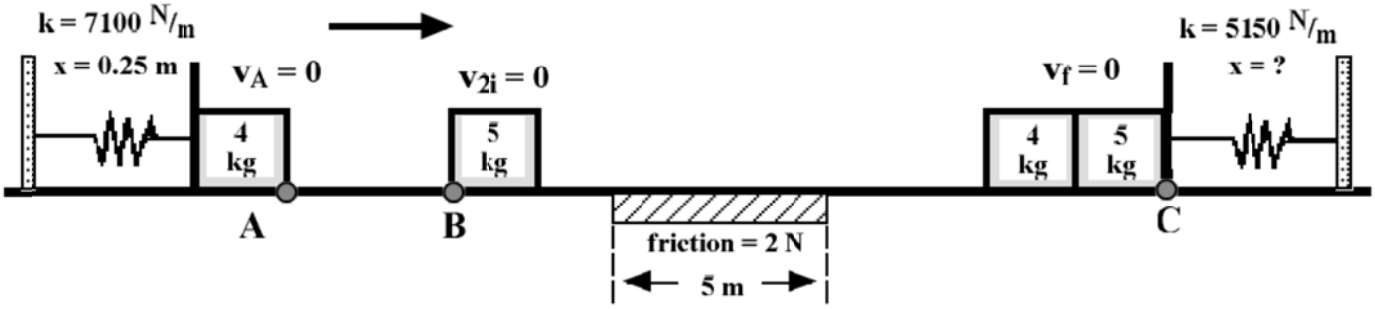
Name: _____ Date:_____

Mr. Croom's Physics Chapter 6: Momentum

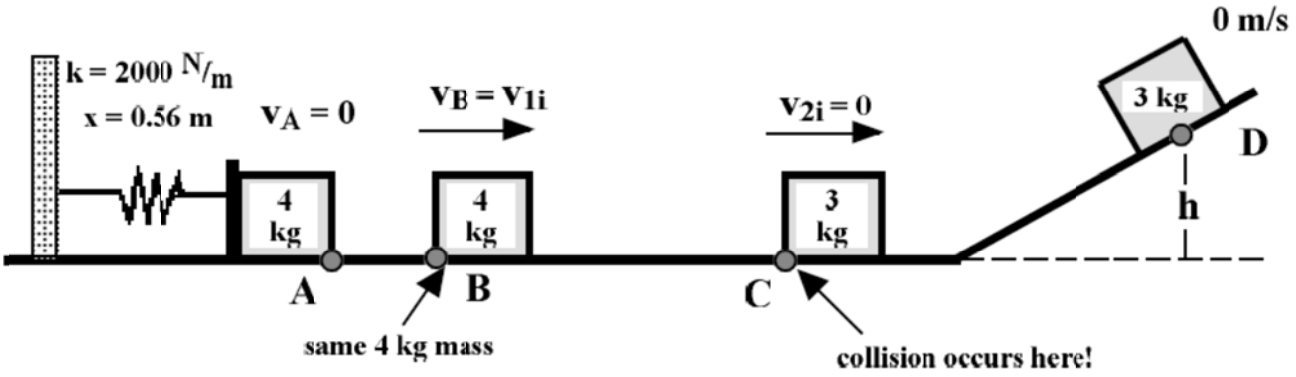
Advanced Momentum

Solve the following problems

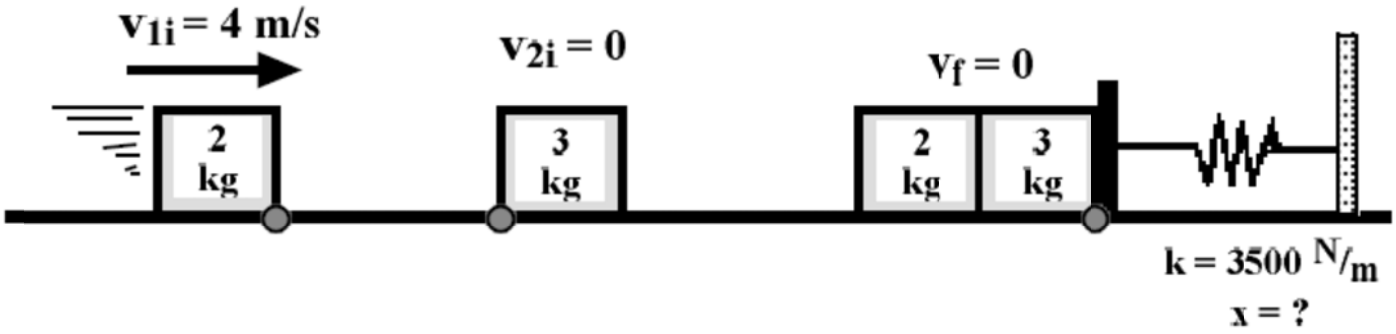
1. Calculate the compression in the spring assuming an inelastic collision between the masses. Computer how much kinetic energy has been lost in the entire interaction from start to finish by using and Energy Table. What happens to the missing energy? Can this mechanical energy ever be recovered? Explain.



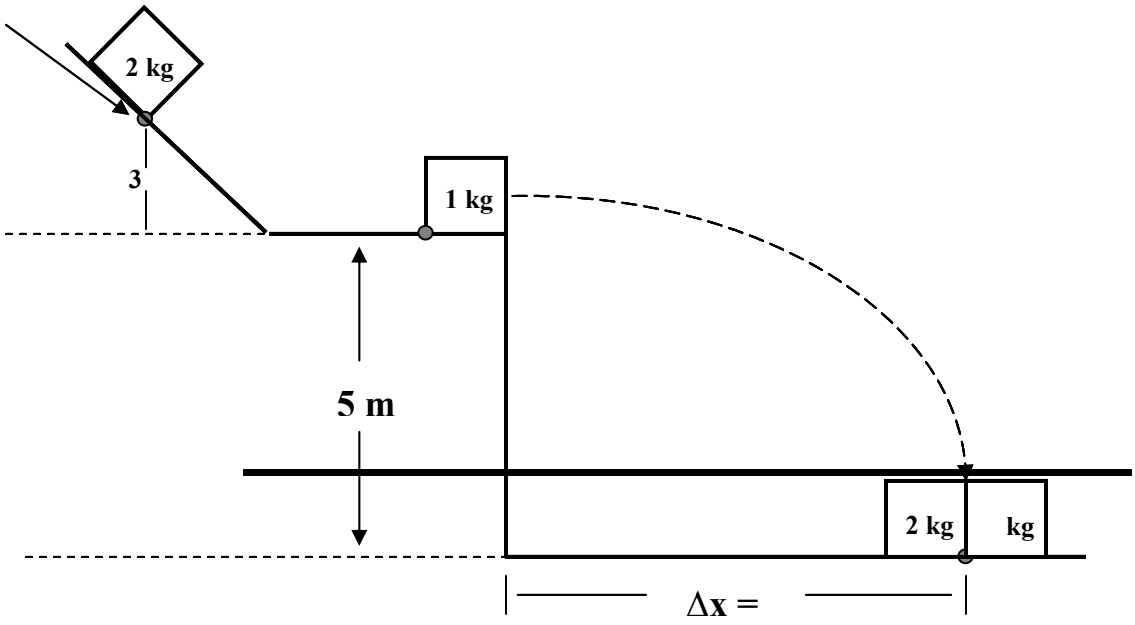
2. Calculate the height at D after the perfect elastic collision.



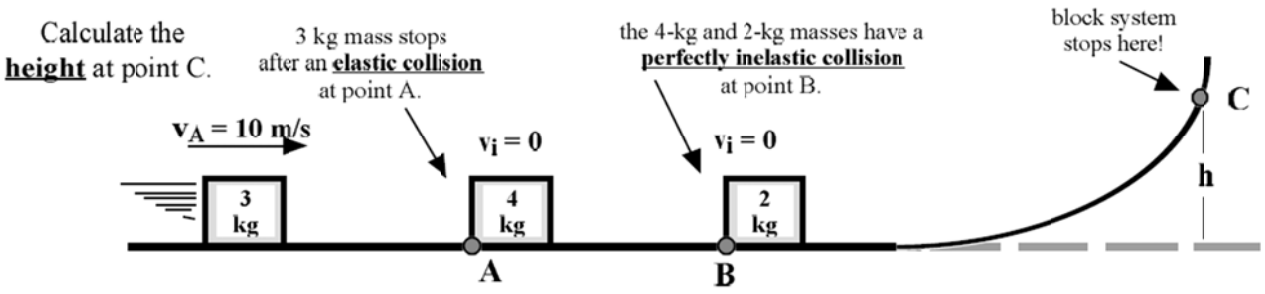
3. Calculate the combined velocity of the masses just after they collide in a perfectly inelastic collision? Calculate the compression (x) of the spring with an Energy Table. Compare the initial kinetic energy with the final kinetic energy. If they are equal, explain why this is so. If they are different, explain the loss in kinetic energy.



4. A 2 kg box slides down a smooth inclined plane and slides into a second, open box of 1kg. The two boxes slide together off the end of the table. How far from the base of the table will the combined boxes hit the ground? Calculate the total initial momentum (p_i) of the system. Calculate the total final momentum (p_f) of the system. Compare the initial momentum to the final momentum. If they are equal, explain why this is so. If they are different, explain the loss in momentum. HINT 1: EACH block has momentum, both before AND after the collision HINT 2: What's wrong with the term "loss in momentum"? Calculate the total initial kinetic energy (E_{Ki}) of the system in problem 3 and the total final kinetic energy (E_{Kf}) of the system. If the kinetic energies are different, explain what happened to the *lost* energy. If they're the same, explain in terms of the energy of the system.



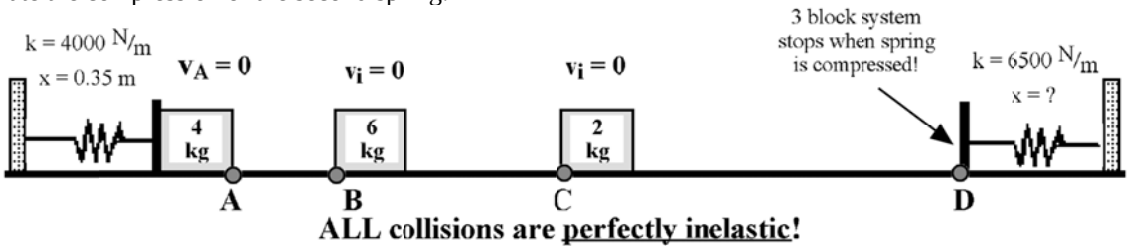
5. Solve for the height the 2kg block goes to based on the information of each collision described in the picture.



6. Algebraically prove that $E_k = \frac{p^2}{2m}$. (Hint: Start with $E_k = \frac{1}{2}mv^2$ and then substitute in p = mv.)

7. A 0.470-kg block of wood hangs from the ceiling by a string, and a 0.0700-kg wad of putty is thrown straight upward, striking the bottom of the block with a speed of 5.60 m/s. The wad of putty sticks to the block. **(a)** Is the mechanical energy of this system conserved? **(b)** How high does the putty-block system rise above the original position of the block?

8. Calculate the compression of the second spring.



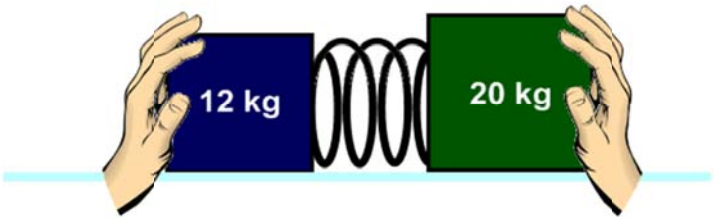
9. (Giancoli, p. 204, # 28) In physics lab, a small cube slides down a frictionless incline and elastically strikes a cube at the bottom that is only one-half its mass. If the incline is 30 cm high and the table is 90cm, of the floor, where does each cube land?

10. An 8.0-kg mass traveling at 6.0 m/s collides with a 4.0-kg mass that sits at rest. After the collision, the two masses stick together.

a. What type of the collision is this? Why?

b. How fast do the two masses move after the collision?

11. Two masses are pushed together against a spring as shown below. The blocks are held together at rest and then released such that each block feels the same force. After being released, the 12-kg mass moves to the left with a speed 5.0 m/s. How fast does the 20-kg block move after being released?



12. A 0.5-kg metal ball is traveling at 150 m/s when it encounters a block of ice. The ball passes through the block of ice and emerges from the other side traveling at only 10 m/s.

c. How much momentum did the metal ball transfer to the block of ice?

d. How fast does the block of ice move after the metal ball emerges from the right side?

13. Two bumper cars experience a head-on collision as shown below.

e. What is the final velocity of the car on the right?

f. Is this an elastic collision or an inelastic collision? Use calculations to justify your answer.