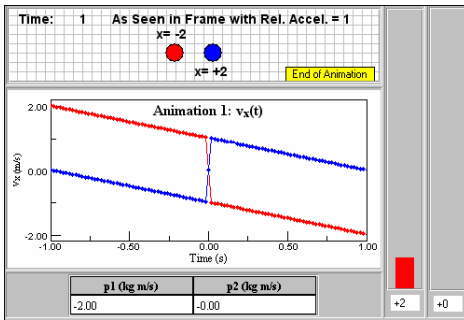# Worksheet for Exploration 9.4: Compare Motion in Accelerating Frames

Is physics different when viewed in different reference frames? The momentum of each ball is shown in the table, and the kinetic energy of each cart is shown in the bar graph in joules **(position is given in meters and time is given in seconds)**. You can change your reference frame using the text box, -2 m/s^2 < a < 2 m/s^2. Answer the following questions. <u>Restart</u>.

a. Does the total momentum depend on the reference frame?
   i. Select a couple of times to measure (one before and one after the collision) and complete the following tables. Fill in each box with the total momentum.

a=0.0m/s^2	animation 1	animation 2	animation 3
t$_1$=_____			
t$_2$=_____			

a=1.0m/s^2	animation 1	animation 2	animation 3
t$_1$=_____			
t$_2$=_____			

a=-1.0m/s^2	animation 1	animation 2	animation 3
t$_1$=_____			
t$_2$=_____			

b. Does the change in momentum depend on the reference frame?

c. Is the total momentum conserved in all reference frames?
   i.   Discuss what conditions must exist to observe conservation of total momentum.

d. Find the ratio of the two masses. Is this result the same in all reference frames?
   i.   Animation 1.

   $m_{red}/m_{blue}=$_____

   ii. Animation 2.

   $m_{red}/m_{blue}=$_____

   iii. Animation 3.

   $m_{red}/m_{blue}=$_____

e. Is there a reference frame in which the total momentum is zero?
   i.   Answer in general and determine the reference frame for each animation if possible.