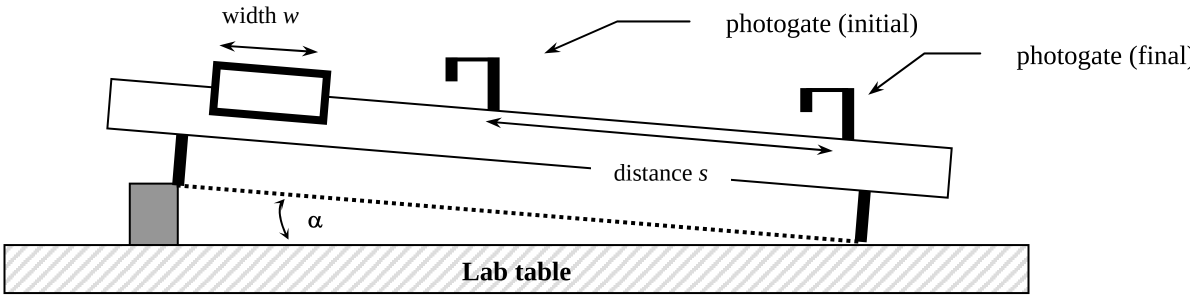
Lab #5 **Work-Energy Theorem:**

Physics 111 Prediction and Measurement Name: ___________________

I. Motion down an incline—work done and change in kinetic energy

A. Use one of the large wooden blocks to elevate one end of the airtracks as shown in the drawing below. Place 2 photogates 120cm apart along the airtrack.



[5 pts] Determine the angle at which ***your*** airtrack is inclined.

α = _______degrees (two sig. figures)

[4 pts] Measure the following ***carefully*** for ***your*** aircart:

mass of your aircart: m = ______kg. width *w* of your aircart: *w* = _________ cm.

[16 pts] Release the aircart a short distance above the first photogate.

- Release the aircart from the same location each time.
- Record the times it takes the aircart to pass through the two photogates. Do this ***FOUR*** times—with the aircart empty, then after adding 100g to the aircart, then 200g and finally 300g.
- Use your data to complete the table below.

Total mass of aircart	t_o (sec)	v_o	t_f (sec)	v_f

[12 pts] In the table below, calculate the initial and final kinetic energies of your aircart, and then the change in the kinetic energy from one location to another.

Total mass of aircart	KE_o (Joules)	KE_f (Joules)	ΔKE (Joules)

Work-Energy Theorem: Prediction and Measurement

Name: ___________________

B. The work done by a force F on an object that moves through a distance s is $W = F\cos(\theta)s$, where θ is the angle between F and the displacement s.

[6 pts] In the space to the right, draw and correctly label the free body diagram for the aircart as it moves down the track. Assume friction is negligible.

[10 pts] Calculate the magnitude of each force on your free body diagram for all four masses.

Total mass of aircart	Size of forces (4. sig. figs. needed here)

[12 pts] Calculate the total work done on the aircart by calculating the work done by each force acting on your object, and then adding these together.

Total mass of aircart	Total Calculated Work = Σ Fcos(θ)s (Joules)

Work-Energy Theorem: Prediction and Measurement

Name: ___________________

There are two ways to get the work done on an object:

(1) Calculate the change in kinetic energy, $W = \Delta KE = KE_{final} - KE_{initial}$ for the whole object. This is the measured work here since you measured the initial and final speeds using the photogates.

(2) Calculate the work done by ***each*** force using $W = F\cos(\theta)s$ and add everything together. This is the theoretical method since you're calculating what you expect the work to be as it moves the distance s with the forces on the free body diagram above.

[6 pts] Look back at your two methods for getting the work done on your aircart. To about ***2*** significant figures, compare your numbers by listing them in the table below.

Total mass of aircart	**ΔKE** (Joules)	**Work = Σ F cos(θ)s** (Joules)

[4 pts] There are three possibilities here. Circle the one that your numbers indicate.

(1) All of your numbers are essentially the same.
(2) All of your numbers are definitely different.
(3) Some combination of the two.

[8 pts] Write a brief explanation of what your numbers show you regarding the work-energy theorem, $W = \Delta KE = F\cos(\theta)s$. Hint: What do your numbers imply about another force that often appears on free body diagrams?