Name: _____ Date: _____ Partners: _____

Preliminary questions

1. When you push on an object, how does the magnitude of the force affect its motion?

   If you push harder, is the change in motion smaller or larger?

   Do you think this is a direct or inverse relationship?

2. Assume that you have a bowling ball and a baseball, each suspended from a different rope. If you hit each of these balls with a full swing of a baseball bat, which ball will change its motion by the greater amount? Why?

3. In the absence of friction and other forces, if you exert a force, *F*, on a mass, *m*, the mass will accelerate. If you exert the same force on a mass of 2*m*, would you expect the resulting acceleration to be twice as large or half as large?

Is this a direct or inverse relationship?

Data Table

Trial I

Mass of cart (kg)	
Mass or sensors (kg)	
Mass of cart with sensors (kg)	

Fitted equation for force *vs*. acceleration data

Force pulling cart (N)	Acceleration (m/s^2)
1.0 N	
–1.0 N	

Trial 2

Mass of cart with sensors (kg)	

Fitted equation for force *vs*. acceleration data

Force pulling cart (N)	Acceleration (m/s^2)
1.0 N	
–1.0 N	

Analysis

1. Compare the graphs of force *vs.* time and acceleration *vs.* time for a particular trial.

2. Are the net force on an object and the acceleration of the object directly proportional? Explain, using experimental data to support your answer.

3. What are the units of the slope of the force *vs.* acceleration graph? Simplify the units of the slope to fundamental units (m, kg, s).

4. For each trial compare the slope of the regression line to the mass being accelerated. What does the slope represent?

5. Write a general equation that relates all three variables: force, mass, and acceleration.

Extensions

1. Use this apparatus as a way to measure mass. Place an unknown mass on the cart. Measure the acceleration for a known force and determine the mass of the unknown. Compare your answer with the actual mass of the cart, as measured using a balance.

Experimentally Determined Mass of the Cart (kg)	
Measured Mass of the Cart (kg)	