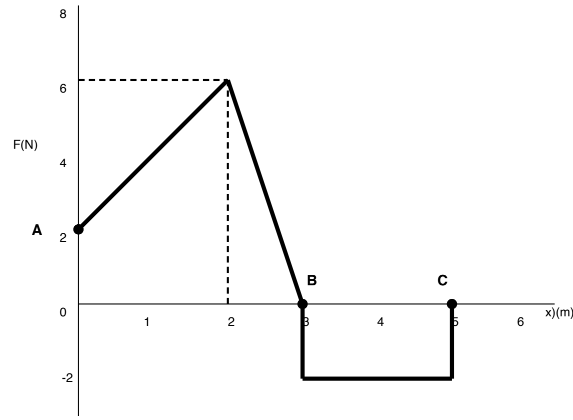
Your Name: ___________________________

PHY203
Exam #3
Chapters 6-8
Fri., 4/4/14

Solutions



1. A force is applied to a block with mass 1.50 kg as it travels along the x-axis, as shown in the plot above.
a. Find the work done (magnitude and sign) on the block as it travels from point A to point B.

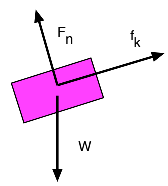
W=area under curve =
$$(2N)(2m)+\frac{1}{2}(4N)(2m)+\frac{1}{2}(6N)(1m)=+11.0J$$ **5**

b. Find the work done (magnitude and sign) on the block as it travels from point B to point C.

W=area under curve = $-(2N)(2m)=-4.00J$ **5**

c. If the block was moving with a speed of 3.50 m/s at x=0, find the speed of the block at point C.

$$K_f=\frac{1}{2}mv_f^{\ 2}=\frac{1}{2}(1.50)(3.50)^2+11.0J-4.00J=16.2J$$
$$v_f=4.65m/s$$ **10**



2. A 4.00 kg block is sliding down a ramp which makes an angle of 35.0° with respect to the horizontal direction. The coefficient of kinetic friction between the block and the ramp is 0.200.

a. On the figure to the right sketch a free body diagram. **5**

b. Assuming the block starts at a height of 1.50 m, find the distance it slides along the ramp before it reaches the bottom of the ramp.

$$sin(35^o) = (1.5m)/d$$
$$d = 2.62m$$

5

c. Find the magnitude of the normal force on the block as it is sliding down the ramp.

$$F_n - mg\cos\theta = 0$$
$$F_n = (4.00kg)(9.81)\cos(35^o) = 32.1N$$

5

d. Find the energy that goes into friction as the block slides down the ramp.

$$E_{th} = f_k\Delta s = \mu_k F_n \Delta s$$
$$= (0.200)(32.1N)(2.62m) = 16.8J$$

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e. Assuming that at the beginning of the slide the block was traveling with a speed of 5.00 m/s, use conservation of energy to find the speed of the block at the bottom of the ramp.

$$E = mgh + \frac{1}{2}mv_i^2 = \frac{1}{2}mv_f^{\ 2} + E_{th}$$
$$v_f^{\ 2} = 2g(h) + v_i^2 - (\frac{2}{m})E_{th}$$
$$= 2(9.81)(1.50m) + (5.00m/s)^2 - (\frac{2}{4.00kg})16.8J$$
$$v_f = 6.78m/s$$

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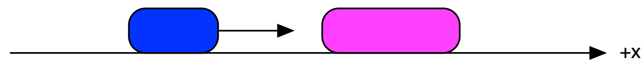

3. A disk with a mass of 0.500 kg slides along the ice (assumed to be frictonless) with a speed of 2.50 m/s. In a 1D collision, the disk hits and sticks to a second disk (initially at rest) which has a mass of 0.750 kg.

a. In the collision which of the following are conserved? (Circle all that apply.)

momentum kinetic energy **total energy** **5**

b. Find the speed at which the two-disk combination travels after the collision.

$$(0.500kg)(2.50m/s) = (0.500kg + 0.75kg)v$$
$$v = 1.00m/s$$

10

c. If *instead* the collision were elastic, which of the following are conserved? (Circle all that apply.)

momentum **kinetic energy** **total energy** **5**

d. **Set up the problem** (don't need to solve it) to find the speeds and directions at which the disks travel after the collision assuming an elastic collision between the disks: briefly explain how you would solve the problem and write down the equations including numbers you would need.

Since the collision is elastic, we need to conserve momentum and kinetic energy.

$$(0.500kg)(2.50m/s) = (0.500kg)v_1 + (0.75kg)v_2$$
$$\frac{1}{2}(0.500kg)(2.50m/s)^2 = \frac{1}{2}(0.500kg){v_1}^2 + \frac{1}{2}(0.75kg){v_2}^2$$

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