

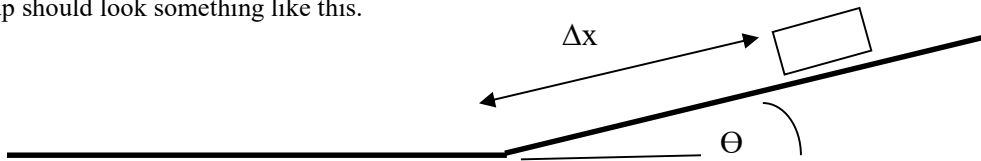
**Car down a ramp. An introduction to Smart Cars, vectors and applied kinematic equations.**

Students should first connect their Cell Phone to the Smart Car via the SparkVue Ap. Once the connection has been established, set up one of the Aluminum tracks at some convenient angle (just stack some books the table or floor.. being sure to leave some 'runway' for the car to roll a few feet before someone catches it (NOTE: PLEASE DO NOT ALLOW THE CARS TO CRASH TO THE FLOOR!).

Make note of a) the angle the ramp makes with the surface (table top or floor), using either a protractor or by simply measuring the based and height of the 'triangle' and b) the distance down the ramp the car will roll before hitting 'the flat' surface..(note: once the car hits the flat surface, it will no longer accelerate).

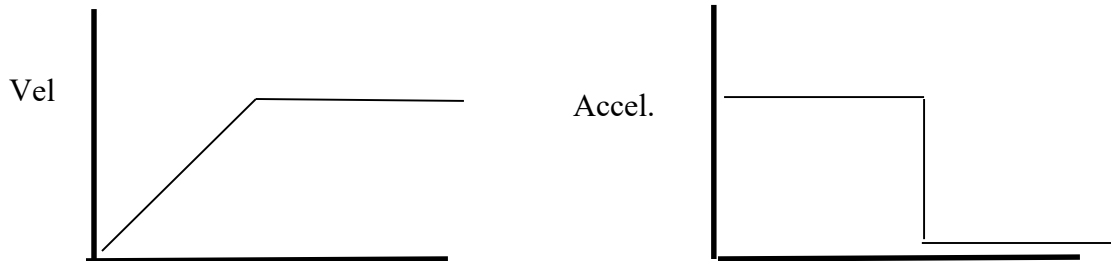
The data set you are looking for will be the velocity data (along the X-axis). "turn off" all other data sets.. (or your Excel file will be extra huge). Set the resolution of data collection down to 10 Hz (ten data points per second).

The setup should look something like this.



Now, go into your Excel File and examine the column of data which is the velocity data. Use your eyes to determine where 'the good data' starts and stops. Delete all other data from the range of data and save the file with a new file name (i.e., "good\_data\_cardownaramp.xls".. don't delete your original file, just rename it 'original\_data\_cardown a ramp). Now Create a new column entry and title it acceleration.

Write a formula using the definition of acceleration ( $\Delta V/\Delta t$ ). pointing to the respective cells to construct it. Run the function down the entire data set.. Then graph both the velocity and acceleration of the car as a function of time (starting from just before you released the car to just before you finally 'catch it' .. and it stops.. The graphs should look something like this.



Now: Back to kinematics. Using the acceleration you determined based on your Excel function, and the distance the car rolled down the ramp, use the kinematic equations to predict what the velocity of the car should be as it 'hits the flats'.. (draw a sketch illustrating the values you used). Compare this value to the value which was 'measured' by the smart car. Determine the percent error of your calculation.

Finally, draw a vector diagram showing the vector component of the acceleration of gravity (9.8) which points 'down the ramp' (in the direction of motion).. and compare to the value of acceleration you determined using Excel. Assuming that the vector component is the true value the acceleration (based on theory), determine the percent error for your measurements.

**Write up a Lab Summary (showing the usual, stated objective followed by a 'clear progression of ideas').  
Up to three names may appear on this report.. Due Friday, October 12<sup>th</sup>.**