Student #: _____ Student Name: _____

Physics 12 Homework Class 4: Conservation of Energy

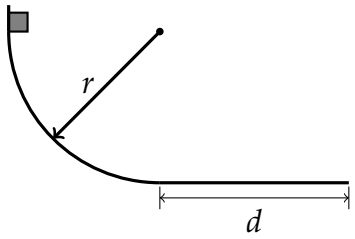
_____ 1. A boy pushes a crate of mass m across a level floor with a constant speed v. The coefficient of friction between the crate and the floor is μ. What is the rate at which the boy does work on the crate?

(a) μmg
(b) mgv
(c) μmgv
(d) $\mu mg/v$
(e) $\mu v/mg$

_____ 2. A power company charges its customers 15 ¢ per kilowatt-hour. A kilowatt-hour is a unit of

(a) power
(b) energy
(c) electricity
(d) current
(e) voltage

_____ 3. A block slides down a smooth quarter-circle ramp of radius r, then onto a rough flat surface at the bottom of the ramp. The friction on the horizontal surface causes the block to come to rest in a distance d. The work done by the frictional force on the horizontal surface is

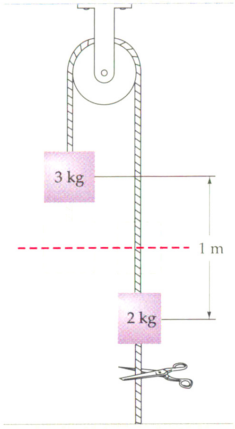


(a) mgr
(b) $\sqrt{mgr}$
(c) $2mgr\cos\theta$
(d) $2mgr(r - r\cos\theta)$
(e) $2mgr(r - r\sin\theta)$

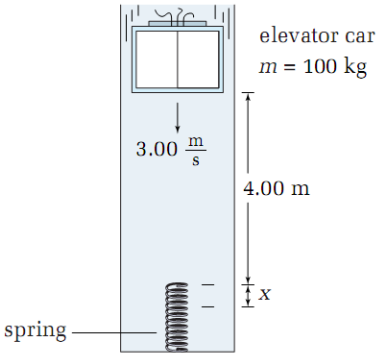
4. A boy does 465 J of work pulling an empty wagon along level ground with a force of 111 N at 31° below horizontal. A frictional force of 155 N opposes the motion and is actually slowing the wagon down from an initial high velocity. The distance the wagon travels is:

5. A spring hanging from the ceiling of a house has a spring constant of $15.3\,\mathrm{N/m}$ and a maximum extension of $1.2\,\mathrm{cm}$. What is the largest mass that can be placed on the spring without damaging it?

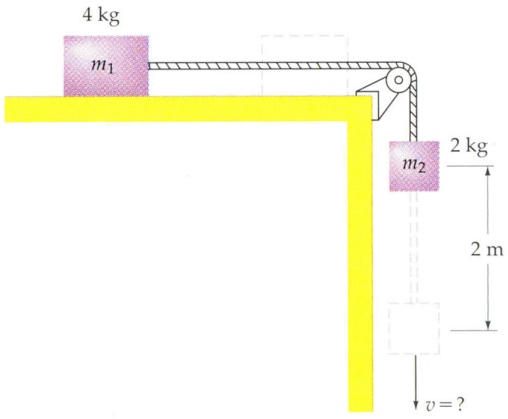
6. The system shown in the figure below is at rest when the lower string is cut. Find the speed of the objects when they are at the same height.



7. An empty freight elevator car with a total mass of $100\,\mathrm{kg}$ is moving downward at $3.00\,\mathrm{m/s}$ when the supporting cable snaps. The car falls $4.00\,\mathrm{m}$ onto a huge spring with a spring constant of $8.00 \times 10^3\,\mathrm{N/m}$. By how much will the spring be compressed when the car reaches zero velocity?



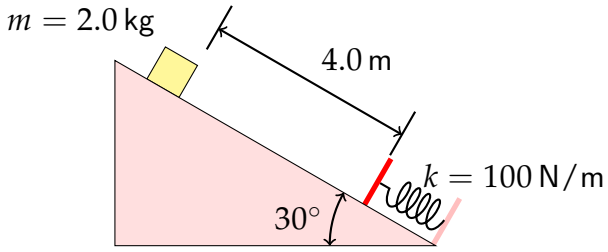
8. In the figure below, the blocks are initial at rest. Choose $U = 0$ at this initial position. Find the speed of the 2-kg mass after it has fallen from rest a distance of $2\,\text{m}$, assuming no friction. Give answer to 3 significant figures.



9. Using the same diagram from the previous question, suppose that the the coefficient of kinetic friction between the 4-kg block and the table is 0.35. Give answer to 3 significant figures.

   (a) Find the work done by friction when the 2-kg block falls a distance of $2\,\text{m}$.
   (b) Find the total mechanical energy (kinetic plus potential) E_{tot} of the system after the 2-kg falls a distance of y, assuming that initially, $U = 0$.
   (c) Use your results from part (b) to find the speed of either block after the 2-kg has fallen $2\,\text{m}$.

10. A 2.0-kg block is released $4.0\,\text{m}$ from a massless spring with a spring constant of $100\,\text{N/m}$ that is fixed along a frictionless plane inclined at 30°, as shown in the figure below.



(a) Find the maximum compression of the spring.
(b) If the plane is not frictionless, and the coefficient of kinetic friction between it and the block is 0.20, find the maximum compression.
(c) For the rough incline ($\mu_k = 0.20$), how far up the incline will the block travel after leaving the spring?