Physics Activity

Position, Velocity and Acceleration using Video analysis

In this activity, you and your group will attempt to determine the acceleration of an object as it rolls down an incline by using video analysis from a video you make of your experiment. You must download

HUDL Technique from the App store and have it set up to record video

**Part I**

*How you could set up an experiment to determine the relationship between distance and time?*

*What measurements need to be made?*

Set up a table to record the measurements you indicated above by labeling the columns in the table below with appropriate headings.

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Make sure you have your phone, tablet or Ipad with HUDL technique loaded, a steel ball, a plastic ball, a pair of meter sticks, and an aluminum rail roughly 1.8 m long.

Set the rail up so that it is at a small incline. (Just a few inches up at one end). Set up your meter sticks beside the rail, making sure they are also inclined at the same angle as the rail. You will have to video the ball as it rolls down the incline, and then you will analyze the video to collect the data you mentioned above.

Make a graph of the distance vs time for your data.

*Is the graph linear?*

Would you expect the graph to be linear? If not, how can we make the graph linear?

Calculate the new data you will need and record it in data table. **Be sure to label the columns in the table below with the data you will be recording.** Use this data to produce the linear graph. Starting with the position-time equation, show how the acceleration of the ball is related to the slope of the graph you just produced.

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Find the acceleration of the ball down the incline using this linear graph.

***Part II***

*Using the initial position and time data, can you calculate the average velocity of the ball? How is this average velocity related to the final velocity?*

*Calculate the average and final velocity of the ball using the initial position time data and record the values in the table below.*

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| **Distance** | **Time** | **Vavg** | **Vfin** |
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*Describe what a final velocity vs time graph shows using words.*

*What do we call a change in velocity? And how do we calculate it? (Looking for a mathematical definition here)*

*Rearrange this definition so it is in the slope intercept form of a linear equation, and describe which values you need to graph on which axis in order to determine the acceleration from the slope of the graph. What would be represented by the y-intercept of this graph?*

*Using the data from Part II, create a data set that you can graph so that you can have the slope of the graph equal to the acceleration of the ball down the ramp.*

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| **Time** | **Vfin** |
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*Produce the graph and determine the acceleration of the ball.*

**You will also create each of these graphs using excel. On your graphs, make sure you label the axes as well as units, title the graph, and make sure to display the equation of your line or parabola (graph 1) on your graph as well.** Your first graph, distance vs time should also have a R2 value displayed with the equation for the parabola. You can find this in the more trendline options menu in excel. There is a box that says *display R2 value*. Check the box.

You will hand in all six of your graphs.