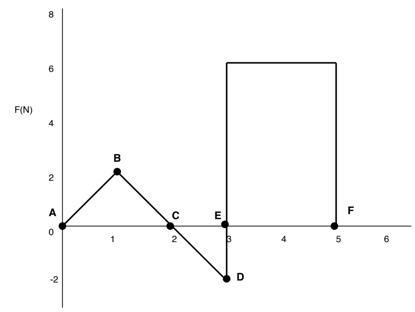
Your Name: ____________________________

PHY203
Exam #3
Chapters 6-8
Mon., 4/8/13

Solutions



1. The plot above depicts the force vs. distance curve for a 3.00 kg block being pushed along a frictionless horizontal surface.
a. Find the work done by the pushing force from A to C (magnitude and sign).

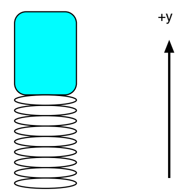
W=area under curve = $\frac{1}{2}(2N)(1m)(2) = +2.00J$ **5**

b. Find the work done by the pushing force from C to E (magnitude and sign).

W=area under curve = $\frac{1}{2}(-2N)(1m) = -1.00J$ **5**

c. If the block was traveling at a speed of 4.50 m/s at point E, use work and energy to find the speed at point F.

$$K_f = \frac{1}{2}mv_f^2 = \frac{1}{2}(3.00)(4.50)^2 + 12.0J = 42.4J$$
$$v_f = 5.32m/s$$
10



2. A 1.50 kg block is placed on a spring, as shown above and the spring is compressed by 0.350 m. Assume that at this point the block is at a position of y=2.50 m. The spring constant is 1.50 kN/m

a. Find how much energy is stored in the spring.

$$U = \frac{1}{2}kx^2 = \frac{1}{2}(1.50x10^3)(0.350)^2 = 91.9J$$ **5**

b. Now the block/spring is released. Use energy conservation to find the highest point (give the y position) the block reaches before it starts to fall back down.

$$91.9J = mgh$$
$$h = \frac{91.9}{(1.50)(9.81)} = 6.24m$$ **10**
$$y = 6.24 + 2.5 = 8.74m$$

c. Use energy conservation to find the speed of the block when it is at a position of y=6.00 m.

$$91.9J = mgh + \frac{1}{2}mv^2$$
$$h = 6 - 2.5 = 3.5m$$ **15**
$$v = 7.34m/s$$

3. A tennis ball with a mass of 57 grams traveling in the positive x-direction strikes a tennis racket which is not moving. The speed of the tennis ball before it struck the racket was 30.0 m/s. After striking the racket the ball travels in the opposite direction with a speed of 25.0 m/s

a. Find the momentum of the ball before it struck the racket and write it in vector notation.

p=(0.057)(30.0) = 1.71kgm/s**i** **5**

b. Find the momentum of the ball after it struck the racket and write it in vector notation.

p=(0.057)(-25.0) = -1.42kgm/s**i** **5**

c. Find the magnitude of the impulse of the racket on the tennis ball.

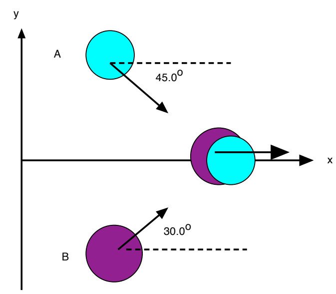
I = Δp = 1.71-(1.42)= 3.13kgm/s or Ns **5**

d. Assuming the collision took 20.0 ms, find the magnitude of the average force between ball and racket during the collision.

$$I = F_{avg}\Delta t = 3.13$$

$$F_{avg} = \frac{I}{\Delta t} = \frac{3.13}{20.0x10^{-3}} = 156N$$

5



4. Two disks collide and stick together as shown above. The masses of the disks are 2.00 kg each. After the collision, the two-disk combination travels in the +x-direction with a speed of 5.50 m/s.
a. Is this collision elastic or inelastic? Explain briefly.

Inelastic-the disks stick together **5**

b. Which of the following are conserved in the collision? (Circle all that apply.)

momentum kinetic energy **total energy 5**

c. Write the momentum of the two disk system after the collision in vector notation.

p=(1.5+2.5)(5.5) = 22.0kgm/s**i** **5**

d. Find the speeds of the two disks, v_A and v_B, before the collision.

$$22.0 = mv_A\cos(45^o) + mv_B\cos(30^o)$$

x: $$22.0 = (2.00kg)[(0.707)v_A + (0.866)v_B]$$

$$11.0 = (0.707)v_A + (0.866)v_B$$

15

$$0 = -mv_A\sin(45^o) + mv_B\sin(30^o)$$

y: $$0 = -(0.707)v_A + (0.500)v_B$$

$$v_B = 1.414v_A$$

Combine: v_A=5.69 m/s; v_B = 8.05 m/s