

OBJECTIVES

- **Compare** the accelerations of a mass acted on by different forces.
- **Compare** the accelerations of different masses acted on by the same force.
- **Examine** the relationships between mass, force, acceleration, and Newton's laws of motion.

MATERIALS LIST

- balance
- C-clamp
- calibrated masses and holder
- cord
- dynamics cart
- hooked mass, 1000 g
- mass hanger
- masking tape
- meterstick
- pulley with table clamp
- recording timer and tape
- stopwatch

Newton's second law states that any net external force applied to a mass causes the mass to accelerate according to the equation $\mathbf{F} = m\mathbf{a}$. Because of frictional forces, experience does not always seem to support this. For example, when you are driving a car, you must apply a constant force to keep the car moving with a constant velocity. In the absence of friction, the car would continue to move with a constant velocity after the force was removed. The continued application of force would cause the car to accelerate.

In this lab, you will study the motion of a dynamics cart pulled by the weight of masses falling from a table to the floor. In the first part of the experiment, the total mass will remain constant while the force acting on the cart will be different for each trial. In the second part, the force acting on the cart will remain constant, but the total mass will change for each trial.

SAFETY

- **Tie back long hair, secure loose clothing, and remove loose jewelry to prevent its getting caught in moving or rotating parts. Put on goggles.**
- **Attach masses securely. Falling or dropped masses can cause serious injury.**

PROCEDURE**Preparation**

1. Read the entire lab procedure, and plan the steps you will take.
2. If you are not using a datasheet provided by your teacher, prepare a data table in your lab notebook with six columns and six rows. In the first row, label the first through sixth columns *Trial*, *Total Mass (kg)*, *Accelerating Mass (kg)*, *Accelerating Force (N)*, *Time Interval (s)*, and *Distance (m)*. In the first column, label the second through sixth rows 1, 2, 3, 4, and 5.
3. Choose a location where the cart will be able to move a considerable distance without any obstacles and where you will be able to clamp the pulley to a table edge.