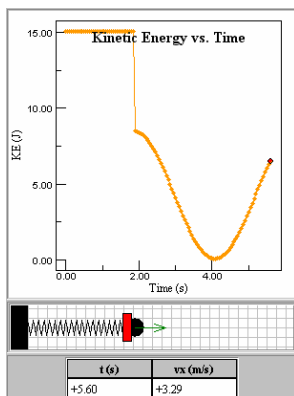# Worksheet for Exploration 7.4: A Ball Hits a Mass Attached to a Spring

Whenever objects interact, energy is likely to be converted from one form to another and/or dissipated **(position is given in meters and time is given in seconds)**. Consider two models of a ball hitting a 0.4-kg rectangle attached to a massless spring. After the collision the masses stick together and oscillate. Animation 1 represents an ideal spring and frictionless conditions, while Animation 2 represents a more realistic spring, and friction takes its inevitable toll on the system (only the kinetic energy of the ball is shown in the graph). Consider a system made up of the mass, the rectangle, and the massless spring as you answer the following questions. The potential energy of the spring is zero when the spring is uncompressed and, since the spring is massless, it has no kinetic energy. Restart.

t (s)	vx (m/s)
+5.60	+3.29

a. What is the mass of the black ball?

m_{ball}=_____

b. What is the initial energy of the system?

KE_i=_____

Answer the following questions for each animation.

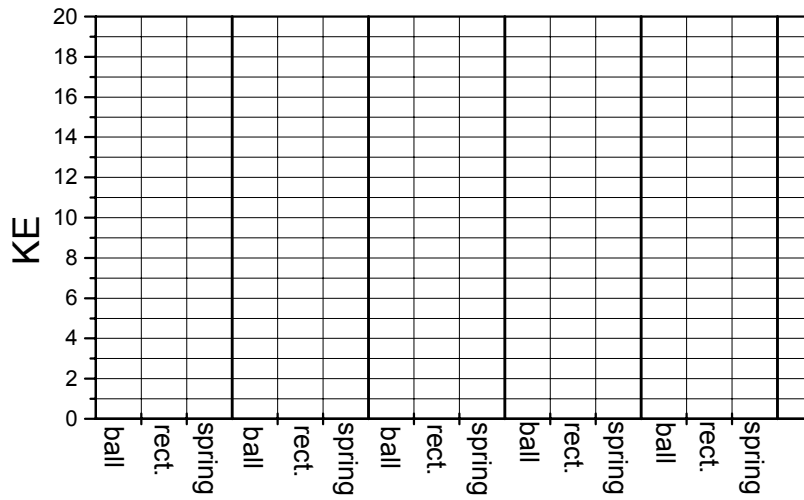c. What is the energy of the system immediately after the collision? (each animation)

1)$KE_{after\ collision}$=_____   2)$KE_{after\ collision}$=_____

     i.   Is the collision reversible?

e.   Draw energy diagrams for the three objects that make up the system at the following times: t = 0 s, t = 1.90 s, t = 4.10 s, t = 6.30 s, and 8.55 s.

    i.   Animation 1 bargraph

KE

| 20 |
| 18 |
| 16 |
| 14 |
| 12 |
| 10 |
| 8 |
| 6 |
| 4 |
| 2 |
| 0 |

ball · rect. · spring · ball · rect. · spring · ball · rect. · spring · ball · rect. · spring · ball · rect. · spring

    ii.   Animation 2 bargraph

KE

| 20 |
| 18 |
| 16 |
| 14 |
| 12 |
| 10 |
| 8 |
| 6 |
| 4 |
| 2 |
| 0 |

ball · rect. · spring · ball · rect. · spring · ball · rect. · spring · ball · rect. · spring · ball · rect. · spring