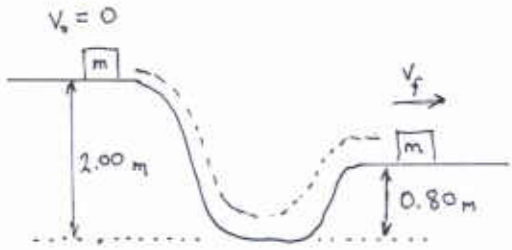
Name Units? Units?

Phys 121
Quiz #3 — Spring 2001



1. A 1.2 kg mass slides along a frictionless track, starting from rest at a height of 2.0 m above its lowest point and ending at 0.8 m above its lowest point.

$m = 1.20$ kg

a) From the start to the finish of the motion, what was the change in potential energy of the mass?

$PE = mgh$

$\Delta PE = \Delta(mgh) = mg(\Delta h)$

$= (1.2\,kg)(9.8\,m/s^2)(0.80\,m - 2.00\,m) = \boxed{-14.1\ J}$

b) What is the change in kinetic energy of the mass?

No friction forces, so $\Delta E = 0$, i.e. $\Delta PE + \Delta KE = 0$, or $\Delta KE = -\Delta PE$. From part (a) then,

$\Delta KE = \boxed{+14.1\ J}$

c) What is the final speed of the mass?

Using part (b),

$\Delta KE = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2 = \frac{1}{2}mv_f^2 - 0 = +14.1\ J$

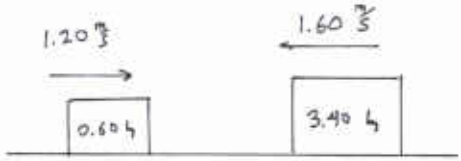
So $v_f^2 = \frac{2(14.1\,J)}{m} = \frac{2(14.1\,J)}{(1.2\,kg)} = 23.5\,m^2/s^2$

$\rightarrow \boxed{v_f = 4.85\ m/s}$

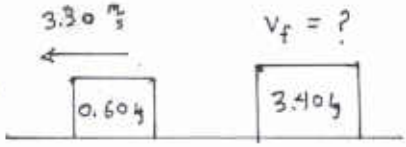
2. What do we mean when we say a collision is *elastic*?

An elastic collision is one in which (kinetic) energy is conserved.

3. On a 1-dimensional frictionless track, a 0.60 kg mass moves to the right with speed $1.20\frac{\text{m}}{\text{s}}$, toward a 3.40 kg mass which is moving to the left with speed $1.60\frac{\text{m}}{\text{s}}$



After the collision, the 0.60 kg mass is moving to the left with speed $3.30\frac{\text{m}}{\text{s}}$. What is the final *velocity* of the 3.40 kg mass? Total momentum is conserved.



$P_{x,0} = (0.60\,\text{kg})(1.20\frac{\text{m}}{\text{s}}) + (3.40\,\text{kg})(-1.60\frac{\text{m}}{\text{s}}) = -4.72\frac{\text{kg m}}{\text{s}}$

$P_{x,f} = (0.60\,\text{kg})(-3.30\frac{\text{m}}{\text{s}}) + (3.40\,\text{kg})\,v_f$

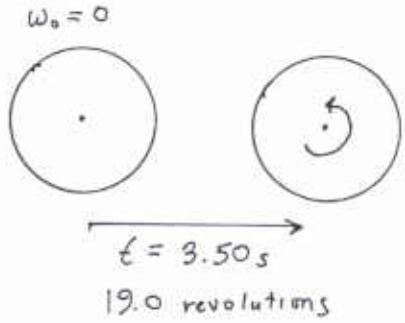
$P_{x,0} = P_{x,f}$ so

$(0.60)(-3.30\frac{\text{m}}{\text{s}}) + (3.40)\,v_f = -4.72\frac{\text{kg m}}{\text{s}}$

Solve for v_f, get

$v_f = -0.81\frac{\text{m}}{\text{s}}$

4. A wheel starts from rest and after 3.5 s has turned through 19.0 revolutions (its angular acceleration is constant).



a) What was the angular displacement of the wheel in *radians*?

$19\ \text{rev} = (19\ \text{rev})\left(\frac{2\pi\ \text{rad}}{1\ \text{rev}}\right) = 119\ \text{rad}$

b) Find the angular acceleration of the wheel.

Since $\omega_0 = 0$, $\theta = \frac{1}{2}\alpha t^2$, so

$\alpha = \frac{2\theta}{t} = \frac{2(119\ \text{rad})}{(3.5\,\text{s})^2} = 19.5\frac{\text{rad}}{\text{s}^2}$

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

$g = 9.8\frac{\text{m}}{\text{s}^2}$ 1 m = 100 cm 1 kg = 1000 g

$W = Fs\cos\theta$ $\text{KE} = \frac{1}{2}mv^2$ $\text{PE} = mgh$ $\Delta E = \Delta\text{PE} + \Delta\text{KE} = W_{\text{nc}}$

$\mathbf{p} = m\mathbf{v}$ Isolated System: $\Delta\mathbf{P} = 0$

$2\pi\ \text{rad} = 360\ \text{deg}$ $s = r\theta$ $\omega = \omega_0 + \alpha t$ $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$ $\omega^2 = \omega_0^2 + 2\alpha\theta$

360 deg = 1 rev