1 point(s)
Final Speed with Conservative and non-conservative forces
An object moves from one position to another in two different situations. In situation **A**, the object is hanging from the ceiling by an ideal spring. In situation **B**, the object is connected to a spring and sliding on a level 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**: no
   B. **A**: no, **B**: yes
   C. **A**: yes, **B**: no
   D. **A**: yes, **B**: yes

Tries 0/15

---

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 **I** begins just as the athlete starts the upward motion and ends right as her feet leave the ground. The second time period **II** begins just as the athlete's feet touch the ground upon landing, and ends as soon as she is stationary again in the squatted position. The height of the athlete's center of mass is the same when her feet leave the ground and when they touch upon landing.
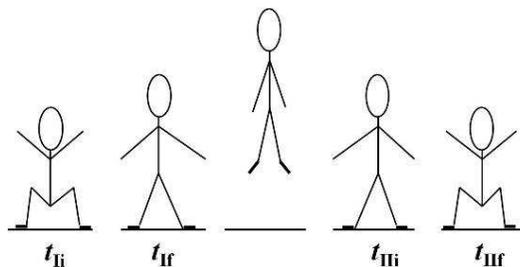
Compare the impulse from the normal force of the ground on the athlete for the two time periods.

   A. The impulse for period **I** is equal in magnitude and opposite in direction to that for period **II**.

   B. The impulse for period **II** is larger in magnitude than for period **I**.
   C. The impulse for period **I** is equal in magnitude and direction to that for period **II**.
   D. More information is needed to compare the impulses.
   E. The impulse for period **I** is larger in magnitude than for period **II**.

Tries 0/15

1 point(s)
ManWithWheel4.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 not rotating initially, but the wheel is spinning clockwise as viewed from above. Which of the following would cause the man to start rotating counter-clockwise?
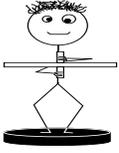
   A. Turning the wheel over or slowing the rotation of the wheel.

   B. Slowing down the rotation of the wheel.

   C. Turning the wheel over.

   D. There is nothing he can do to begin rotating since the wheel and the man experience no net external torque and thus their angular momentum must be conserved.

   E. Speeding up the rotation of the wheel.

Tries 0/15

---

1 point(s)
SignOfWorkFromStaicFriction
A book is resting on a cart that is being pushed up a ramp with increasing speed. The work done by static friction on the book is:

   A. 0 J

   B. negative

   C. positive

   D. Unable to be determined without more information

   E. Not well defined since the book is in an accelerating reference frame

Tries 0/15

---

1 point(s)
Rolling Race Up a Ramp
A solid sphere and a solid cylinder are both launched from the bottom of an inclined ramp with the same initial velocity. If both roll without slipping, which one will travel higher up the ramp before coming to rest?

   A. They will both travel the same distance up the ramp.

   B. The sphere.

   C. More information is needed to determine which one travels highest up the ramp.

   D. The cylinder.

Tries 0/15

4 point(s)
Angular Collisions
Two disks are initially spinning above one another, as shown in the figure below. Both disks have the same radius, $R = 2.71$ m. Disk 1 has a moment of inertia $I_1 = 10.5$ kg·m². Disk 2 has a moment of inertia $I_2 = 6.3$ kg·m². Disk 1 is initially spinning with angular velocity $\omega_1 = 16.1$ rad/s, and disk 2 is initially spinning with angular velocity $\omega_2 = $ -11.5 rad/s.
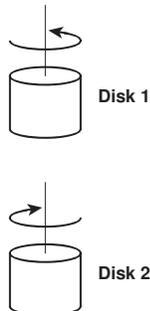
Disk 1

Disk 2

Disk 1 is then dropped on disk 2, and eventually the two discs reach a common, final angular velocity. Find their final angular velocity. Let counteclockwise rotation as viewed from above be positive.
$\omega_{\text{common}} = $
Tries 0/15

How much thermal energy is created in the process of disk 1 falling on disk 2 such that they reach a common final angular velocity? You do not need to worry about the gravitational potential energy because the initial separation of the disks is small.
$\Delta E_{\text{therm}} = $
Tries 0/15

You want to speed up the system of rotating disks. To do this, you throw a ball of mass m_b at the two disks that are still rotating together with the same speed. You throw the ball at the disks, and the ball follows the following trajectory as viewed from above.

ϕ θ

R
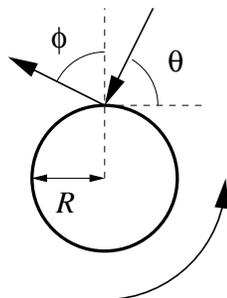
The ball of mass m_b approaches the disks at an angle θ with respect to the tangent line to the disk and rebounds at an angle ϕ with respect to the normal. The ball's initial speed is v_0, and its final speed is v_f. What is the new angular velocity of the system of rotating disks (they still rotate together) after the collision with the ball? Use these values for the parameters:

$v_f = 1.41$ m/s
$v_0 = 8.8$ m/s
$\theta = 65$ degrees
$\phi = 73.6$ degrees
$m_b = 1.82$ kg

$\omega_{\text{new}} = $
Tries 0/15

Now you want to slow the system down, so you decide to throw a mud ball ($m_{mud} = 1.72$ kg) at the system of rotating disks. The trajectory from above looks like this:
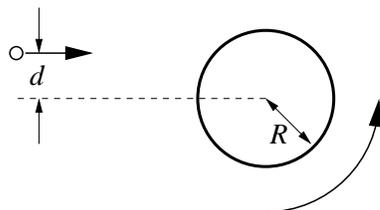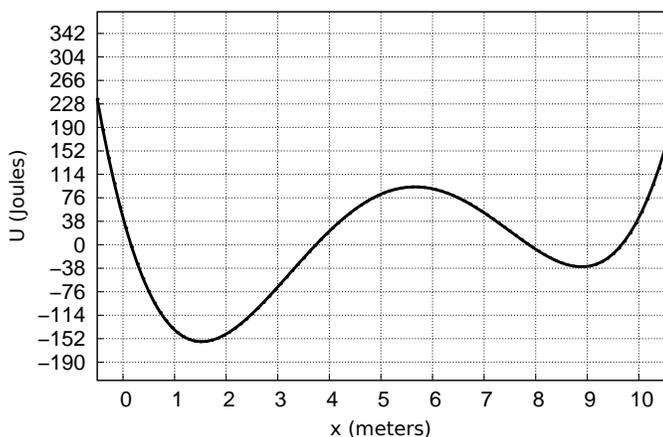

The mud is moving with initial speed $v_m = 15.9$ m/s and sticks to the rim of the disk upon impact. The distance d is 1.35 m. Find the common final angular velocity of the two disks and the mud. Make your answer positive if the rotation is counterclockwise as viewed from above.

$\omega_f =$ _____

Tries 0/15

---

1 point(s)
Graphical Potential Energy Function

Shown above is a graph of potential energy as a function of position for a certain particle. The particle is released with an initial kinetic energy of 65 J at $x = 10$ m. From the list below, select the value that is closest to the maximum kinetic energy for this particle.

  A. 79.4 J

  B. 35.7 J

  C. 318 J

  D. 265 J

  E. 144.4 J

Tries 0/15

1 point(s)
Helicopter's Winch
A helicopter winches up an injured person from a boat. The person plus equipment has a mass of
145 *kg*. If the height of the lift is 88 *m* and it is carried out at a uniform rate over 60 *s*, what is the
power expended by the helicopter's winch motor? Assume that the engine is 62% efficient.

[   ]

Tries 0/15

---

1 point(s)
Equilibrium From Potential
A particle moves under the influence of a radial potential given by

$$U(r) = U_o(\frac{r^2}{2R} - 3r)$$

where r is the radial coordinate and $U_o = 0.30$ Newtons and $R = 0.14$ m.

Find the value of r for which this particle is in mechanical equilibrium.

[   ]

Tries 0/15

---

3 point(s)
Inelastic collision between a car and truck
A car of mass 670 kg and a truck of mass 2790 kg in a demolition derby are about to crash into one
another. The truck is moving with a speed of 6.1 m/s at an angle of $\phi = 54.3$ degrees and the car
is moving with a speed of 6.1 m/s at an angle of $\theta = 30.7$ degrees as indicated in the figure.
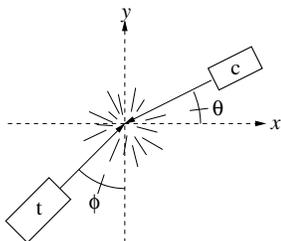
The collision is perfectly inelastic.

What is the x component of the velocity of the wreck just after the collision?

[   ]

Tries 0/15

What is the y component of the velocity of the wreck just after the collision?

[   ]

Tries 0/15

During the collision, which auto *exerted* a larger magnitude average force on the other auto?

  A. the answer depends on which auto got more crushed
  B. the magnitudes were equal
  C. the truck
  D. the car
  E. the answer depends on how long the collision lasted

Tries 0/15

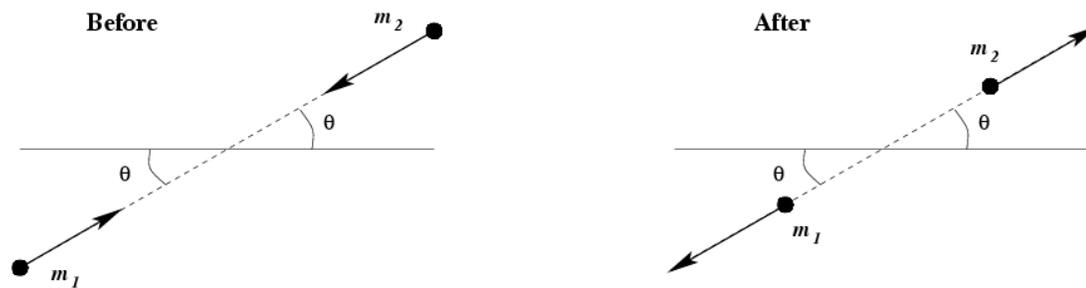1 point(s)
Work Energy With Thermal Percentage
A block of mass 5.7 kg is sliding along a level table with an initial speed of 2.6 m/s. The coefficient of kinetic friction between the book and the table is 0.81. The block eventually comes to rest. During this process 30% of the thermal energy generated goes into the book. Calculate the change in thermal energy of the table.

[   ]

Tries 0/15

---

1 point(s)
1Das2Dcollision
Two masses $m_1 = 5$ kg and $m_2 = 2$ kg undergo an elastic collision as shown where $\theta = 30°$. You know that m_1 has an initial speed $v_{1o} = 8.4$ m/s and you know that m_2 has an initial speed $v_{2o} = 3.11$ m/s before the collision. Calculate the final speed after the collision v_{1f} for the first mass m_1.
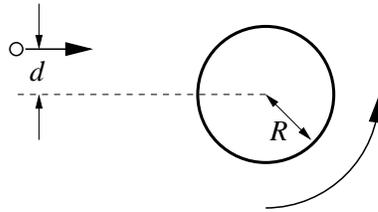

[   ]

Tries 0/15

---

1 point(s)
Angular and Translational Collision

A disk of radius $R = 4$ m and moment of inertia $I = 6$ kgm^2 is initially spinning counterclockwise with an angular speed $\omega = 3$ rad/s on a frictionless axle. You decide to throw a sticky ball of mass $m = 0.3$ kg at the disk as shown.

The sticky ball is moving with initial speed $v_i = 4$ m/s and sticks to the edge of the disk upon impact. The distance d is 0.5 m. Find the magnitude of the common final angular velocity of the disk and the sticky ball.

$\omega_f =$ [   ]

Tries 0/15

---

1 point(s)
Work From Theta
A uniform disk of radius 0.6 m and mass 4 kg is rotating about its center of mass. Its moment of inertia about its center of mass is $I = \frac{1}{2}mR^2$. Its angular position as a function of time is given by $\theta(t) = kt^6/T^6$ where $k = 4.3$ rad and $T = 2$ s. Find the magnitude of the work done by external forces on the disk from $t_i = 0$ s to $t_f = 4$ s.

[   ]

Tries 0/15

---

1 point(s)
**Speed of a block attached to a pulley and spring**
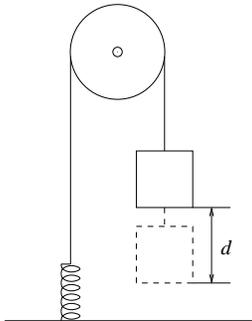
A block of mass 1.61 kg is attached to a string that is wrapped around a pulley and then attached on the other side to a spring as shown. The pulley is a solid cylinder of mass $m_p = 2.38$ kg and radius $R = 0.38$ m ($I = (1/2)m_pR^2$). At first the block is held so the spring is unstretched. You then let the block go. What is the speed of the block after it has fallen a distance $d = 0.42$ m if the spring constant equals 22.5 N/m?

[   ]

Tries 0/15

---

2 point(s)

Two Blocks Colliding

A solid block of mass $m_2 = 4.2$ kg, at rest on a horizontal frictionless surface, is connected to a relaxed spring. The other end of the spring is fixed, and the spring constant is $k = 90$ N/m. Another solid block of mass $m_1 = 2.5$ kg and speed $v_1 = 4.1$ m/s collides with the 4.2 kg block. The blocks stick together, and compress the spring.
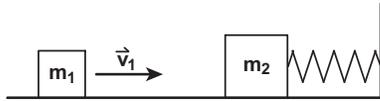
What is the maximum compression of the spring?

$x_{max} = $ [ ]

Tries 0/15

What is the magnitude of the acceleration of the two blocks when the spring is at maximum compression?

$a = $ [ ]

Tries 0/15

Name: _Lois Kuo_   **CWID:** _____   **Exam Code**_____   do not write in the box above

Circle Studio Time: 8-10   10-12   12-2   2-4

   Note: Your responses will be graded for **accuracy and presentation**. **Please circle your final answer**

A particle of mass m_b moves in one-dimension under the influence of a single unknown force $\vec{F}_{ab}$. The resulting velocity of the object is given by $\vec{v}(t) = v_o(1 + \frac{t}{T} - \frac{t^2}{T^2})\hat{i}$ where v_o and T are constants. All of your answers to the questions below should be in terms of m_b, v_o, and T.

1.(*7 pts*) Develop an expression for the work done by the force $\vec{F}_{ab}$ on the particle from $t_i = 0$ to $t_f = 2T$.

system = particle

$$\boxed{W_{\vec{F}} = \tfrac{1}{2}m_b v_o^2 - \tfrac{1}{2}m_b v_o^2 = 0}$$

$W_{tot} = \Delta E_{sys}$

$W_{tot} = W_{\vec{F}}$

$\Delta E_{sys} = \Delta K_{trans} = \tfrac{1}{2}m_b v_f^2 - \tfrac{1}{2}m_b v_i^2$

$V_f = |V_o(1 + \frac{2T}{T} - \frac{4T^2}{T^2})| = |-V_o| = V_o$

$V_i = |V_o(1 + 0 - 0)| = V_o$

2.(*7 pts*) Develop an expression for the average force $\vec{F}_{ab,avg}$ on the particle from $t_i = 0$ to $t_f = 2T$.

$\vec{F}_{ab,avg} = \frac{\vec{I}_{ab}}{\Delta t} = \frac{\Delta \vec{p}_b}{\Delta t}$ since $\vec{I}_{net} = \vec{I}_{ab} = \Delta \vec{p}_b$ for   system = particle

$\vec{F}_{ab,avg} = \frac{1}{2T}m_b(\vec{v}_f - \vec{v}_i) = \frac{m_b}{2T}(-V_o\hat{i} - V_o\hat{i}) = \boxed{-\frac{m_b V_o}{T}\hat{i}}$

3.(*6 pts*) Develop an expression for the force $\vec{F}_{ab}$ on the particle at the time $t = 0.5\,T$.

system = particle

$$\boxed{\vec{F}_{ab} = 0}$$

$\sum_i \vec{F}_{ib} = m_b \vec{a}_b = \vec{F}_{ab}$

$\vec{a}_b = \frac{d\vec{v}_b}{dt} = V_o(\frac{1}{T} - \frac{2t}{T^2})\hat{i}$

$\vec{a}_b(0.5T) = V_o(\frac{1}{T} - \frac{1}{T})\hat{i} = 0$