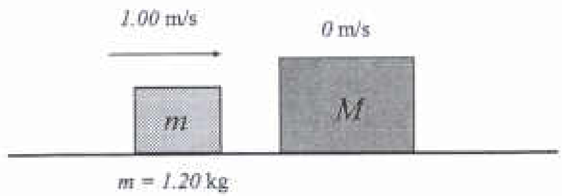
Name_______________ Units? Units?

Oct. 29, 2003

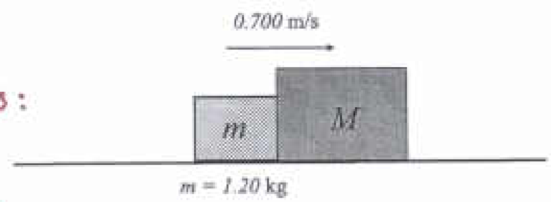
Phys 2010, Section 3
Quiz #4 — Fall 2003

1. A 1.20 kg mass slides to the right with a speed of $1.00\,\frac{\text{m}}{\text{s}}$ on a frictionless track; it collides with a stationary mass M and sticks to it.

After the collision, the combined mass moves to the right with speed $0.700\,\frac{\text{m}}{\text{s}}$.



a) Find the value of M. (Hint: Use the condition of conservation of momentum and solve for M!)



Total momentum conserved in collision. This gives:

$(1.20\text{ kg})(1.00\,\tfrac{\text{m}}{\text{s}}) = (1.20\text{ kg} + M)(0.700\,\tfrac{\text{m}}{\text{s}})$

(Before the collision only the 1.20 kg mass is in motion; afterwards both masses move with same velocity)

Solve for M:

$(1.20\text{ kg} + M) = \dfrac{(1.20\text{ kg})(1.00\,\frac{\text{m}}{\text{s}})}{(0.700\,\frac{\text{m}}{\text{s}})} = 1.71\text{ kg} \rightarrow M = \boxed{0.514\text{ kg}}$

b) How much kinetic energy is lost in this collision?

Total KE before collision is:

$KE_{init} = \frac{1}{2}(1.20\text{ kg})(1.00\,\tfrac{\text{m}}{\text{s}})^2 = 0.600\text{ J}$

Total KE after collision is

$KE_{final} = \frac{1}{2}(1.20\text{ kg} + 0.514\text{ kg})(0.700\,\tfrac{\text{m}}{\text{s}})^2 = 0.420\text{ J}$

Then the amt of KE lost is

$|\Delta KE| = 0.600\text{ J} - 0.420\text{ J} = \boxed{0.180\text{ J}}$

2. A disk of radius 6.00 cm is turning at a rate of $188.0\frac{\text{rad}}{\text{s}}$.

a) Find its angular velocity in units of revolutions per second.

$188.0\ \frac{\text{rad}}{s} = (188.0\ \frac{\text{rad}}{s})(\frac{1\text{ rev}}{2\pi\text{ rad}}) = \boxed{29.9\ \frac{\text{rev}}{s}}$

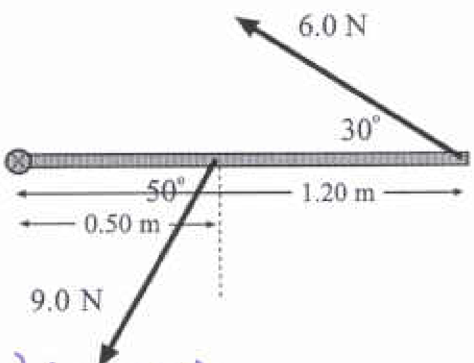
b) Find the speed of a point of the rim of the disk.

At the rim (edge) of disk, $r = 0.0600$ m, so

$v = \omega r = (188\ /s)(0.0600\ m) = \boxed{11.3\ \frac{m}{s}}$

3. Two forces act on a bar of length 1.20 m which turns around a frictionless pivot, as shown. (You can ignore the mass of the bar.)

Find the total torque which acts on the bar. Be clear about the *direction* (clockwise or counter-clockwise) of the net torque.



Taking the counter-clockwise direction as positive we get:

$\Sigma\tau = -(9.0N)(0.50m)\sin 50° + (6.0N)(1.20m)(\sin 30°)$

$= \boxed{0.153\ N\cdot m}$

Positive sign tells us net torque is $\boxed{\text{counterclockwise}}$

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

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

$\text{KE} = \frac{1}{2}mv^2$ $\quad \mathbf{p} = m\mathbf{v}$ $\quad$ For isolated system $\mathbf{P}$ is conserved

$2\pi\text{ rad} = 360° = 1\text{ rev}$ $\quad \omega = \omega_0 + \alpha t$ $\quad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$ $\quad \omega^2 = \omega_0^2 + 2\alpha\theta$ $\quad |\tau| = Fr\sin\phi$

$v = \omega r$ $\quad a_T = \alpha r$ $\quad a_c = \frac{v^2}{r} = \omega^2 r$