Name______________________________

Date__________ **Pd**____

UNIT 2 CP LAB 1 - Go! Go! Go!

Purpose: To determine the mathematical relationship between position and time for a battery-powered car and to see how the relationships differ for cars moving at different speeds.

Apparatus:
2 motorized toy cars (one marked with a piece of tape and one not)
dry erase marker
stopwatch
meterstick
graph paper

Background:
Sometimes two quantities are related to each other, and the relationship is easy to see. Sometimes the relationship is harder to see. In either case, a graph of the two quantities often reveals the nature of the relationship. In this experiment, we will plot a graph that represents the motion of a real object.

We are going to observe the motion of the toy car. By keeping track of its position relative to time, we will be able to make a graph representing its motion. To do this, we will let the car run along the floor. At one-second intervals, we will mark the position of the car. This will res ult in several ordered pairs of data—positions at corresponding times. We can then plot these ordered pairs to make a graph representing the motion of the car.

Start by making observations to help with your hypotheses. Turn on both cars and observe their motion.

Hypothesis:
Write your hypothesis below. Use this sentence as a guide: “Position will be _______ to time for a motorized toy car because ______. “

Describe how the graph of position vs time for the car with tape will be different from the one for the car without tape and explain why.

Procedure:

NOTE: *After you are done, wipe up all marks on the floor with a paper towel and cleaning solution (ask your teacher for some)!*

Step 1: Choose a long stretch of floor (like in the hall, but be quiet! Other classes are going on!).

Step 2: Aim the car so that it will run the length of your stretch of floor. Turn it on and give it a few trial runs to check the alignment (make sure it goes straight).

Step 3: Practice using the stopwatch. For this experiment, the stopwatch operator needs to call out something like, “Go!” at each one-second interval. Try it to get a sense of the one-second rhythm.

Step 5: Practice and then do the task.

a. Aim the car and let it go.

b. **After** it starts, the stopwatch operator will start the stopwatch and say, “Go!”

c. Another person in the group should practice marking the location of the front or back of the car on the floor every time the watch operator says, “Go!” For the practice run, simply touch the cover of the marker at the appropriate points.

d. The watch operator continues to call out, “Go!” once each second and the marker continues to practice marking the location of the car until he/she has made ten marks.

Step 6: Label the marked points. The first mark is labeled “0,” the second is labeled “1,” the third is “2,” and so on. These labels represent the time at which the mark was made.

Step 7: Measure the distances—to the nearest tenth of a centimeter—of each point from the point labeled “0.” (The “0” point is 0 cm from itself.) Record the distances on the data table.

Step 8: Repeat steps 1-7 for the other car.

Data:

independent variable ________________________

dependent variable ________________________

Observations - describe (in words) the motion of each car:

car with no tape:

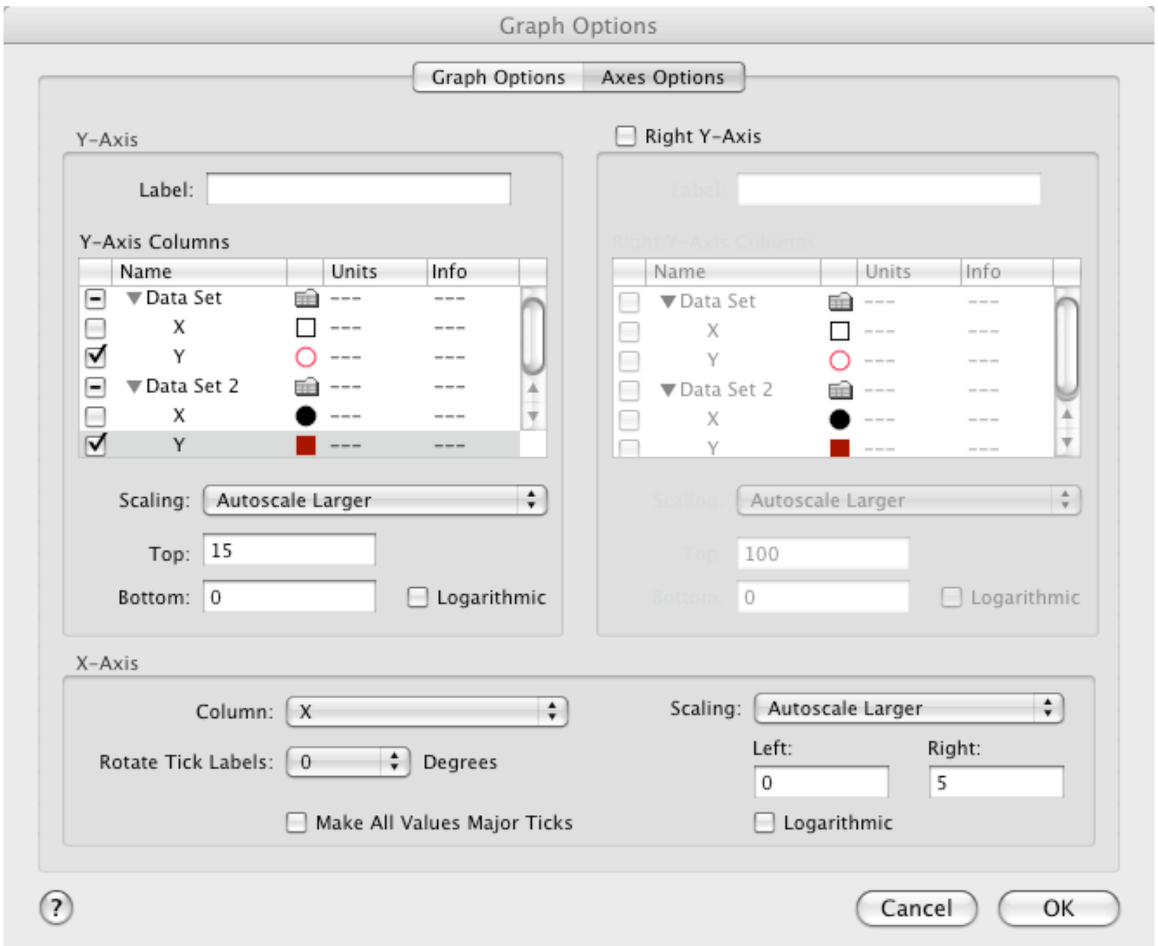
car with tape:

Convert position in centimeters to meters. Since 100 cm = 1 m, divide the value in centimeters by 100 to get meters.

	car with no tape		car with tape	
time (s)	**position (cm)**	**position (m)**	**position (cm)**	**position (m)**
0	0	0	0	0
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Data Analysis:

Make a graph of position (in meters) vs. time using LoggerPro. Use best graphing practices—for example, make sure your independent variable is on the x-axis. To graph both data sets on the same graph, choose "New Data" under the "Data" menu. Double click the graph to get the "Graph Options" window. Enter your title and then choose "Axes Options." Under "Y-Axis Columns", click the arrow next to "Data Set 2" and then the box next to "Y" underneath as show below.



Find the best fit curve for your graphs and print the graphs (staple them to this handout). Record your mathematical models below:

Car with no tape: ____

Car with tape: ____

Conclusions:

1. What were your results (describe the relationship between the independent and dependent variables in a clear, English sentence and restate your equations or mathematical models)?

2. How does the graph of the car with no tape compare to that of the car with tape?

3. Do your results agree with your hypotheses? Explain.

4. How does the distance between marks on the floor compare for a slow car vs a fast car?

5. How would the time to go the same distance compare for a slow car vs a fast car?

6. What is the physical meaning of your slopes in terms of the car's motion or starting place?

7. What is the physical meaning of your y-intercepts in terms of the car's motion or starting place?

8. How accurate do you think your results are and why?

9. While you were collecting data, what were places experimental error occurred and how did this affect your results?

10. How could you improve the accuracy of this experiment if you were to do it again?

Extensions:

11. How far could the car with no tape go in 20 seconds? Explain your reasoning.

12. How long would it take the car with tape go 600 cm? Explain your reasoning.

13. Describe the motion of a car that would produce line A on the graph below.

14. Describe the motion of a car that would produce line B on the graph below.