**Acceleration on an incline**

**Purpose:** To measure the acceleration due to gravity, *g*.

Around 1600, the amazing Galileo Galilei was able to show, experimentally, not only that the acceleration of objects in free fall was constant, but was able to determine a pretty good value for this acceleration. Galileo performed this feat by rolling wooden balls down long inclined planes, and he didn't even have the luxury of a clock! He marked intervals of time using his pulse.

Today, we can do better. We can recreate Galileo's experiment with very little effort using a dynamics track, cart, and a photogate.

The motion of a cart on an incline is accelerated by only a component of the acceleration due to gravity. For motion on an incline it is useful to use a rotated frame of reference. The “x” direction is parallel to the incline and the “y” direction is perpendicular to the incline.

For motion on an incline, the parallel component of the acceleration due to gravity is what causes the cart to accelerate down the slope.

θ

θ

90 - θ

*g*

*g* sin θ = a

*g* cos θ = a⊥

What is the relationship between the acceleration of the cart and the acceleration due to gravity, *g*?

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A photogate can be used to measure the velocity of an object very accurately. A photogate has a laser beam that records whether the gate is blocked or unblocked. When used as a gate timer, the photogate reports the length of time that the gate is blocked. If you enter the length of an object that passes through the gate, it can also report the average velocity of the object when it passes through the gate.

Complete the following worksheet to develop a procedure. The first few steps of the process are completed for you for this experiment.

Question: **What is the acceleration due to gravity?**

Hypothesis: **The observed acceleration due to gravity will not differ from the accepted value of 9.81 m/s2.**

Experimental Conditions: **Motion of a cart on an incline.**

Independent Variable(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable (s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Control Variables: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Materials and Illustration:

Procedure: HOW EXACTLY will you measure your variables? Draw/print a data table to hold your measured values. Define how many trials you plan on performing given the time available. Outline what calculations you will need to do to find a) the acceleration of the cart down the incline and b) the acceleration due to gravity. Consider average, standard deviation, graphing, and error propagation.