Open Logger Pro 3.6

Under the Insert menu, click Movie.

In the Selection window, navigate to the location of the videos (as instructed by your teacher) and select "Inelastic1"

In the lower right-hand corner of the movie window, click on the *Enable/Disable video analysis* button (with three red dots).

Set the scale by clicking on the *Set Scale* button on the right side of the movie window. It looks like a yellow ruler. Click and drag the mouse along the length of the meter stick in the picture. Make sure the length is set to 1.00 m and click OK.

Click on the graph to bring it to the front. Click on the Y-axis label and select "X" in the dialogue box that appears. Now the graph will show only the x position.

Record the masses of the two carts.

Click on the movie window to bring it to the front. Click on the *Add Point* button (with the single red dot). Mark the position of the front of cart #1 (the blue cart) by positioning the crosshairs on the front of the cart and clicking with the mouse. Repeat for each successive frame until just before the carts collide.

Click on the graph. Highlight the points and fit a line to the graph. Record the slope as cart 1 initial velocity.

Under the *Data* menu, select *Clear all Data*. Click along the edge of the movie window to bring it back to the front. Don't click in the actual video or you will put an analysis point there. If you accidentally produce a stray point, it can be removed by highlighting it on the graph and choosing *Strike Through Data Cells* under the *Edit* menu. Click the *Next Frame* button (lower left) to advance the movie until the carts are moving together as a unit. Mark the position of the carts for at least 15 frames as they move together. Be sure to use the same point on the carts for each mouse click. Analyze the graph as before by fitting a line and recording the slope as the final velocity.

Using the same process, analyze the other two movies, "Inelastic2" and "Elastic2". The elastic collision will have an extra step since there are two final velocities. After finding the final velocity of one cart, clear the data and step backward using the *Previous Frame* button until just after the collision to find the final velocity of the other cart.

Calculate the initial momentum for each cart

Calculate the total initial momentum for each collision

Calculate the final momentum for the combined carts in the inelastic collisions and the final momentum for each cart in the elastic collision.

Calculate the total final momentum for the elastic collision.

Compare the total initial and total final momentum for each collision. According to the Law of Conservation of Momentum, how should these quantities be related?

Using the Elastic2 video data, calculate the kinetic energy for each cart before and after the collision and the total initial KE and the total final KE.

Calculate the percent difference for the momentum in each collision and the kinetic energy in the elastic collision only.

Inelastic I	Mass	Initial	Initial	Final	Final
		Velocity	Momentum	Velocity	Momentum
Blue cart 1				Combined Carts 1 & 2	
Red cart 2					
	Total Init		-		
Inelastic II	Mass	Initial	Initial	Final	Final
		Velocity	Momentum	Velocity	Momentum
Blue cart 1				Combined Carts 1 & 2	
Red cart 2					
	Total Init	tial Momentum			

Elastic II	Mass	Initial Velocity	Initial Momentum	Initial Kinetic Energy	Final Velocity	Final Momentum	Final Kinetic Energy
Blue Cart 1							
Red Cart 2							
Totals							

Quantity	% difference
Inelastic I Momentum	
Inelastic II Momentum	
Elastic II Momentum	
Elastic II Kinetic Energy	

Questions:

- 1. Under what conditions does the Law of Conservation of Momentum apply?
- 2. Allowing for a small error, was Momentum conserved in this exercise? Use your data to support your answer.
- 3. Was kinetic energy conserved in the elastic collision? Use your data to support your answer.
- 4. Name two possible sources of error in this exercise.