College Physics – Summer 2014 Name:_____

Lab 1: Measuring Motion 1

Goals: Improve communication and teamwork capacities**;** Improve confidence in hands-on work with equipment; Improve ability to make, describe, and record observations; Improve ability to design an investigation; Use the relationship between distance, time, and (average) speed so that given any two, the third can be calculated.

Equipment: You will be oriented to the location and proper use of the equipment for this lab. At the end of the session, return the equipment to its original configuration and location. Obtain a tumble buggy, 2 C batteries, a C-sized slug, a screwdriver (you may need to share with a neighboring group), a meter-stick or tape measure, 2 stopwatches, and (when needed) some pieces of masking tape.

Groups: For today's investigation, you will work in groups of 2. Group formation will be facilitated by your instructor.

Part 1. Observing Motion

a) Install 2 C batteries into the tumble buggy. Turn on the tumble buggy, place it on the ground, and observe its motion for at least five seconds (and for up to 20 s if you can).
b) Adjust so that 1 C battery and 1 C slug are installed in the tumble buggy. Turn on the buggy and observe its motion for at least five seconds (and for up to 20 s if you can).
c) What do you observe about motion, specifically focusing on the single key difference in the two cases? Briefly describe the essential similarities and differences in your notes; when you have a lab notebook, cut and tape your notes or copy your notes into your lab notebook.

Part 2. Measuring Motion

Before carrying out the measurements described next, briefly discuss and decide how you will make them, including a discussion of your procedure, the role of each team member, and steps to ensure careful measurements. Document your procedure, observations, measurements and calculations in your notes which you will later cut/paste or copy into your lab notebook.

a) Use the tumble buggy with 1 C battery and 1 C slug. Measure and record the time it takes the buggy to travel 1.00 meter.
b) Measure and record the distance the buggy travels in 10.0 seconds.
c) Which, if any, of these two measurements was easier to make? Why?
d) Determine the average speed of the buggy using your data for the 1.00 m trip. The average speed for an object moving in one direction along a straight line is determined by distance of the trip divided by the time it takes to make the trip.
e) Determine the average speed of the buggy using your data for the 10.0 s trip.
f) Assuming the buggy travels at constant speed, how long would it take to travel 3.00 m?
g) Assuming the buggy travels at constant speed, how far would it go in 15.0 s?
h) To carry out the previous calculations, you assumed that the buggy travels at constant speed. Is this a reasonable assumption? What evidence supports or contradicts this assumption?
i) Carefully lay down 5 pieces of tape that are exactly 0.50 m apart, so that the distance between the first piece of tape and the last piece of tape is 2.00 m.
j) Design an investigation to gather evidence to test the assumption of constant speed. The data you gather should be how long it takes the buggy to travel 0.50 m, 1.00 m, 1.50 m, and 2.00 m. In your team, briefly discuss and decide how you are going to make your careful measurements. Write down your procedure so each team member knows her or his role. Practice a few times before recording data.
k) Organize your data in a data table. A good data table has clear labels for the columns (or rows, depending on how you lay out your table) with units indicated. It is good practice to leave space so you can add in extra columns to the right or rows below if needed.

Analysis. Complete after class and before Day 2 as needed.

a) By hand, draw a careful graph of time vs. distance. Note that by convention, a "blah" vs. "bleh" graph means "blah" is plotted on the vertical axis and "bleh" is plotted on the horizontal axis. So a time vs. distance graph has time on the vertical axis and distance on the horizontal
b) By hand, draw a careful graph of distance vs. time. Again, by convention, a distance vs. time graph has distance on the vertical axis and time on the horizontal.
c) Draw a straight line that best fits the data points for each graph, and determine the slope of each hand-drawn best-fit line. Record the numerical value and the units for each slope.
d) If you know how, use a data analysis or spreadsheet program (e.g. Excel, LoggerPro, etc.) to make computer generated plots of the data, best-fit straight lines, and find the slopes of those lines.

Clean-up. Put away borrowed equipment, returning it in the state it was borrowed (batteries out, buggies in boxes, etc.). Clean up and dispose of any tape you used.