Name________________________________

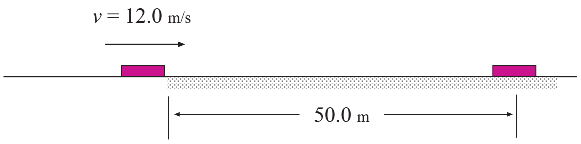
Feb. 8, 2006

Phys 2110 – Spring 2006
Quiz #1

1. Convert $3.5\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}$ to units of $\frac{\mathrm{g\cdot cm^2}}{\mathrm{s}}$

$$3.5\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}} = \left(3.5\,\frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}\right)\left(\frac{1000\ \mathrm{g}}{1\ \mathrm{kg}}\right)\left(\frac{100\ \mathrm{cm}}{1\ \mathrm{m}}\right)^2 = 3.5\times 10^7\,\frac{\mathrm{g\cdot cm^2}}{\mathrm{s}}$$

2. A hockey puck moves with speed $12.0\frac{\mathrm{m}}{\mathrm{s}}$; it encounters rough place where its acceleration is constant. The puck stops after moving 50.0 m on the rough surface.



a) What is the magnitude of the puck's acceleration on the rough surface?

With the $+x$ axis pointing to the right, we can use

$$v_f^2 = v_i^2 + 2a\Delta x \qquad \Longrightarrow \qquad 0^2 = (12.0\tfrac{\mathrm{m}}{\mathrm{s}})^2 + 2a(50.0\ \mathrm{m})$$

Solve for a,

$$a = \frac{(-144\,\frac{\mathrm{m^2}}{\mathrm{s^2}})}{(100.0\ \mathrm{m})} = -1.44\frac{\mathrm{m}}{\mathrm{s^2}}$$

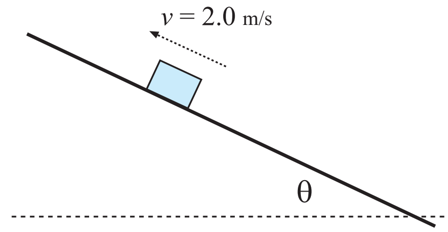
The magnitude of a is $1.44\frac{\mathrm{m}}{\mathrm{s^2}}$.

b) How long does it take the puck to come to a halt on the rough surface?

Use $v_f = v_i + a\Delta t$, then

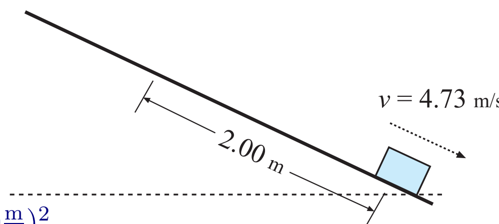
$$\Delta t = \frac{v_f - v_i}{a} = \frac{(0\frac{\mathrm{m}}{\mathrm{s}} - 12.0\frac{\mathrm{m}}{\mathrm{s}})}{(-1.44\frac{\mathrm{m}}{\mathrm{s^2}})} = 8.33\ \mathrm{s}$$

3. A block slides freely on a very long frictionless slope. It is initially projected up the slope with a speed of $2.00\frac{\text{m}}{\text{s}}$. When it gets back to a point on the slope 2.00 m from the starting position, its speed is $4.73\frac{\text{m}}{\text{s}}$



a) What is the magnitude of the block's acceleration?

If we take the $+x$ axis as going down the hill, then considering the whole trip up and down we have $v_i = -2.0\frac{\text{m}}{\text{s}}$ and $v_f = +4.73\frac{\text{m}}{\text{s}}$ and $\Delta x = +2.00\ \text{m}$. Then use



$$v_f^2 = v_i^2 + 2a\Delta x$$

to get

$$a = \frac{v_f^2 - v_i^2}{2\Delta x} = \frac{(4.73\frac{\text{m}}{\text{s}})^2 - (-2.0\frac{\text{m}}{\text{s}})^2}{2(2.0\ \text{m})} = +4.59\frac{\text{m}}{\text{s}^2}$$

b) How long does the block take to get to the final position?

Here we can use $\Delta x = \frac{1}{2}(v_i + v_f)\Delta t$ and get:

$$\Delta t = \frac{2(2.00\ \text{m})}{(-2.0\frac{\text{m}}{\text{s}} + 4.73\frac{\text{m}}{\text{s}})} = 1.46\ \text{s}$$

c) What is the angle of the slope?

Since $|a| = 4.59\frac{\text{m}}{\text{s}^2} = g\sin\theta$, we get

$$\sin\theta = \frac{4.59\frac{\text{m}}{\text{s}^2}}{9.80\frac{\text{m}}{\text{s}^2}} = 0.469 \qquad \Longrightarrow \qquad \theta = 27.9^\circ$$

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

$$v_{fx} = v_{ix} + a_x\Delta t \qquad x_f = x_i + v_{ix}\Delta t + \tfrac{1}{2}a_x(\Delta t)^2 \qquad v_{fx}^2 = v_{ix}^2 + 2a_x(x_f - x_i) \qquad \Delta x = \tfrac{1}{2}(v_{ix} + v_{fx})\Delta t$$

$$g = 9.80\frac{\text{m}}{\text{s}^2} \qquad |a_{\text{slope}}| = g\sin\theta$$