Conservation of Momentum and Energy

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Data

Complete the table. (Let the positive direction be the direction of motion in which cart 1 initially travels. Indicate the direction with the sign of your answer.)

Table 1

	Inelastic collision $m_1 = m_2$	**Inelastic collision** $m_1 \neq m_2$	**Elastic collision** $m_1 = m_2$	**Elastic collision** $m_1 < m_2$
Mass of cart 1 (kg)				
Mass of cart 2 (kg)				
Initial velocity of cart 1 (m/s)				
Initial velocity of cart 2 (m/s)				
Final velocity of of cart 1 (m/s)				
Final velocity of cart 2 (m/s)				

Case A - Inelastic collision of carts of equal masses - Formulas

Type in the equations you will use to complete the calculations below. (Do not substitute numerical values; use variables only.)

momentum of cart 1 before the collision (Use the following as necessary: m, v_{i1}, and v_{i2}.)

momentum of cart 2 before the collision (Use the following as necessary: m, v_{i1}, and v_{i2}.)

momentum of the system before the collision (Use the following as necessary: p_{i1} and p_{i2}.)

momentum of cart 1 after the collision (Use the following as necessary: m, and v for the final velocity of the carts.)

momentum of cart 2 after the collision (Use the following as necessary: m, and v for the final velocity of the carts.)

momentum of the system after the collision (Use the following as necessary: p_{f1} and p_{f2}.)

relative change in the total momentum of the system (Use the following as necessary: p_{i} and p_{f}.)

kinetic energy of cart 1 before the collision $\mathrm{KE}_{\mathrm{i1}}$ (Use the following as necessary: m, v_{i1}, and v_{i2}.)

kinetic energy of cart 2 before the collision $\mathrm{KE}_{\mathrm{i2}}$ (Use the following as necessary: m, v_{i1}, and v_{i2}.)

kinetic energy of the system before the collision KE_{i} (Use the following as necessary: $\mathrm{KE}_{\mathrm{i1}}$ and $\mathrm{KE}_{\mathrm{i2}}$.)

kinetic energy of cart 1 after the collision $\mathrm{KE}_{\mathrm{f1}}$ (Use the following as necessary: m, and v for the final velocity of the carts.)

kinetic energy of cart 2 after the collision $\mathrm{KE}_{\mathrm{f2}}$ (Use the following as necessary: m, and v for the final velocity of the carts.)

kinetic energy of the system after the collision KE_f (Use the following as necessary: KE_{f1} and KE_{f2}.)

relative change in the total kinetic energy of the system (Use the following as necessary: KE_i and KE_f.)

Case A - Inelastic collision of carts of equal masses - Analysis

Using the above equations and your experimental data, analyze data for collision A below.

Calculate the momentum of cart 1 and cart 2 before the collision – $\mathbf{p}_{i1}$ and $\mathbf{p}_{i2}$. (Indicate the direction with the sign of your answer.)

Calculate the momentum of the system before the collision – $\mathbf{p}_i$. (Indicate the direction with the sign of your answer.)

Calculate the momentum of cart 1 and cart 2 after the collision – $\mathbf{p}_{f1}$ and $\mathbf{p}_{f2}$. (Indicate the direction with the sign of your answer.)

Calculate the momentum of the system after the collision – $\mathbf{p}_f$. (Indicate the direction with the sign of your answer.)

Calculate the relative change in the total momentum of the system – $(\Delta \mathbf{p}/\mathbf{p}_i) * 100\%$. (Include the appropriate sign in your answer.)

Calculate the kinetic energy of cart 1 and cart 2 before the collision – KE_{i1} and KE_{i2}.

Calculate the total kinetic energy of the system before the collision – KE_i.

Calculate the kinetic energy of cart 1 and cart 2 after the collision – KE_{f1} and KE_{f2}.

Calculate the total kinetic energy of the system after the collision – KE_f.

Calculate the relative change in the kinetic energy of the system. (Include the appropriate sign in your answer.)