1 point(s)
Final Speed with Conservative and non-conservative forces
Consider the following two different situations. In situation **A**, a ball is pushed by an external conservative force and rolls without slipping on an inclined surface. In situation **B**, a block is pushed by an external conservative force and slides on an inclined surface with friction. If the object starts at rest in both situations, determine whether the final speed of the object depends on the path of motion between the initial and final positions.

   A. **A**: no, **B**: yes

   B. **A**: no, **B**: no

   C. **A**: yes, **B**: no

   D. **A**: yes, **B**: yes

Tries 0/15

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1 point(s)
Impulse For Jumping
An athlete who is initially at rest in a squatted position jumps vertically upward and then lands going back to the original squatted position (ending at rest with the same center of mass height as at the start). The time period under consideration begins just before the athlete starts the upward motion and ends just after she has landed and comes to rest back in the squatted position.
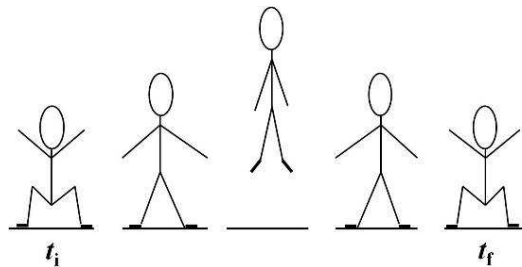
Compare the impulse from the normal force of the ground on the athlete to the impulse from gravity on the athlete during this time period.

   A. The impulse from the normal force is equal in magnitude and opposite in direction to the impulse from gravity.

   B. The impulse from the normal force is smaller in magnitude than the impulse from gravity.

   C. The impulse from the normal force is larger in magnitude than the impulse from gravity.

   D. The impulse from the normal force is equal in magnitude and direction to the impulse from gravity.

Tries 0/15

1 point(s)
SignOfWorkFromStaticFriction
Mass 1 sits on top of mass 2 which sits on top of a cart. The cart is being accelerated from rest along a horizontal surface by an external force (which is applied to the cart). None of the objects (mass 1, mass 2 or the cart) slip with respect to each other. The work done by static friction from mass 1 on mass 2 is:

  A. 0 J

  B. negative

  C. Unable to be determined without more information

  D. positive

  E. Not well defined since mass 2 is in an accelerating reference frame

Tries 0/15

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1 point(s)
ManWithWheel5.problem
A man is standing on a turn-table with an axle that has negligible friction. He is holding a bicycle wheel that is mounted on an axle of negligible friction. The man is initially rotating counter-clockwise on the platform (as seen from above), and the wheel is spinning counter-clockwise about its axle. Which of the following would cause the man to rotate counter-clockwise at a slower speed?
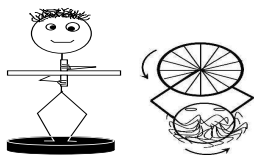
  A. Turning the wheel over and speeding up the rotation of the wheel.

  B. Slowing down the rotation of the wheel.

  C. Turning the wheel over and slowing the rotation of the wheel.

  D. Speeding up the rotation of the wheel.

  E. Turning the wheel over.

Tries 0/15

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1 point(s)
Comparing Kinetic Energies With Rolling
A hoop and a solid cylinder of equal mass are rolling along a level surface with the same center-of-mass velocity. If both roll without slipping, compare their total and rotational kinetic energies?

  A. $K_{tot, hoop} < K_{tot, cylinder}$, $K_{rot, hoop} < K_{rot, cylinder}$.

  B. $K_{tot, hoop} = K_{tot, cylinder}$, $K_{rot, hoop} > K_{rot, cylinder}$.

  C. $K_{tot, hoop} > K_{tot, cylinder}$, $K_{rot, hoop} > K_{rot, cylinder}$.

  D. $K_{tot, hoop} < K_{tot, cylinder}$, $K_{rot, hoop} > K_{rot, cylinder}$.

  E. $K_{tot, hoop} = K_{tot, cylinder}$, $K_{rot, hoop} < K_{rot, cylinder}$.

Tries 0/15

1 point(s)
Frequencies of resonances in pipes
The figure below represents the spatial distribution of sound amplitude associated with a standing wave in a long pipe that is closed at the left end and open at the right end. The vertical axis is the maximum displacement of the air, and the horizontal axis is position along the length of the pipe. The length of the pipe is 2.00 m.
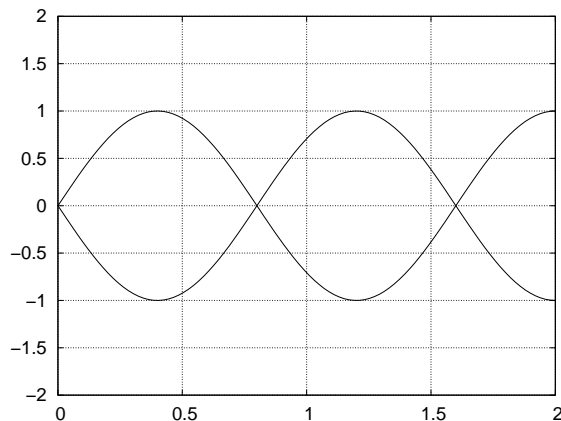
What multiple of the fundamental frequency does this represent?
  A. 6
  B. 5
  C. 8
  D. 7
  E. 9

Tries 0/15

---

1 point(s)
Newton's Second and Third Law 1
You are standing on the side of a hill. Which of the following is true?
  A. The magnitude of the normal force from the ground on you is equal to the magnitude of your weight because of Newton's second law.
  B. The magnitude of the normal force from the ground on you is greater than the magnitude of your weight because of Newton's third law.
  C. The magnitude of the normal force from the ground on you is greater than the magnitude of your weight because of Newton's second law.
  D. The magnitude of the normal force from the ground on you is less than the magnitude of your weight because of Newton's second law.
  E. The magnitude of the normal force from the ground on you is equal to the magnitude of your weight because of Newton's third law.

Tries 0/15

3 point(s)
Kinematics with Calculus 2
For this problem you should set your calculator to radians. At the end of the problem you should remember to set your calculator back to degrees.

The velocity of a dust particle in a magnetic field is given by

$$v_x(t) = v_o \cos(\pi t / t_1); \quad v_y(t) = v_o \sin(\pi t / t_1)$$

where $v_o = 6.0$ m/s and $t_1 = 8.47$ s.

What is the x component of the dust's acceleration when $t = 11.7$ s?
$a_x = $ [   ]
Tries 0/15

What is the y component of the dust's displacement from $t = 0$ s until $t = 11.7$ s?
$\Delta y = $ [   ]
Tries 0/15

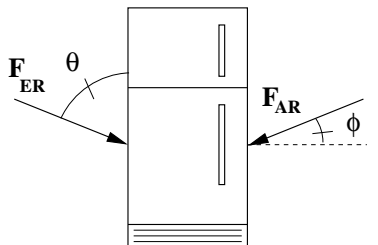What is the x component of the dust's average acceleration from $t = 0$ s until $t = 11.7$ s?
$a_{x,\text{ave}} = $ [   ]
Tries 0/15

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1 point(s)
Static friction on a refrigerator with two applied forces
Ed and Al are pushing on a refrigerator as shown in the picture. They are **not** pushing hard enough to make the refrigerator move.


Ed is pushing with a force of 70.5 N at an angle of $\theta = 53.2$ degrees with respect to the vertical and Al is pushing with a force of 23.8 N at an angle of $\phi = 31.8$ degrees with respect to the horizontal. If the refrigerator has a mass of 172 kg and the coefficients of static and kinetic friction between the floor and refrigerator are $\mu_s = 0.56$ and $\mu_k = 0.42$, what is the magnitude of the force of friction exerted by the floor on the refrigerator?

[   ]

Tries 0/15

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8 point(s)
Traveling Wave
Two plots concerning a harmonic wave on a wire are shown below. The first plot is a snapshot (at a specific time) of the wire as a function of position from $x = 0$ to $x = 1143$ cm. The second plot is of the time dependence of a specific point on the wire from $t = 0$ to $t = 0.0984$ s. Pay attention to the units of the graphs, and note that an integer number of wavelengths or periods fit into the graphs.
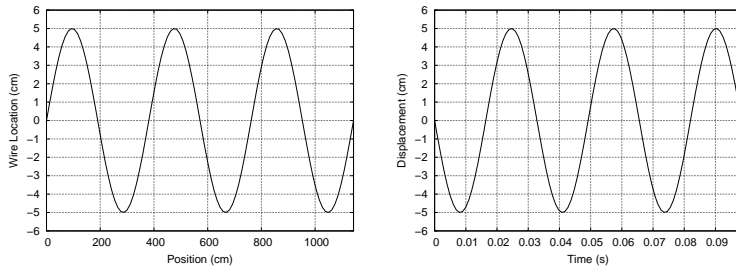
The general form of the wavefunction for this harmonic wave is given by:

$$y(x,t) = A\sin(kx - \omega t)$$

Find the wavelength of the wave.
$\lambda = $ [   ]
Tries 0/15

Find the period of the wave.
$T = $ [   ]
Tries 0/15

Find the frequency of the wave.
$f = $ [   ]
Tries 0/15

Find the angular frequency of the wave.
$\omega = $ [   ]
Tries 0/15

Find the wave number of the wave.
$k = $ [   ]
Tries 0/15

Find the speed of the wave.
$v_{wave} = $ [   ]
Tries 0/15

Find the maximum speed of a particle on the wire.
$v_{max} = $ [   ]
Tries 0/15

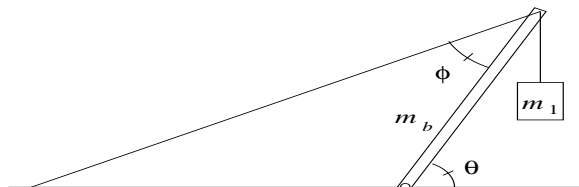If the tension in the wire is 57.00 N, what is the linear mass density (mass per unit length) of the wire?
$\mu = $ [   ]
Tries 0/15

3 point(s)

Mass Hanging from Beam

A beam of length 7 m is supported as shown below. There is a pin in the bottom end of the beam and a mass hanging from the top end of the beam.

If the mass of the beam is $m_b = 244$ kg, the hanging mass is $m_1 = 61$ kg, $\theta = 51.5$ degrees, and $\phi = 36.5$ degrees, what is the tension in the wire attaching the beam to the ground?

[   ]

Tries 0/15

If a different hanging mass equal to 122.0 kg is hung on the beam in the same geometrical configuration, and the tension is measured to be 2505 N, what is the horizontal component of the force from the pin on the beam?

[   ]

Tries 0/15

As is the above case with the different hanging mass equal to 122.0 kg and the tension 2505 N, what is the vertical component of the force from the pin on the beam?

[   ]

Tries 0/15

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3 point(s)

The Height of a Cliff

You want to know the height of a cliff so you throw a rock off the edge with initial speed $v_0 = 21$ m/s upwards, inclined at an angle $\theta = 13°$ with respect to the horizontal. You have a friend that records the time that it takes for the rock to hit the bottom of the canyon below. It takes 3.8 s for the rock to hit the bottom of the canyon from when you throw it.

If you ignore air resistance, what is the height of the cliff?

[   ]

Tries 0/15

If you ignore air resistance, what is the speed of the rock right before it hits the ground?

[   ]

Tries 0/15

   Choices: **greater than**, **less than**, **equal to**.

- In the situation above where you calculated the height of the cliff, you neglected air resistance. Because there is some air resistance, how does the actual height compare to the height you calculated?

- For the situation above where you calculated the height of the cliff: If you decreased the initial angle of inclination, but kept the initial speed the same, how would the time at the new angle compare to the time when you threw it at the original angle?

Tries 0/15

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1 point(s)
Intensity and Power of Sound 2
The sound intensity level of a certain source is measured by two listeners located at different positions. The first listener is located a distance 5 m from the source while a second listener is located a distance 20 m from the source. The first listener hears the sound with a sound intensity level of 63 dB. What is the sound intensity level heard by the second listener?

Tries 0/15

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3 point(s)
Simple Harmonic Motion Nomenclature and Calculus 2
Note: Because the argument of the sine function is unitless in this question, your calculator must be in radian mode if you use it to evaluate any trigonometric functions.

A magnetic field is used to trap and confine an electron. The electron undergoes simple harmonic motion with the acceleration shown below:

$$a_x(t) = -a_{max}\sin(2\pi t/T)$$

with $a_{max} = 45.56$ m/s^2 and $T = 3.23$ seconds.
What is the maximum speed of the electron?

Tries 0/15

What is the amplitude of the electron's position?

Tries 0/15

What is the change in velocity of the electron from $t = 0$ seconds to $t = (5/8)T$?

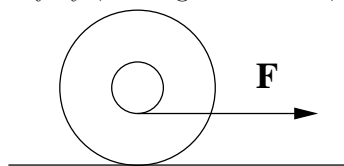*Tries 0/15*

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1 point(s)
Pail of Water
Suppose you wish to whirl a pail full of water in a vertical circle without spilling any of its contents. If your arm is 1.00 m long (from shoulder to fist) and the distance from the handle to the surface of the water is 20.5 cm, what minimum speed is required?

Tries 0/15

1 point(s)
Conceptual motion of a yo-yo
A yo-yo, arranged as shown, is at rest on a *frictionless* surface.

If a force is applied to the string as in the diagram, the yo-yo
   A. moves to the left, rotating counter-clockwise
   B. moves to the right, rotating counter-clockwise
   C. moves to the left, rotating clockwise
   D. moves to the right, rotating clockwise

Tries 0/15

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1 point(s)
Sound Wavelength From String
During a concert a pianist hits a key that sets up a standing wave in a piano string that is vibrating in its fundamental mode. The string is 0.5 m long, has a mass density of 0.002 kg/m and is held under a tension of 120 N. What is the wavelength of the sound wave heard by the listener? The speed of sound in air is 343 m/s.

Tries 0/15

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5 point(s)
Dynamics of a falling (pinned) sign
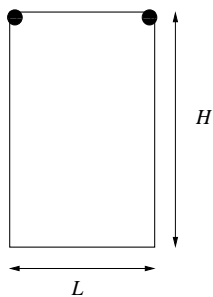
A uniform sign is nailed into a wall at its top two corners. The nail on the upper-right corner breaks, and the sign begins to rotate about the remaining nail in the upper-left corner. The mass of the sign is 69 kg, $L = 1.6$ m, $H = 2.2$ m, and the moment of inertia of the sign about the upper-left corner is 170 kg $\cdot$ m^2.

What is the moment of inertia about an axis that is parallel to the one through the upper-left nail but passes through the center of mass of the sign?

Tries 0/15

What is the angular acceleration of the sign just after the nail breaks?

Tries 0/15

What is the magnitude of the tangential acceleration of the center of mass of the sign just after the nail breaks?

Tries 0/15

What is the magnitude of the total acceleration of the center of mass of the sign just after the nail breaks?
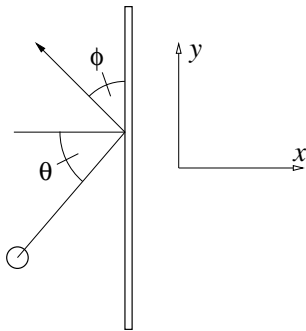
Tries 0/15

The angular speed of the sign is 0.625 rad/s when the center of mass of the sign is directly below the remaining nail. What is the magnitude of the centripetal acceleration of the center of mass at this point?

Tries 0/15

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2 point(s)
Puck Collides with Stick on Ice
A puck with a mass $m_p = 0.32$ kg is hit, giving it an initial speed of $v_{pi} = 17.68$ m/s at an angle of $\theta = 27°$. The puck hits a stick with a mass $m_s = 0.51$ kg as indicated in the figure.

The puck leaves with a speed of $v_{pf} = 6.25$ m/s at an angle $\phi = 36.1°$. The collision occurs on ice, so friction can be neglected during the collision.

Find the x component of the final velocity of the center of mass of the stick.

Tries 0/15

Find the y component of the final velocity of the center of mass of the stick.

Tries 0/15

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1 point(s)
180TurnAverageAcceleration
An airplane makes a gradual 180° turn (heading goes from north to south) while flying at a constant
speed of 203 m/s and maintaining the same altitude. The process takes 22.8 seconds to complete
and the radius of the turn is 2947 m. For this turn, the magnitude of the *average acceleration* of
the plane is closest to

   A. 17.81 m/s^2

   B. 0 m/s^2

   C. 13.98 m/s^2

   D. 12.59 m/s^2

   E. 8.90 m/s^2

Tries 0/15

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3 point(s)
Spinning Space Ship
One way to provide artificial gravity (i.e., a feeling of weight) on long space voyages is to separate
a spacecraft into two parts at the ends of a long cable, and set them rotating around each other. A
craft has been separated into two parts with a mass of 86000 kg each, at the ends of a cable with
their centers of mass 106 m apart, rotating around the center point of the cable with a period of
232.2 seconds.

If the cable is reeled in so that the the centers of the two pieces are now only 74.2 m apart, what
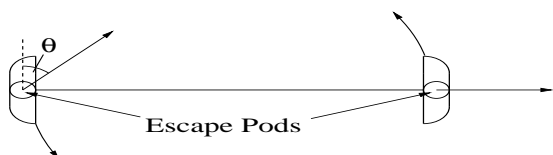will the new period be?

[   ]

Tries 0/15

What happens to the angular momentum L and kinetic energy K of the system consisting of both
pieces of the space ship when the two pieces are pulled closer to the center?

   A. L remains the same, K increases

   B. L remains the same, K decreases

   C. L increases, K increases

   D. L increases, K remains the same

   E. L and K remain the same

Tries 0/15

The two pieces of the spacecraft are returned to their initial configuration with a period of 232.2 seconds. A radiation leak is detected in one of the engines. An escape pod from each section of the spacecraft are ejected as indicated in the figure. Notice that the direction of rotation for the two pieces of the spacecraft is also indicated in the figure.

The escape pods each have a mass of 12000 kg and are ejected with a speed of 77.99 m/s along the directions indicated in the figure with $\theta = 32.5$ degrees.

What is the new period of the remaining spacecraft after the two escape pods are ejected?

Tries 0/15

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1 point(s)
Spring and Hanging Mass
A block of mass 4 kg hangs vertically from a spring with constant k = 100 N/m which is attached to the ceiling and initially is not stretched or compressed. The block is initially held at rest by an external force. The block is then released and falls under the combined forces of gravity and the spring.

What is the speed of the block when it has dropped a vertical distance 0.4 m?

Tries 0/15