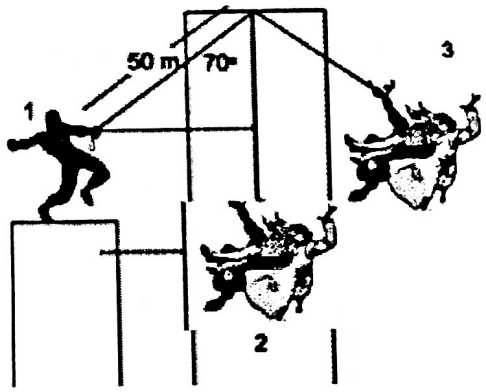
Name: _____

## Day 11-12: Practice Conservation of Energy AND Momentum

**Objective:** You will be able to demonstrate an understanding of Energy and Momentum by solving complex problems that combine both concepts.

Do Now: Spiderman (70 kg) swings from a 50 m long web to catch his girlfriend, Mary Jane (50 kg). He starts at rest at point 1, where the web is at a 70° angle from the vertical.




a. Where does Spiderman have the biggest velocity? How do you know?

b. What is Spiderman's velocity at point 2?

c. Spiderman catches Mary Jane at point 2. Assume she has no horizontal velocity at that moment. What is their combined velocity after the "collision"?

d. How high above point 2 will Spiderman and Mary Jane reach after the web swings up to the right? (i.e. Find the height of Point 3)

**B5-WWT16: OBJECT CHANGING VELOCITY III—IMPULSE**

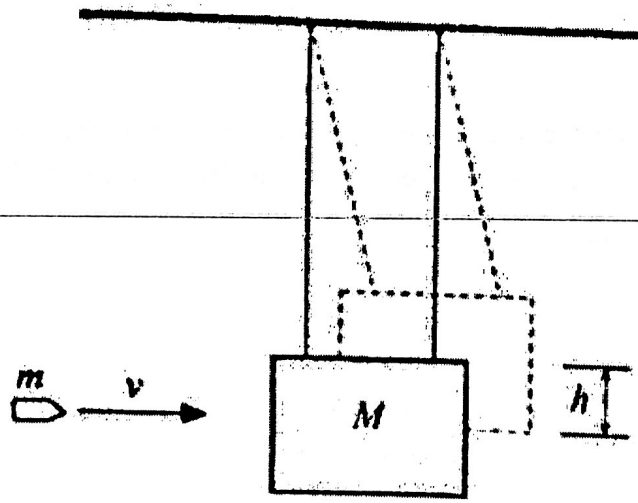
A 2-kg object accelerates as a net external force is applied to it. During the 5-second interval that the force is applied, the object's velocity changes from 3 m/s to the right to 7 m/s to the left.


A student states:

*"The change in velocity for this 2 kg object was 4 m/s, so the change in momentum, and also the impulse, was 8 kg·m/s."*

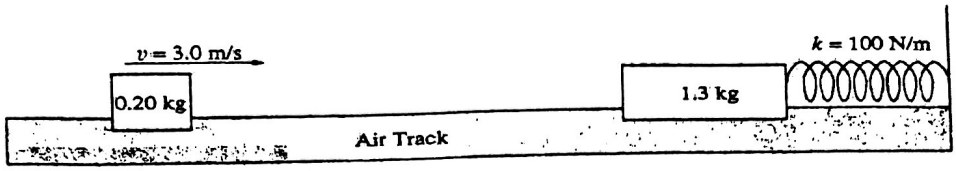
**What, if anything, is wrong with this statement? If something is wrong, identify it and explain how to correct it. If this statement is correct, explain why.**

A 20.0 g pellet is fired into a 1.50 kg block hanging by a vertical cord from the ceiling.




After the collision, the center of mass of the system rises 15.0 cm from its initial position.

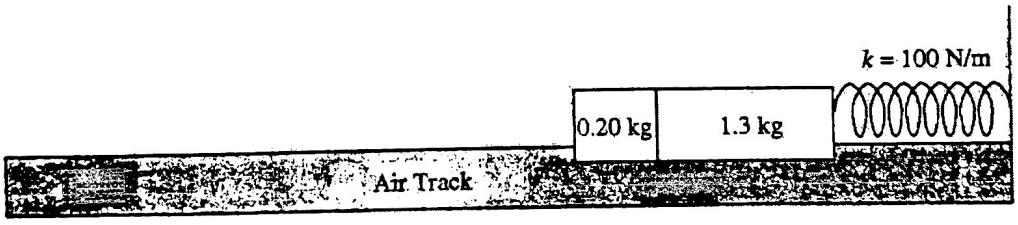
The initial velocity of the pellet is




**1995B1.** As shown above, a 0.20kilogram mass is sliding on a horizontal, frictionless air track with a speed of 3.0 meters per second when it instantaneously hit and sticks to a 1.3kilogram mass initially at rest on the track. The 1.3kilogram mass is connected to one end of a massless spring, which has a spring
constant of 100 newtons per meter. The other end of the spring is fixed.

a. Determine the following for the 0.20kilogram mass immediately before the impact.
   i. Its linear momentum ii. Its kinetic energy

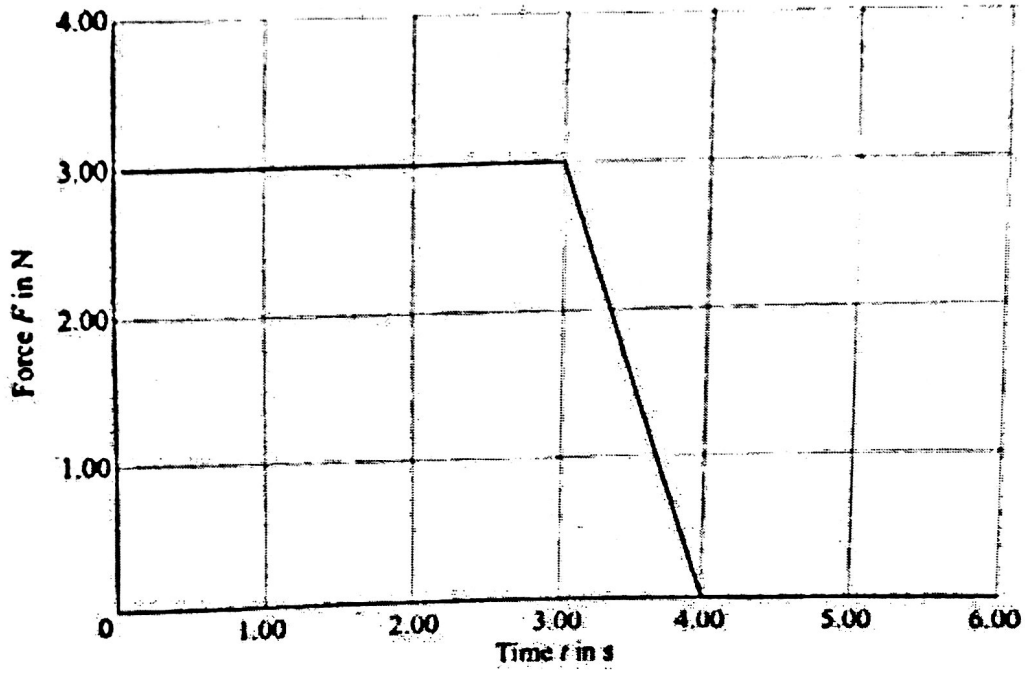
b. Determine the following for the combined masses immediately after the impact.
   i. The linear momentum ii. The kinetic energy




After the collision, the two masses compress the spring as shown.

c. Determine the maximum compression distance of the spring.

An object moving in the positive $x$-direction experiences a variable force as shown below in the force vs. time graph.




What is the change in momentum $\Delta p$ of the object