1. (3) A bead slides without friction around a loop-the-loop of radius r. The bead is released from a height of 3.5r.
   a) What is the speed of the bead at the top of the loop, and at the distance r from the bottom, on either side of the loop.
   c) What is the normal force on the bead at the top?
   a) $v = \sqrt{3gr}$ b) $v = \sqrt{5gr}$ c)2mg=0.098N

2. A block of mass 0.250 kg is placed on top of a light vertical spring of force constant 5000 N/m and pushed downward so that the spring is compressed by 0.100m. After the block is released from rest, it travels upward and then leaves the spring. To what maximum height above the point of release does it rise?
   10.2m.

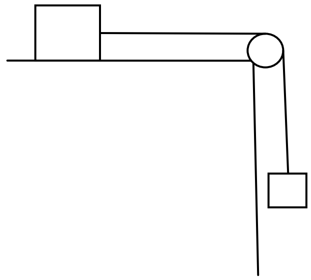
3. A simple pendulum consists of a point mass suspended from a string. The string with its top-end fixed has negligible mass and does not stretch. In the absence of air friction, the system oscillates by swinging back and forth in a vertical plane. If the string is 2.00 m long and makes an angle of 30.0º with the vertical, calculate the speed of the mass a) at the lowest point of the trajectory, and b) when it makes an angle of 14.0º with the vertical.
   a) 2.29m/s; b)1.98m/s

4. (7) Two objects are connected by a light string passing over a light frictionless pulley, hanging from a ceiling. The object of mass 3.00kg is released from resting on the floor. The second object of 5.00kg, hanging on the other side of the pulley, starts to move from its original height of 4.00 m above the ground. Using the isolated system model a) determine the speed of the 5 kg object just before it hits the ground. b) Find the maximum height which the 3 kg object rises.
   a) 4.43m/s; b) 5.00m

5. Calculate the curl of the following vector function: $\langle xy, yz, z^2 \rangle$
   $\langle -y, 0, -x \rangle$

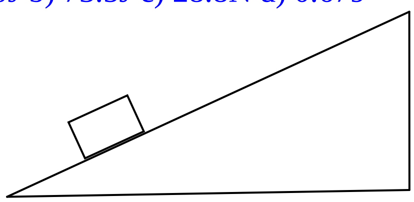
$$curl\vec{A} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ xy & yz & z^2 \end{vmatrix} = \vec{i}\left(\frac{\partial z^2}{\partial y} - \frac{\partial yz}{\partial z}\right) - \vec{j}\left(\frac{\partial z^2}{\partial x} - \frac{\partial xy}{\partial z}\right) + \vec{k}\left(\frac{\partial yz}{\partial x} - \frac{\partial xy}{\partial y}\right) = \langle -y, 0, -x \rangle$$

6. (19) A 3.00 kg block A rests on a horizontal table with a coefficient of friction 0.400. A weightless non stretching string passes from this block over a pulley at the edge of the table to a 5.00kg block B which hangs from the end of the string. What is the speed of block B after the system has been released from rest and block B has fallen

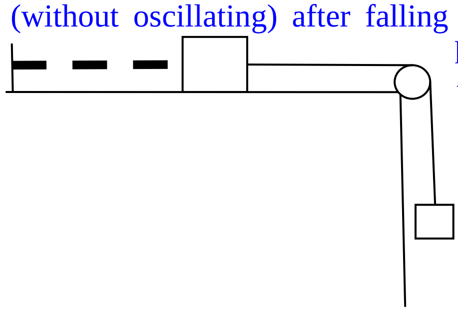


by 1.50m
answer: 3.74m/s

7. (21) A 5kg block is set in motion up an inclined plane with an initial speed of 8.00 m/s. The block comes to rest after traveling 3.0m along the plane, which is inclined at an angle of 30.0º to the horizontal.
   a) find the change in the block's KE b) the change of the block's potential energy c) the friction force exerted on the block d) the coefficient of kinetic friction.
   a) -160J b) 73.5J c) 28.8N d) 0.679



8. A mass of 0.500kg is sliding on a horizontal table. A spring with spring constant 50.0N/m is attached to its left. To its right it is attached to a string that passes over a pulley at the edge of the table. On the vertical end of this string hangs a second mass of 1.00kg. When the whole system is released from rest, the hanging mass comes to a rest (without oscillating) after falling a distance h=0.30m. Find the coefficient of kinetic friction between the sliding block and the table. 0.47



$$\Delta K + \Delta U = -f_k x = -\mu_k m_1 g x;$$

$$\Delta K = 0; \Delta U = \frac{1}{2}kx^2 - m_2 g x$$

9. a) Find the speed at which the rest mass energy of a particle is just 0.100% of the total energy. Assume the particle is a proton with a rest-mass of 1.67E-27kg. Find the b) rest-mass energy and c) the total energy at the given speed in MeV.
   a) v=0.9999995c b) 939Mev c) 939,000MeV=939GeV