Conservation of Linear Momentum

Name: ____________________________________ Date: _____________________________

Purpose: To investigate and determine the law of ***conservation of linear momentum***.

Procedure:

LESSON

1. Go to the online air track simulator...
   or the short url: **https://bit.ly/2SnV8Fs**
2. Complete the charts and answer all questions fully. (stop the carts before they reach the edges. Mass 1 is the red cart and mass 2 is the green cart.

Useful Equations:

$$E_k = \frac{1}{2}mv^2 \qquad p = mv$$

Part A: Elastic Collision of Two Objects

1. Set Scenario to **m1=m2 elastic (elasticity 100%)**.

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 1.0 kg	50.00					
m_2= 1.0 kg	0					

Sample calculations:

Total Momentum Before: ___________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 3.0 kg	50.00					
m_2= 1.0 kg	0					

Total Momentum Before: ___________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 5.0 kg	10.00					
m_2= 1.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 1.0 kg	50.00					
m_2= 3.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 1.0 kg	50.00					
m_2= 5.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 3.0 kg	50.00					
m_2= 1.0 kg	-25.00					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Conclusion:

Part B: Inelastic Collision of Two Objects

1. Set Scenario to **m1=m2 inelastic (elasticity 0%)**.

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 1.0 kg	50.00					
m_2= 1.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 3.0 kg	50.00					
m_2= 1.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 1.0 kg	50.00					
m_2= 3.0 kg	0					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Masses	v_i (before)	v_f (after)	p_i (before)	p_f (after)	E_{ki} (before)	E_{kf} (after)
m_1= 3.0 kg	50.00					
m_2= 1.0 kg	-25.00					

Total Momentum Before: ____________ Total Kinetic Energy Before: _____________

Total Momentum After: _____________ Total Kinetic Energy After: _____________

Conclusion:

State the Law of Conservation of Linear Momentum (both elastic and inelastic):

Question(s):

1. Suggest where the energy might have gone during the inelastic collisions.

2. What two properties are ***conserved*** during an ***elastic collision***?

3. What property ***is conserved*** and which is ***not conserved*** during an ***inelastic collision***?

4. List three (3) mass and velocity combinations that result in both of the cars stopping after they collide (assume an *inelastic* collision). Try them using the applet.

   a)

   b)

   c)

5. Give two (2) examples of "real life" collisions that are *elastic* (or very close to elastic)

6. Give two (2) examples of "real-life" collisions that are *inelastic* (or very close to inelastic)