Name ________________________________

Section _____________ **Date** ____________

Physics 211 PreLab #1: 1D Kinematics

Reading: **Tipler**

Chapter 2 - Motion in One Dimension

The Physics of Everyday Experiences

Whether or not you realize it, most of you have probably developed a pretty good intuitive sense for the motion of macroscopic objects. For example, you may have a good feel for swinging a bat at just the right time to hit a baseball, or for shooting a basketball with the correct speed and angle to make a basket, or even for accelerating your car by just the right amount when the light turns yellow to beat the light (and the police!).

The ancient Greeks were among the first to offer explanations for the motion of objects (in fact the term *kinematics*, the study of particle motion, as well as the word "cinema," motion pictures, derives from the Greek "kinema," meaning *motion*), but their descriptions were necessarily qualitative due to the absence of a suitable mathematical foundation with which to work. Such a foundation was provided in the 16th and 17th centuries by Galileo and Newton. Galileo first quantified the study of motion by making detailed measurements of particle motion and deducing mathematical relationships between measured quantities. Newton used the new invention of calculus to derive the kinematical relationships that you'll study in this course.

In Investigations 1 and 2 of Lab 1, you will use a cart, track, and motion detector like those illustrated in Figure 1 to explore the relationship between an object's displacement, velocity, and acceleration under different circumstances.

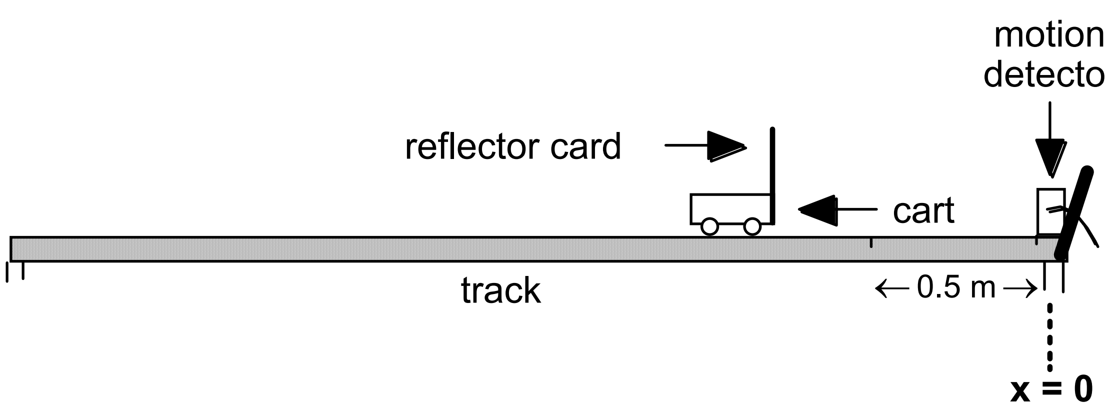

Figure 1. Experimental setup for Investigations 1 and 2 of Lab 1

Consider the following questions relevant to Investigations 1 and 2.

Q1 - How can you tell from a velocity vs. time graph that a moving object has changed direction?

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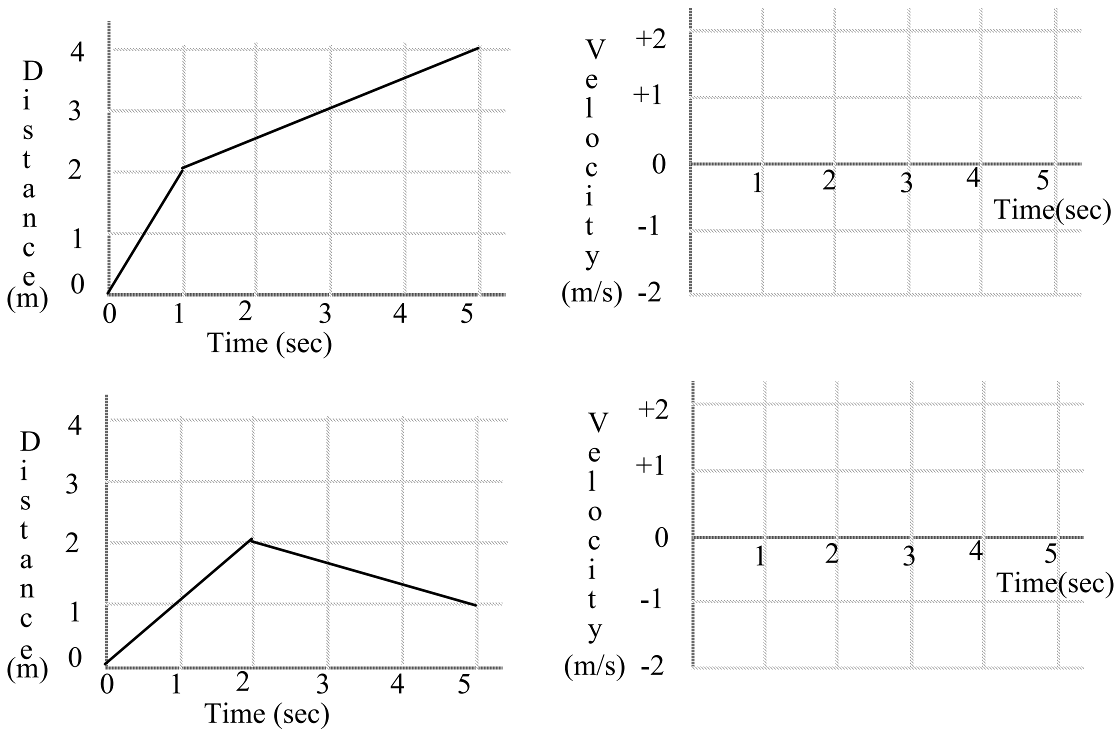
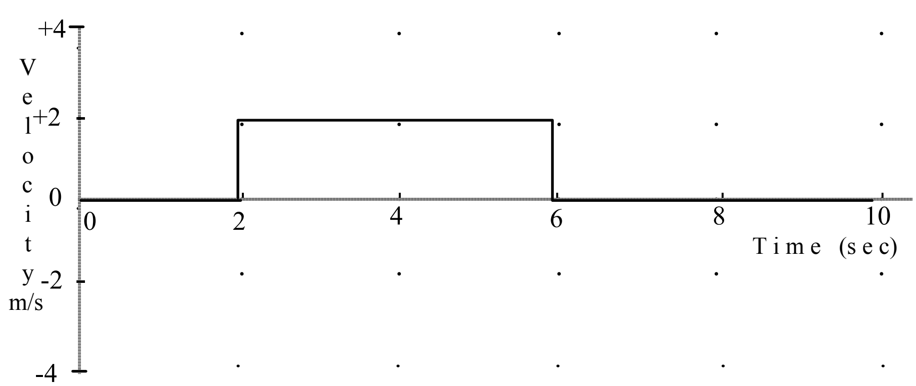
Q2 - Draw the velocity vs. time graphs for an object whose motion produced the distance vs. time graphs shown below. Assume the object can change velocity so quickly that it looks instantaneous on the time shown.



Q3 - The velocity vs. time graph of an object is shown below. Determine the total *distance* traveled by the object. Show your work.

Distance = ____________ meters



Q4 - How can you tell from velocity and distance vs. time graphs that an object has a constant acceleration?

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In Investigation 3 of Lab 1, you will explore the influence of gravity on the motion of an object by studying a cart sliding down an inclined track (see Figure 2). This will allow you to study behavior similar to that found in "free-fall" motion of an object. Consider the following question concerning Investigation 3.

Q5 - Because the cart in Investigation 3 (see Figure 2) rolls down a track which is inclined at an angle θ, it experiences only a component of the gravitational acceleration, g_{eff}. By studying Figure 2 carefully, determine the relationship for g_{eff} in terms of the known or measureable parameters g, x, and L.

g_{eff} = ______________

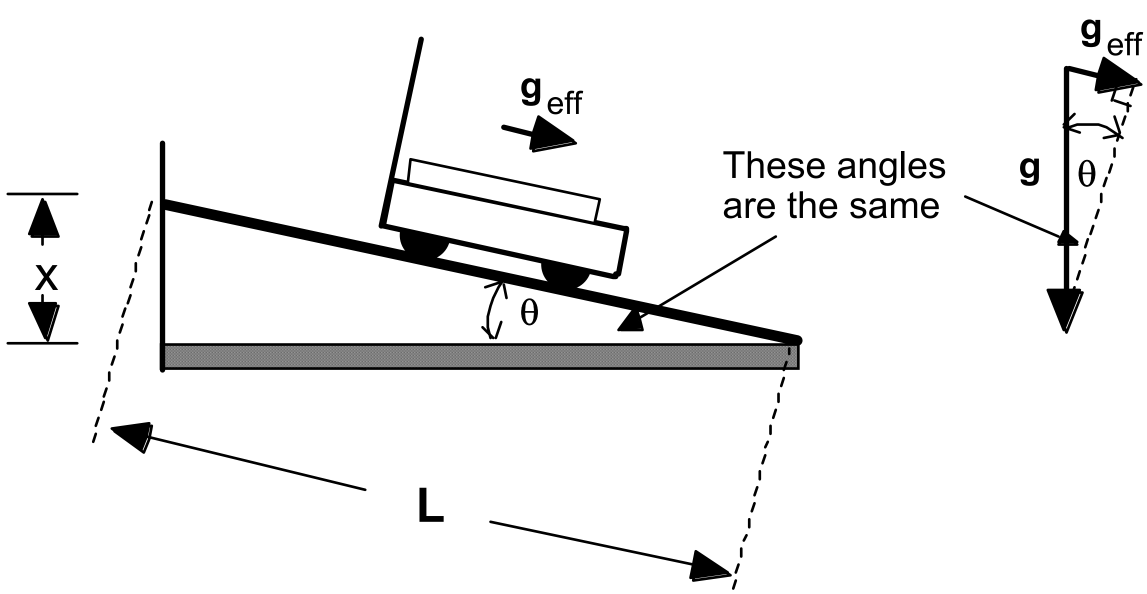

Figure 2. Geometry of Experimental setup in Investigation 3 of Lab 1