Spark Timer Lab – Acceleration on an Inclined Plane **Name _____**

Lab Partners _____ Date _____

Note: You need to follow the following Procedure carefully, but you do not need to retype it for your report. If you wish to copy it into your report, you may do so.

Purpose: Learn to calculate velocity and acceleration using a spark timer.

Materials: 1 Spark Timer, 2 pieces Tape, 4 Textbooks, 1 m Spark Paper, 1 Kinematics Cart, 2 Cart Masses, 1 Metal Track

Procedure:

1. Set up track on the lab counter, with one end propped up on some number of books (from 1 to 4).
2. Measure the vertical distance between the lab counter and the bottom corner of the top end of the track.
3. Measure the length of the entire track, along the incline.
4. Attach one cart mass to the kinematics cart.
5. Set the spark timer at the top end of the track with the metal spark tips pointing downhill. *Do not turn it on or plug it in yet.*
6. Cut off 35-50 cm of spark paper, and pull the paper through your fingers to uncurl it. Then thread the paper through the spark timer in the downhill direction.
7. Place the kinematics cart on the track just in front of the spark timer. Use a small piece of tape to attach the spark paper to the top end of the kinematics cart.
8. Move the spark timer if necessary in order to make the paper tape lay as straight and flat as possible. Lay the paper tape straight out beyond the end of the track.
9. Adjust the frequency switch on the spark timer to 10 Hz. [10 Hertz means it will make a spark 10 times per second.]
10. Have a person move to the bottom of the track in order to catch the cart when it arrives.
11. By gently pulling the end of the paper tape, pull the cart up the slope until it is just in front of the spark timer.
12. Plug in and turn on the spark timer, and then immediately let go of the tape, in order to release the cart down the track. As soon as the back end of the tape leaves the spark timer, catch the cart, and turn off the timer.
13. Label the undotted side of the paper with group members' initials and with the trial setup details (e.g., "black track, 3 books, 10 Hz, 1 cart mass")
14. Add a second cart mass (or if supplies are short, remove the cart mass from the cart) and repeat steps 6-13.

Data:

1. Make a diagram of your setup, with labeled objects and distances.
2. Tape the ends of the paper strip down on a table.
3. Mark a zero point where the last of the cluster of dots is. From there, count off the dots, and mark every fifth one (5, 10, 15, 20,…).
4. Measure and record the position (in meters) of every dot.

Results:

1. Make a graph of displacement versus time. Put the data for two carts with different masses on the same graph.
2. Using the data for the heavier cart, calculate the velocity of the cart during each 0.10 second interval.
3. Graph velocity versus time.
4. Use a ruler to draw a best fit line for the data points.
5. Calculate the slope of the line, which will represent the acceleration of the cart.

Conclusion questions: (to be answered in complete, grammatically correct sentences)

1. Why did the graph of displacement vs. time curve?
2. Was there a difference between the graphs for the light and heavy carts? If so, what could have caused that? What forces other than gravity were acting on the carts?
3. Explain why the slope of the velocity vs. time graph was equal to acceleration.
4. Why was the slope of velocity vs. time fairly constant along the whole graph?
5. Compare your measured acceleration to the acceleration predicted by ideal physics laws on a frictionless perfect track. This acceleration = $g \bullet \sin\theta$, where $g = 9.81\ m/s^2$ (here on earth) and $\sin\theta$ is the height of the track divided by its length.

Summary: (to be answered in paragraph form)

- Explain the use of the spark timers in this lab.
- How could we use the spark timers in future labs?
- What does "rate of change" mean?
- Explain the concepts of displacement, velocity, and acceleration, including the proper units for each.