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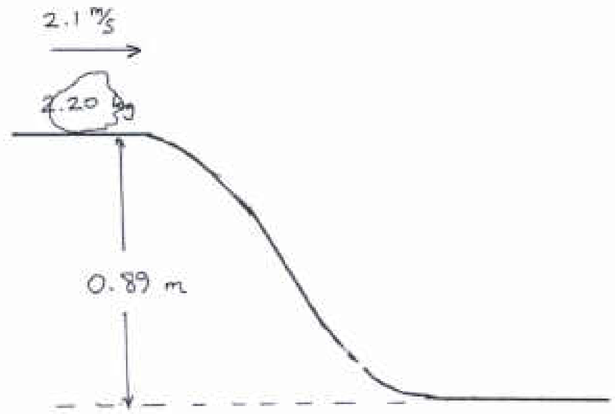
**Phys 121**
**Quiz #3**

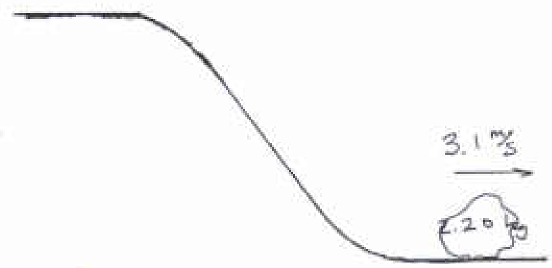



**1.** A 2.2 – kg <u>Gummy Bear</u> is moving at 2.1 $\frac{m}{s}$ at the top of a ramp. It slides down the ramp during which time it drops a vertical distance of 0.89 m and is acted on by frictional (non–conservative) forces. At the bottom of the slope it has a speed of 3.1 $\frac{m}{s}$.

Find the work done by the non–conservative (friction) forces on the <u>Gummy Bear</u>.

Work done on the g.b. by the non conservative forces is the change in energy:

$$W_{nc} = \Delta E = E_f - E_o$$




Final and initial energies are (measuring height from lower level):

$$E_f = PE_f + KE_f = 0 + \tfrac{1}{2}(2.20\ kg)(3.1\ \tfrac{m}{s})^2 = 10.6\ J$$

$$E_o = PE_o + KE_o = (2.20\ kg)(9.8\ \tfrac{m}{s^2})(0.89\ m) + \tfrac{1}{2}(2.20\ kg)(2.1\ \tfrac{m}{s})^2$$

$$= 24.0\ J$$

$$W_{nc} = E_f - E_o = 10.6\ J - 24.0\ J = -13.5\ J$$

Work done by "friction" is $\boxed{-13.5\ J}$

**2.** A $0.010 - \text{kg}$ bullet is fired horizontally with speed $430 \frac{m}{s}$ into a $2.3 - \text{kg}$ nauseating purple dinosaur resting on a horizontal frictionless surface. But the bullet does not stick in the nauseating purple dinosaur ...it passes right through it! After emerging from the n. p. d., the bullet has a speed of $70.0 \frac{\text{m}}{s}$.

Find the speed of the n. p. d. just after the bullet has gone through.

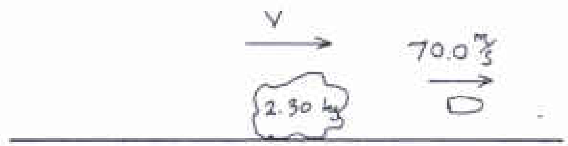
During the collision, the bullet and n. p. d. are an isolated system: the total momentum is conserved (in particular, the horizontal component).


$m_{bullet} = 0.010\ \text{kg}$

Thus, with

$$P_{0x} = (0.010\ \text{kg})(430\ \tfrac{m}{s}) + 0 = 4.30\ \tfrac{\text{kg}\cdot m}{s}$$

and




$$P_{fx} = (2.30\ \text{kg})\, v + (0.010\ \text{kg})(70.0\ \tfrac{m}{s})$$

$$= (2.30\ \text{kg})\, v + 0.700\ \tfrac{\text{kg}\, m}{s}$$

so that $P_{0x} = P_{fx}$ gives

$$4.30\ \tfrac{\text{kg}\, m}{s} = (2.30\ \text{kg})\, v + 0.700\ \tfrac{\text{kg}\cdot m}{s}$$

$$(2.30\ \text{kg})\, v = 3.60\ \tfrac{\text{kg}\cdot m}{s} \qquad \boxed{v = 1.57\ \tfrac{m}{s}}$$

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**You must show all your work!**

$$W = Fs\cos\theta \qquad \text{KE} = \tfrac{1}{2}mv^2 \qquad W_{\text{net}} = \Delta\text{KE}$$

$$\text{PE}_{\text{grav}} = mgy \qquad E = \text{PE} + \text{KE} \qquad W_{\text{nc}} = \Delta E = E_{\text{f}} - E_0$$

$$\mathbf{p} = m\mathbf{v} \qquad \mathbf{I} = \Delta\mathbf{p} \qquad \overline{\mathbf{F}} = \frac{\Delta\mathbf{p}}{\Delta t}$$