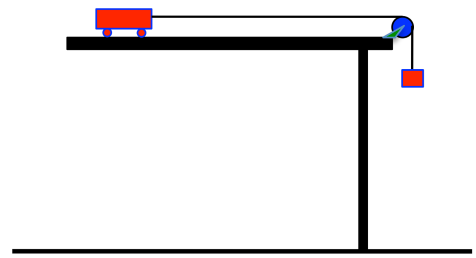
FUN AND GAMES WITH 1-D KINEMATICS

The whole idea behind this lab is to give you a chance to hobnob with kinematics at an intimate level. In the lab, you will use a Smart Pulley to generate a *velocity versus time* and *position versus time* graph for the motion of a cart accelerated across a table. You will then use those graphs to accumulate data from which you can test the various kinematic equations.



The procedure for setting up the system will be explained in class. Once you have the data, all you have to do is execute the write-up, blurbs and all.

CALCULATIONS

1.) You have two graphs. You could pick any two times to do what follows, but for the sake of simplicity I will pick the times for you. Point-in-time-one will be $t_1 = .7 \text{ seconds}$ and point-in-time-two will be $t_2 = 1.3 \text{ seconds}$. With that, in list form, write the time t_1, the position x_1 and velocity v_1 at time t_1; the time t_2, the position x_2 and velocity v_2 at time t_2; and the acceleration "a" of the system. (That's seven bits of information you should write out for this part of the lab).

2.) We want to examine the relationship $(x_2 - x_1) = v_1 t + \frac{1}{2}at^2$, where the "t" term is really the time *interval* between times t_1 and t_2. To do this:

a.) Using your values extracted in Part 1, write out $\left(v_1 t + \frac{1}{2}at^2\right)$, then put in the numbers, then determine a solution. Include units with the final result.

b.) Using your values extracted in Part 1, write out $(x_2 - x_1)$, then put in the numbers, then determine a solution. Include units with the final result.

c.) According to the theory, the $(x_2 - x_1)$ term and the $v_1 t + \frac{1}{2}at^2$ term should numerically equal one another. Do a % comparison using

$$\% \text{ dev} = \left(\frac{(\text{solu from Part b}) - (\text{solu from Part a})}{(\text{solu from Part a})} \right) x100 .$$

d.) How do the two values compare? That is, does $(x_2 - x_1) = v_1 t + \frac{1}{2} a t^2$ seem to be a legitimate relationship?

3.) We want to examine the relationship $v_2 = v_1 + at$, where again the "t" term is really the time *interval* between times t_1 and t_2. To do this:

a.) Using your values extracted in Part 1, write out $(v_1 + at)$, then put in the numbers, then determine a solution. Include units with the final result.

b.) Using your values extracted in Part 1, quote your data's value for v_2.

c.) According to the theory, the v_2 and $(v_1 + at)$ should equal one another. Do a % comparison between your two values.

d.) How do the two values compare?

4.) For the amusement of it, does the acceleration "a" really equal $\left(\frac{v_2 - v_1}{t} \right)$. (This is a modified version of the relationship use in Part 3, but use your numbers and try it, anyway.) Show the calculation, then simply state if the two are essentially the same.

5.) We want to examine the relationship $v_2^2 = v_1^2 + 2a(x_2 - x_1)$. Use the technique you have been using above to check this. After showing the math, state how well the right and left side of the equation matches up.