PROCEDURE

USE DATA TABLE 3.1 AND 3.2 TO RECORD ALL MEASUREMENTS BELOW:

1. Measure and record the effective length of the glider. Record this value as L (cm) in Table 1.3.
2. Mount the hook into the bottom hole on the cart. To counterbalance its weight, attach an equivalent mass to the opposite end. This helps maintain balance during motion.
3. Secure 50–60 grams of mass to the glider using 10 g or 20 g weights. Ensure the masses are evenly distributed to keep the glider balanced. Measure and record the total mass of the glider with the added weights and record this value as **m.**
4. Place approximately 5–10 grams of mass on the weight hanger. Record the combined mass of the hanger and added weights as $\mathbf{m_a}$**.**
5. Power on the **PC.** Log in as **Student** using the password provided by your lab instructor.

   Double-click the **Physics Labs** desktop icon, then open **E3 Newton's 2nd Law.** The PASCO Capstone software should now appear on your screen automatically.
6. To get started, press the buttons on the back of the PASCO Interference 750 unit to power on both photogates. Once activated, the photogates will automatically connect wirelessly to PASCO Capstone.
7. Choose starting point $\mathbf{x_0}$ for the glider, near the end of the track. Mark this point with sticky paper so that you can always start the glider from the same point. Or simply remember on scale which number you start from on the ruler.
8. Switch on the blower and check that the glider moves smoothly. Fine-tune the airflow if necessary.
9. When you're ready to begin data collection, press the PREVIEW button located at the bottom of the Capstone screen. Once data is collected press KEEP SAMPLE.
10. Hold the glider steady at $\mathbf{x_0}$ then release it. Note $\mathbf{t_1}$**,** the time it took for the glider to pass through the first photogate $\mathbf{t_1}$, and $\mathbf{t_2}$**,** the time it took the glider to pass through the second photogate. Repeat the measurements four times. NOTE: $\mathbf{t_3}$ is the time between photogates $\mathbf{t_1}$, and $\mathbf{t_2}$.
11. Vary $\mathbf{m_a}$, by moving masses from the glider to the hanger (thus keeping the total mass,

$\mathbf{m + m_a}$, constant). Record **m** and $\mathbf{m_a}$ and repeat the steps above to record the data. Try at least four different values for $\mathbf{m_a}$.

12. Make sure the glider goes through photo gate 1 (marked '$\mathbf{t_1}$') and then to photo gate 2 (marked '$\mathbf{t_2}$')
13. Now leave $\mathbf{m_a}$ constant at a previously used value. Vary **m** by adding or removing mass form the glider. Repeat steps to record the data in the Table 3.2. Try at least four different values for **m**.
14. **Save your work frequently**: Use clear filenames that include your name and experiment code (e.g., E3_Newton_Kyriakakis).
15. **Export your data properly**: Choose the format that works best for your workflow—**Excel (.xlsx)** or **CSV (.csv)** for Google Sheets. Save the export file to a USB drive so you can access it later.

DATA

Table 3.1 Constant System Mass

Glider Length: L=______ (cm); Total Mass M= $m + m_a$ =__________________

Please expand the data table to accommodate four runs.

m (g)	m_a (g)	t_1 (s)	t_2 (s)	t_3 (s)	v_1 (m/s)	v_2 (m/s)	a (m/s^2)	F_a (N)
Run1								
Run 2								

Table 3.2 M= $m + m_a$ =__________________

Please expand the data table to accommodate four runs.

m	M	t_1 (s)	t_2 (s)	t_3 (s)	v_1 (m/s)	v_2 (m/s)	a (m/s^2)	$F_a = m*g_a$ (N)
Run1								
Run 2								

CALCULATIONS

For each set of experimental conditions:

1. Use the length of the glider and your average times to determine $\mathbf{V_1}$ and $\mathbf{V_2}$, the average glider velocity as it passed through each photogate.
2. Use the equation: $\mathbf{a = (V_2 - V_1)/t_3}$ to determine the average acceleration of the glider as it passed between the two photogates.
3. Determine $\mathbf{F_a}$, the force applied to the glider by the hanging mass. ($\mathbf{F_a = m_a * g}$; $g=9.8 m/s^2=980 cm/s^2$)

ANALYSIS

1. Draw a graph showing average acceleration as a function of applied force $\mathbf{F_a}$.
2. Draw a second graph showing average acceleration as a function of the glider mass with $\mathbf{m_a}$ being constant.
3. Examine your graphs carefully. Ae they straight line? Use your graphs to determine the relationship between applied force, mass, and average accelerations for the air track glider.
4. Discuss your results. In this experiment, you measured only the average acceleration of the glider between two photogates. Do you have a reason to believe that your results also hold true for the instantaneous acceleration? Explain. What further experiments might help extend your results to include instantaneous acceleration?