Units?
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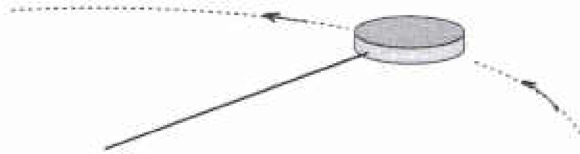
Name________________________________

Phys 2010, Section 3
Quiz #3 — Fall 2003



1. A small disk of mass 0.400 kg is attached to a string of length 0.800 m and moves in a horizontal circle. It takes 0.900 s to make one revolution.

a) What is the speed of the mass?

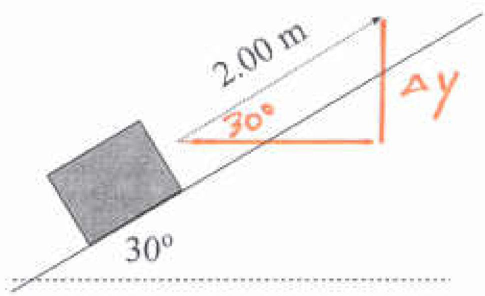
Use $v = 2\pi r / T$ (circumf. divided by period), then:

$$v = \frac{2\pi\,(0.800\,\mathrm{m})}{(0.900\,\mathrm{s})} = \boxed{5.59\,\tfrac{\mathrm{m}}{\mathrm{s}}}$$

b) What is the tension in the string?

The tension in the string is the centripetal force acting on the mass:

$$T = F_c = \frac{mv^2}{r} = \frac{(0.400\,\mathrm{kg})(5.59\,\tfrac{\mathrm{m}}{\mathrm{s}})^2}{(0.800\,\mathrm{m})} = 15.6\,\mathrm{N}$$



2. A 2.00 kg mass moves up a 30.0° slope a distance of 2.00 m (measured along the slope).

What is its increase in potential energy?

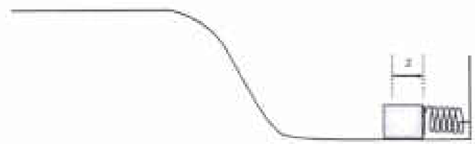
The change in grav. potential energy depends on the change in height which is

$$\Delta y = (2.00\,\mathrm{m})\sin 30^\circ = 1.00\,\mathrm{m}$$

Then the change in potential energy is

$$\Delta PE = mg\,\Delta y = (2.00\,\mathrm{kg})(9.80\,\tfrac{\mathrm{m}}{\mathrm{s}^2})(1.00\,\mathrm{m}) = \boxed{19.6\,\mathrm{J}}$$

3. A spring of force constant 2500 N/m is compressed by a distance 8.00 cm; when it is released it pushes a 0.500 kg mass so that it slides up a slope and then onto a flat surface at a height of 1.2 m.

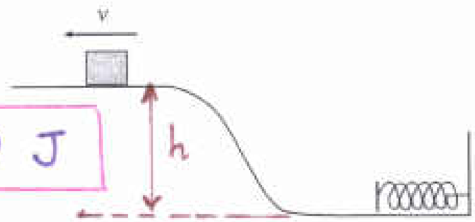


a) How much elastic (spring) potential energy is there before the spring is released?

Potential energy of the spring is

$PE_{spr} = \frac{1}{2}kx^2$

$= \frac{1}{2}(2500\frac{N}{m})(0.0800\,m)^2 = \boxed{8.00\ J}$



b) How much kinetic energy does the mass have on the higher flat surface? (*Use conservation of total energy...*)

The total energy of the mass on the higher surface is

$E_f = PE_{grav} + KE_f = 8.00\,J$, since E is conserved.

So the final kinetic energy is

$KE_f = 8.00\,J - PE_{grav} = 8.00\,J - (0.500\,kg)(9.8\frac{m}{s^2})(1.2\,m) = \boxed{2.12\ J}$

c) What is the speed of the mass as it slides on the upper flat surface?

From (b) we can find v_f:

$KE_f = 2.12\,J = \frac{1}{2}mv_f^2$

$\rightarrow v_f^2 = \frac{2(2.12\,J)}{(0.500\,kg)} = 8.48\,\frac{m^2}{s^2} \rightarrow v_f = \boxed{2.91\ \frac{m}{s}}$

You must show all your work and include the right units with your answers!

$\mathbf{F}_{net} = ma \qquad g = 9.80\frac{m}{s^2}$ *sohcahtoa...sohcahtoa...*mmm-hmm-mm, *sohcahtoa*

$v = \frac{2\pi r}{T} \qquad a_c = \frac{v^2}{r} \qquad F_c = \frac{mv^2}{r} \qquad \mathrm{KE} = \frac{1}{2}mv^2 \qquad \mathrm{PE_{grav}} = mgy \qquad \mathrm{PE_{spr}} = \frac{1}{2}kx^2$

$W = Fs\cos\theta \qquad \Delta E = \Delta\mathrm{KE} + \Delta\mathrm{PE} = W_{non-cons}$