Name: _____ Date: _____ Course: _____ Professor: _____

M26a Prelab: Conservation of Linear Momentum

Read the lab instructions and the appropriate sections from your textbook before answering the questions.

In this experiment, you will investigate elastic and inelastic collisions in one dimension and observe whether the linear momentum and kinetic energy of a system of two carts will be conserved in these two types of collisions. A detailed description of concepts related to this lab can be found in Chapter 9 of the Essential University Physics, 4th edition and in the M26a Lab handout.

1. For a small object with mass $\boldsymbol{m}$ and velocity $\vec{\boldsymbol{v}}$.

a) Write down the equation for the linear momentum; then briefly describe this physical quantity conceptually.

b) Write down the equation for the kinetic energy; then briefly describe this physical quantity conceptually.

2. State the Laws of Conservation of Linear Momentum. Make sure to specify when it is applicable.

3. Describe elastic, inelastic, and completely inelastic collisions. Which type of collisions are you going to investigate in the lab?

4. Do you expect the linear momentum of the system to be conserved in your experiment? In which part? Explain why.

5. Do you expect kinetic energy of the system to be conserved in your experiment? In which part? Explain why.

6. In one trial for inelastic collisions in the experiment, cart 1 has mass $\mathbf{m_1}$ and is initially moving with velocity $\vec{v}_{1i}$ to the right. Cart 2 with mass $\mathbf{m_2}$ is initially moving with velocity $\vec{v}_{2i}$ also to the right. The velocity of the cart 1 is larger than the velocity of cart 2 causing a collision between both carts. After the collision, the carts stick together and move with velocity $\vec{v}_f$ to the right.
   a) Write down the expression for the magnitude of linear momentum of the system before collision.

   b) Write down the expression for the magnitude of linear momentum of the system after the collision.

c) Write down the expression for the magnitude of kinetic energy of the system before collision.

d) Write down the expression for the magnitude of the kinetic energy of the system after the collision.

7. In one trial for elastic collisions in the experiment, cart 1 has mass $\mathbf{m_1}$ and is initially moving with velocity $\vec{v}_{1i}$ to the right. Cart 2 with mass $\mathbf{m_2}$ is initially moving with velocity $\vec{v}_{2i}$ also to the right. The velocity of the cart 1 is larger than the velocity of cart 2 causing a collision between both carts. After the collision, both carts will keep moving to the right with velocities $\vec{v}_{1f}$ and $\vec{v}_{2f}$ respectively.

a) Write down the expression for the magnitude of linear momentum of the system before collision.

b) Write down the expression for the magnitude of linear momentum of the system after the collision.

c) Write down the expression for the magnitude of kinetic energy of the system before collision.

d) Write down the expression for the magnitude of the kinetic energy of the system after the collision.