

## Lab 5-3: Newton's Second Law

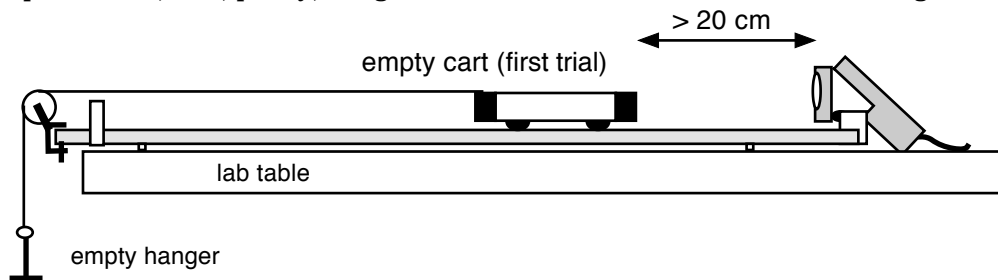
### Part 2

**Purpose:** To qualitatively determine the relationship between acceleration and mass for an object undergoing a constant applied force.

**Materials:** 1 (one) 200 gram slotted mass  
 1 (one) 50 gram slotted mass                      2 black bars (500 grams each)  
 1 string (~75 cm)                      1 pulley                      1 hanger (50 grams)                      1 cart (500 grams)

**Procedure:**

1. Set up the track, cart, pulley, hanger and motion detector as shown in the diagram below.



2. Make sure the track is level. The cart should not be rolling in either direction. Also, make sure that the string is attached to the pulley horizontally. (This means the string is over the end bar of the track.)
3. Start *LoggerPro*. Open up the file "02 Cart.cml." Make sure the bottom graph is velocity vs. time.
4. Pull the cart back about 20 cm away from the motion detector.
5. Start collecting data. When you hear the motion detector, release the cart. **Don't let the cart slam into the end of the track!**
6. To determine the acceleration of the cart, measure the slope of the best fit line of the velocity graph. You will have to highlight the portion of the graph that shows the cart speeding up before you do the linear fit. Record your results in the data table on the other side.
7. Repeat steps 4 to 6 above for five more trials. For each new trial, add 250 grams (0.25 kg) to the cart. **Do not add masses to the hanger!** (The applied force must remain constant.) If needed, use a little tape to keep the masses from falling off the cart. After determining the acceleration of the cart, record the results in the data table. Don't forget to record the total mass accelerated each time.
8. Make a graph of your results ( Acceleration vs Mass) and either print it or sketch it on the other side of this lab in the conclusions.

**Data:**

Applied force exerted by the 50 gram hanger: 0.50 N

<i>Mass Accelerated</i> (kg)	<i>Acceleration</i> (m/s <sup>2</sup> )
cart + hanger = .550 kg	
cart + hanger + .25 = .800 kg	
cart + hanger + 0.5 = 1.05 kg	

## Lab 5-3: Newton's Second Law Part 2

### Conclusions:

1. What was kept constant in this lab?
2. What did you change each trial? By how much did it change?
3. What did you measure each trial?
4. How did you measure the acceleration of the cart?
5. Where did the force come from that made everything accelerate?
6. There were two other large forces in this lab that we ignored. What were they and why was it ok to ignore them?
7. Why should you NOT put a linear fit on the graph of acceleration vs mass that you made?
8. So what was the result of your lab? Make it good! Use the words *mass*, *force* and *acceleration* and include a sketch of your graph.

