

How much potential energy was stored in the compressed spring?

ANSWER:

U = 13.5 J

Correct

Exercise 8.38

Two cars collide at an intersection. Car A, with a mass of 1900kg , is going from west to east, while car B, of mass 1500kg , is going from north to south at 12.0$\mathrm{m/s}$. As a result of this collision, the two cars become enmeshed and move as one afterwards. In your role as an expert witness, you inspect the scene and determine that, after the collision, the enmeshed cars moved at an angle of 65.0° south of east from the point of impact.

Part A

How fast were the enmeshed cars moving just after the collision?

ANSWER:

v = 5.84 $\mathrm{m/s}$

Correct

Part B

How fast was car A going just before the collision?

ANSWER:

v_A = 4.42 m/s

Correct

Exercise 8.42

A bullet of mass 7.00g is fired horizontally into a wooden block of mass 1.23kg resting on a horizontal surface. The coefficient of kinetic friction between block and surface is 0.230. The bullet remains embedded in the block, which is observed to slide a distance 0.220m along the surface before stopping.

Part A

What was the initial speed of the bullet?

ANSWER:

v = 176 m/s

Correct

Problem 8.79

A 5.00kg chunk of ice is sliding at 12.0$\mathrm{m/s}$ on the floor of an ice-covered valley when it collides with and sticks to another 5.00kg chunk of ice that is initially at rest. (See the figure below .) Since the valley is icy, there is no friction.

Part A

After the collision, how high above the valley floor will the combined chunks go? (*Hint:* Break this problem into two parts-the collision and the behavior after the collision-and apply the appropriate conservation law to each part.)

ANSWER:

H = 1.84 m

Correct

Exercise 9.14

A circular saw blade of diameter 0.215m starts from rest. In a time interval of 5.70s it accelerates with constant angular acceleration to an angular velocity of 143$\mathrm{rad/s}$.

Part A

Find the angular acceleration.

ANSWER:

α = 25.1 $\mathrm{rad/s^2}$

Correct

Part B

Find the angle through which the blade has turned.

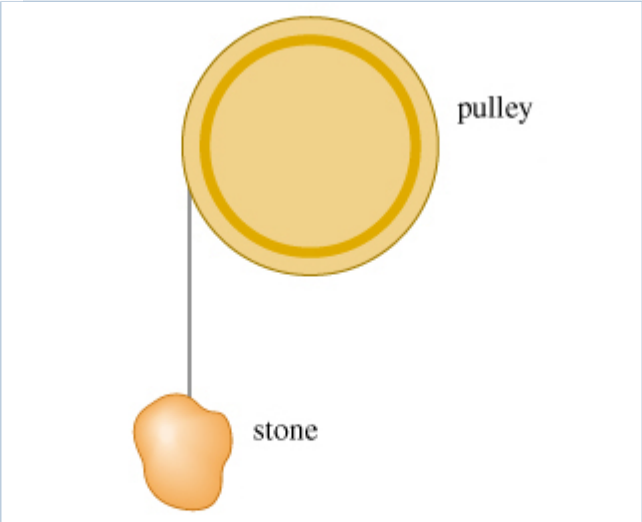
ANSWER:

θ = 408 rad

Correct

Exercise 9.47

A frictionless pulley has the shape of a uniform solid disk of mass 2.20 kg and radius 10 cm. A 1.90 kg stone is attached to a very light wire that is wrapped around the rim of the pulley (the figure), and the system is released from rest.



Part A

How far must the stone fall so that the pulley has 5.10 J of kinetic energy?

ANSWER:

h = 0.747 m

Correct

Part B

What percent of the total kinetic energy does the pulley have?

.

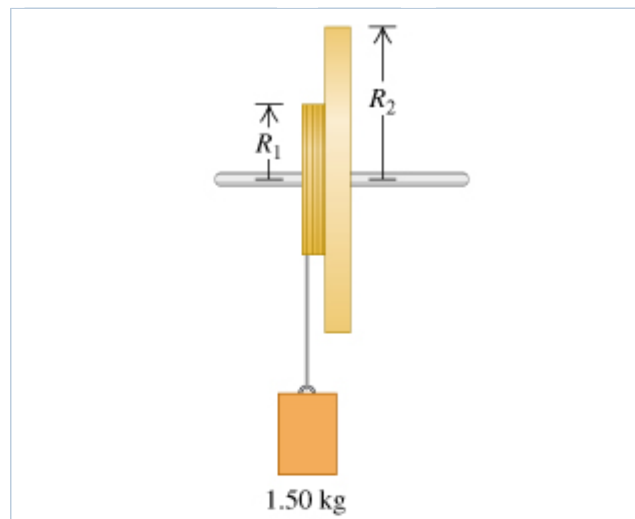
ANSWER:

\frac{K_{\rm p}}{K_{\rm tot}}\, = 36.7 %

Correct

Problem 9.87

Two metal disks, one with radius R_1 = 2.42 cm and mass M_1 = 0.790 kg and the other with radius R_2 = 5.05 cm and mass M_2 = 1.68 kg , are welded together and mounted on a frictionless axis through their common center. .



Part A

What is the total moment of inertia of the two disks?

ANSWER:

I = 2.37×10^{-3} $\mathrm{kg \cdot m^2}$

Correct

Part B

A light string is wrapped around the edge of the smaller disk, and a 1.50-kg block, suspended from the free end of the string. If the block is released from rest at a distance of 2.05m above the floor, what is its speed just before it strikes the floor?

ANSWER:

v = 3.29 $\mathrm{m/s}$

Correct

Part C

Repeat the calculation of part B, this time with the string wrapped around the edge of the larger disk.

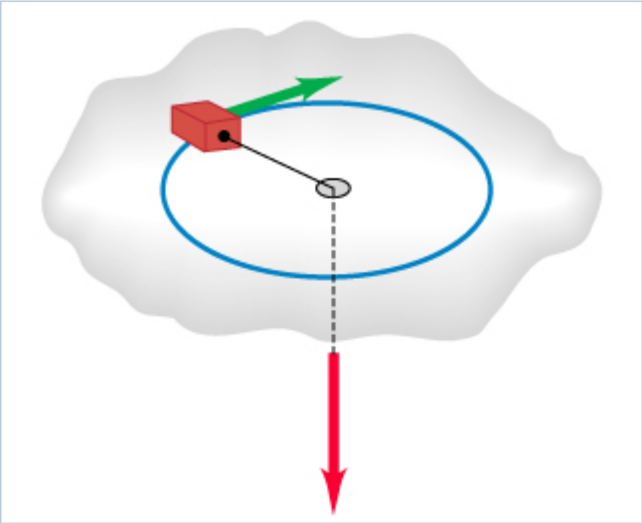
ANSWER:

v = 4.98 $\mathrm{m/s}$

Correct

Exercise 10.42

A small block on a frictionless, horizontal surface has a mass of $2.30 \times 10^{-2}\ \mathrm{kg}$. It is attached to a massless cord passing through a hole in the surface (the figure). The block is originally revolving at a distance of 0.300 m from the hole with an angular speed of $1.95\ \mathrm{rad/s}$. The cord is then pulled from below, shortening the radius of the circle in which the block revolves to 0.150 m. Model the block as a particle.



Part A

Is angular momentum of the block conserved?

ANSWER:

- yes
- no

Correct

Part B

Why or why not?

ANSWER:

3771 Character(s) remaining

Because there is no friction.

Submitted, grade pending

Part C

What is the new angular speed?

ANSWER:

ω_2 = 7.80 $\mathrm{rad/s}$

Correct

Part D

Find the change in kinetic energy of the block.

ANSWER:

ΔK = 1.18×10^{-2} J

Correct

Part E

How much work was done in pulling the cord?

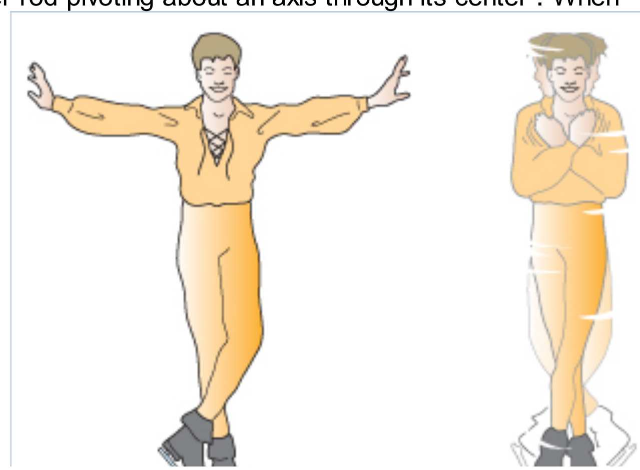
ANSWER:

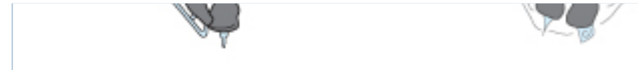
1.18×10^{-2} J

Correct

Exercise 10.43

The outstretched hands and arms of a figure skater preparing for a spin can be considered a slender rod pivoting about an axis through its center . When his hands and arms are brought in and wrapped around his body to execute the spin, the hands and arms can be considered a thin-walled hollow cylinder. His hands and arms have a combined mass 8.0 kg . When outstretched, they span 1.7 m ; when wrapped, they form a cylinder of radius 23 cm . The moment of inertia about the rotation axis of the remainder of his body is constant and equal to $0.40\,\mathrm{kg \cdot m^2}$.





Part A

If his original angular speed is 0.50$\mathrm{rev/s}$, what is his final angular speed?

Express your answer using two significant figures.

ANSWER:

ω_2 = 1.4 $\mathrm{rev/s}$

Correct

Problem 10.79

A basketball (which can be closely modeled as a hollow spherical shell) rolls down a mountainside into a valley and then up the opposite side, starting from rest at a height H_{0} above the bottom. In the figure, the rough part of the terrain prevents slipping while the smooth part has no friction.

Part A

How high, in terms of H_{0}, will it go up the other side?

ANSWER:

$H = \frac{3}{5}H_0$

Correct

Part B

Why doesn't the ball return to height H_{0}? Has it lost any of its original potential energy?

ANSWER:

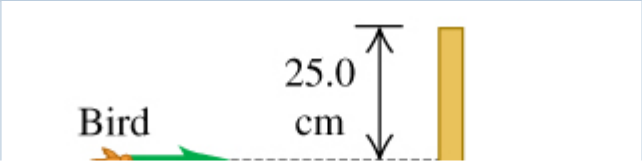
3797 Character(s) remaining

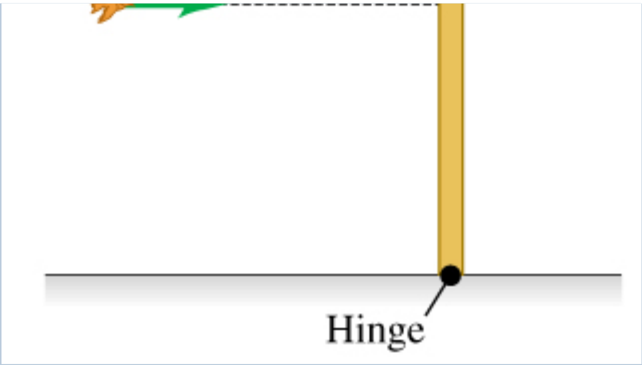
yes

Submitted, grade pending

Problem 10.95

A 540.0$-\mathrm{g}$ bird is flying horizontally at 2.20{\rm{ m/s}} , not paying much attention, when it suddenly flies into a stationary vertical bar, hitting it 25.0cm below the top (the figure). The bar is uniform, 0.700m long, has a mass of 1.60kg , and is hinged at its base. The collision stuns the bird so that it just drops to the ground afterward (but soon recovers to fly happily away).





Part A

What is the angular velocity of the bar just after it is hit by the bird?

ANSWER:

ω = 2.05 $\mathrm{rad/s}$

Correct

Part B

What is the angular velocity of the bar just as it reaches the ground?

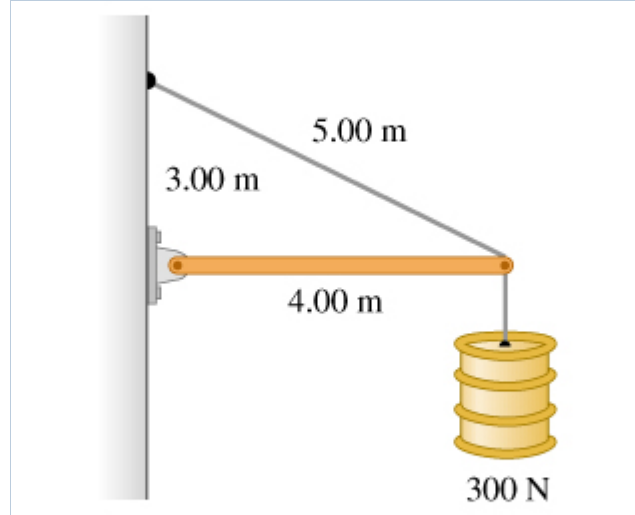
ANSWER:

ω = 6.80 $\mathrm{rad/s}$

Correct

Exercise 11.14

The horizontal beam in the figure weighs 150 N, and its center of gravity is at its center.



Part A

Find the tension in the cable.

ANSWER:

T = 625 N

Correct

Part B

Find the horizontal component of the force exerted on the beam at the wall.

ANSWER:

N_H = 500 N

Correct

Part C

Find the vertical component of the force exerted on the beam at the wall.

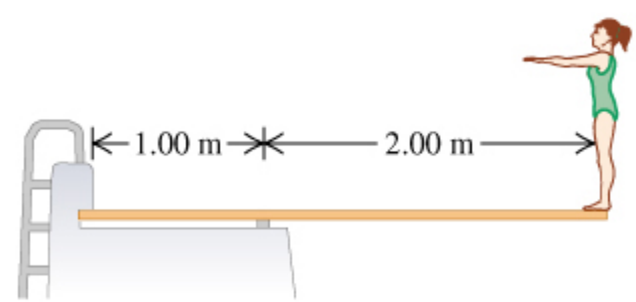
ANSWER:

N_V = 75.0 N

Correct

Exercise 11.11

A diving board of length 3.00 m is supported at a point 1.00 m from the end, and a diver weighing 450 N stands at the free end . The diving board is of uniform cross section and weighs 250 N .



Part A

Find the magnitude of the force at the support point.

ANSWER:

F = 1730 N

Correct

Part B

Find the direction of the force at the support point.

ANSWER:

- upward
- downward

Correct

Part C

Find the magnitude of the force at the left-hand end.

ANSWER:

F = 1030 N

Correct

Part D

Find the direction of the force at the left-hand end.

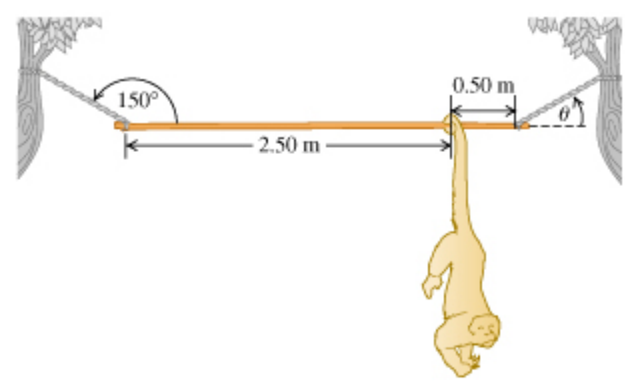
ANSWER:

- upward
- downward

Correct

Exercise 11.19

A 3.00-m-long, 200-N, uniform rod at the zoo is held in a horizontal position by two ropes at its ends (the figure). The left rope makes an angle of 150 $^{\circ}$ with the rod and the right rope makes an angle θ with the horizontal. A 84-N howler monkey (*Alouatta seniculus*) hangs motionless 0.50 m from the right end of the rod as he carefully studies you.



Part A

Calculate the tension in the left rope.

Express your answer using two significant figures.

ANSWER:

T_L = 230 N

Correct

Part B

Calculate the tension in the right rope.

Express your answer using two significant figures.

ANSWER:

T_R = 260 N

Correct

Part C

Calculate the angle θ.

Express your answer using two significant figures.

ANSWER:

θ = 41 °

Correct

Problem 11.45

Mountaineers often use a rope to lower themselves down the face of a cliff (this is called *rappelling*). They do this with their body nearly horizontal and their feet pushing against the cliff (the figure). Suppose that an 76.9-kg climber, who is 1.77m tall and has a center of gravity 1.3m from his feet, rappels down a vertical cliff with his body raised 26.1° above the horizontal. He holds the rope 1.30m from his feet, and it makes a 22.9° angle with the cliff face.

Part A

What tension does his rope need to support?

Express your answer using two significant figures.

ANSWER:

T = 680 N

Correct

Part B

Find the horizontal component of the force that the cliff face exerts on the climber's feet.

Express your answer using two significant figures.

ANSWER:

F_H = 260 N

Correct

Part C

Find the vertical component of the force that the cliff face exerts on the climber's feet.

Express your answer using two significant figures.

ANSWER:

F_V = 130 N

Correct

Part D

What minimum coefficient of static friction is needed to prevent the climber's feet from slipping on the cliff face if he has one foot at a time against the cliff?

Express your answer using two significant figures.

ANSWER:

μ_s = 0.49

Correct

Score Summary:

Your score on this assignment is 0%.
You received 0 out of a possible total of 0 points.