Physics 432 Name _____

SPEEDERS AND ACCELERATORS

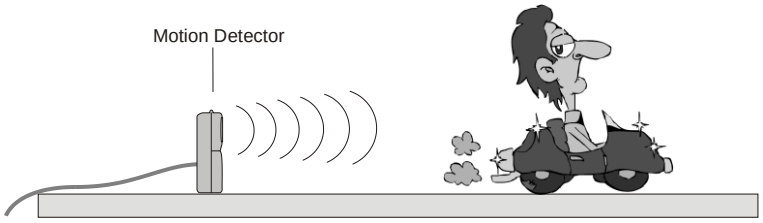
Date _____ Hour _____

Purpose: One of the first things we need to look at is how speeders and accelerators look when you plot graphs of their motion.

Procedure: The Motion Detector measures the time it takes for a high frequency sound pulse to travel from the detector to an object and back. Using this round-trip time and the speed of sound, you can determine the distance to the object; that is, its position. Logger *Pro* will perform this calculation for you. It can then use the change in position to calculate the object's velocity and acceleration. All of this information can be displayed either as a table or a graph.

Part One: "The First Condition –Speeder or Accelerator?"

1. Connect the Motion Detector to DIG/SONIC 2 of the LabPro.



2. Place the Motion Detector so that it points toward an open space on your lab bench.
3. Place a toy car 0.5 m from the detector.
4. Have the car drive away from the detector. As you do this, have your lab partner click Collect. The car should be moving as you hear the detector click. Two graphs will appear.
5. You may need to adjust the height of the distance axis or change the time on the horizontal axis as we did in our previous experiment.
6. When you get a good distance versus time graph, decide if it shows a speeder or accelerator and list that in the title. For Example: **Blue Car Speeder Data.** Simply double click on the graph and edit the information.
7. Go to **Page** on the menu bar and select *ungroup*. Left click on the bottom graph and then press delete. Go to the **Page** button and then select auto arrange to enlarge the graph.
8. Go to **Options** and select *graph options*. On the **Axes Options** tab highlight position, velocity, and acceleration. Three lines should now show on one graph.
9. Print out a copy of this for each member of the group and be sure to list everyone's <u>first and last</u> names on the page when prompted.
10. On the print-out the colors will not appear so be certain to draw arrows to the distance versus time; the velocity versus time and the acceleration versus time for later reference.

Part Two: "The Other Condition"

1. Repeat steps 3 through 9 with a vehicle that does the opposite of the one you first did. In other words, if you had a speeder, use an accelerator this time.
2. After printing out the second graph, answer the following questions in **complete sentences** about speeders and accelerators on the associated graph.

Data and Conclusions:

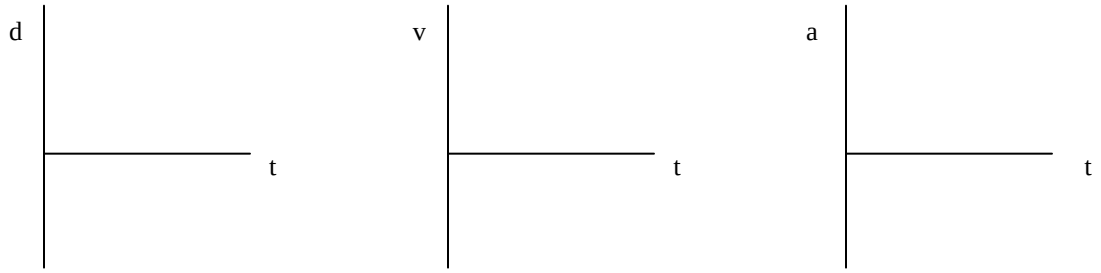
Questions for Speeder:

1. How would you describe the distance versus time graph in words?

2. How would you describe the speed versus time graph in words?

3. How would you describe the acceleration versus time graph in words?

4. Now sketch the graphs for the toy moving away from the motion detector:



5. Go back to the graphs you just drew. There are two other situations in which the toy would be considered a speeder. Predict what the graphs will look like and sketch them into the graphs above. Make one a dotted line and draw the other in a different color. Label each situation.

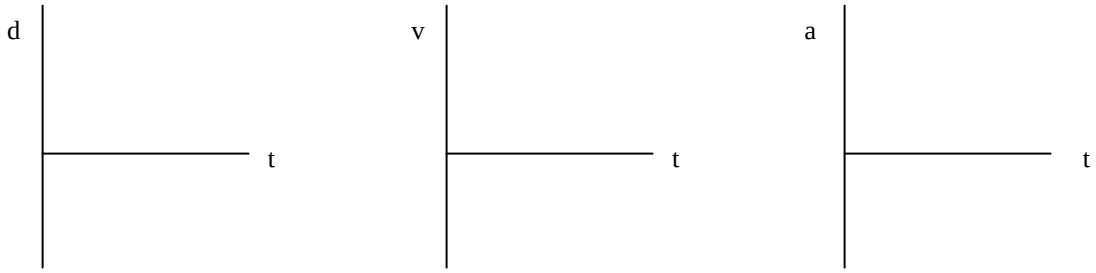
Questions for Accelerator:

6. How would you describe the distance versus time graph in words?

7. How would you describe the speed versus time graph in words?

8. How would you describe the acceleration versus time graph in words?

9.Sketch the graphs for the toy moving away from the motion detector.



10. There is one other situation where the toy would be considered an accelerator. Predict what the graphs would look like for this situation and add this line to the graphs but draw it in a different color. Label what makes this situation different.