Experiment 4: Newton's 2nd Law - Incline Plane and Pulley

In this lab we will further investigate Newton's 2nd law of motion by using an incline-pulley system. The incline-pulley system, shown in Figure 1, can be classi ed as a simple machine, that is, one of the classic elementary devices that more complicated and advanced machines are built around. As shown in Figure 1, the acceleration of the mass along the inclined plane (M_1) can be controlled by using a hanging counterweight (M_2) over the pulley and/or varying the angle of the incline. The free body diagrams for the two masses are shown in Figure 2. We will use the airtrack to create a frictionless plane and also assume that the pulley is frictionless with uniform tension in the string. With these assumptions, the acceleration of the two masses are the same ($a_{1;x} = a_{2;y}$). Applying Newton's second law, $\sum \mathbf{F} = m\mathbf{a}$, to the freebody diagram, we can write a system of equations describing the motion of the two masses (T is the tension in the string):

$$m_1 a = T \quad m_1 g \sin \tag{1}$$

$$m_2 a = m_2 g \quad T \tag{2}$$

Solving these equations for the acceleration:

$$a = \frac{(M_2 \quad M_1 \sin(\ ))g}{M_1 + M_2} \tag{3}$$

Figure 1: A mass M_1 slides along a frictionless incline of angle with a counterweight M_2 passing over a pulley.

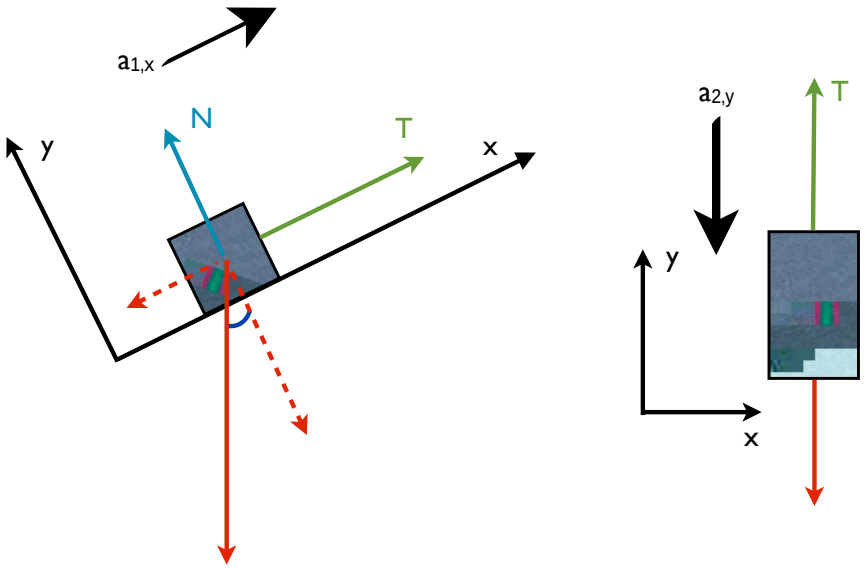

Figure 2: Freebody diagram for the two masses.

Experimental Objectives

PHYS 123, Lab 4 Questions

Name: CWID:

Write your answers on a separate sheet and attach your signed data sheet when turning it in. You must show all of your work for full credit. Make it clear to me you understand what you're doing. Any graphs or tables should be made via computer software and attached to this worksheet.