Toy Car Lab **Name**_____

Physics **Period**_____ **Date**_____

Problem: Determine how fast the toy car is capable of moving.

Materials:

Meter stick	TI Graphing Calculator
Stopwatch	Constant Motion Vehicle
Motion Detector	Ticker Tape and Ticker

Procedure 1: Use the meter stick and stopwatch to measure the speed of the toy car.

1. Measure the time it takes the toy car to travel a predetermined distance for three trials.
2. Record your data in the table below.
3. Calculate the speed for each trial. Show an **example** of your calculation on the right side of the data table.

Data for Procedure 1:

Trial	Time (s)	Distance (cm)	Speed (cm/s)
1			
2			
3			
Average			

Procedure 2: Use the spark timer and ruler to measure the speed of the toy car.

1. Cut a long piece of ticker tape.
2. Preset your spark timer to 10 Hz or 60 Hz (Hertz is the metric unit for frequency.) and with the power off, feed a strip of tape through the timer in the direction indicated by the arrow as shown in figure 1 below.
   *** You will have to decide which Hz setting you will to use. If the timer is set to 10 Hz it will spark every 1/10 of a second and 60 Hz will spark every 1/60 of a second.*

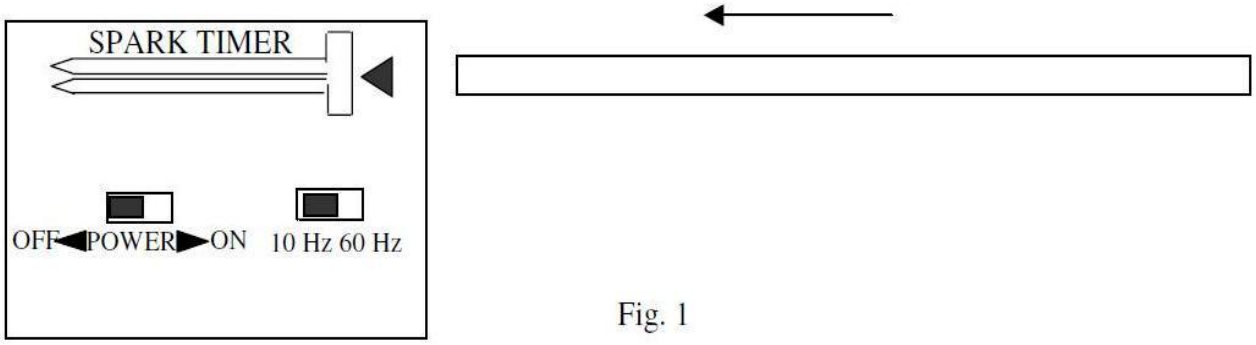
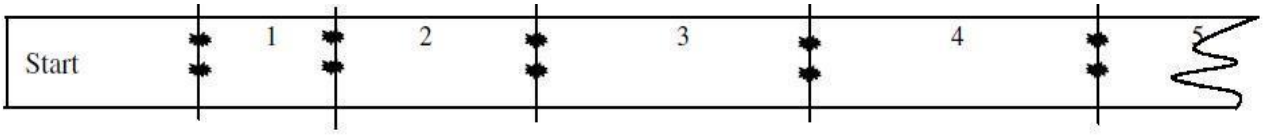


Fig. 1

3. Stop feeding the tape through when there is enough sticking out of the front of the timer to tape to your toy car. Tape to your car.
4. Turn the power switch on and turn the car on so that it pulls the ticker tape through the timer.
5. Turn the timer and toy car off.
6. Using a ruler, draw a straight line through a section of the sets of spark marks on the tape.



7. Pick three intervals and measure the distance between the marks.

Data for Procedure 2

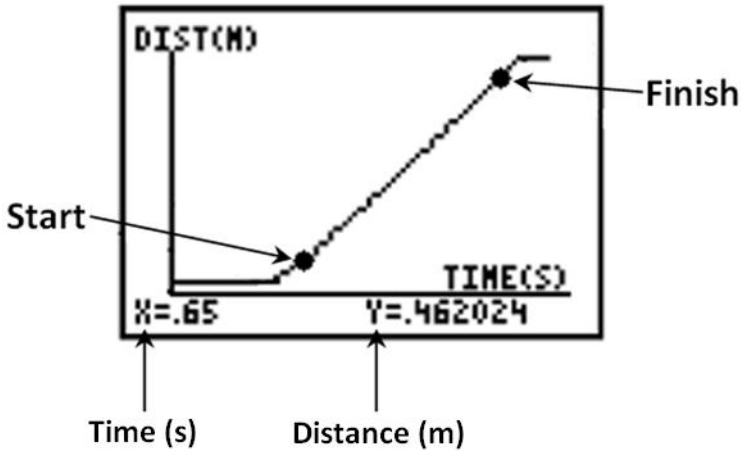
1. Record your data in the table below.
2. Calculate the speed for each trial. Show an **example** of your calculation on the right side of the data table.

Hertz Setting: _____ Time Interval: _____

Trial	Distance (cm)	Speed (cm/s)
1		
2		
3		
Average		

Procedure 3: Use the motion detector and TI-83 to measure the speed of the toy car.

1. Setting up the motion detector probe (ranger). Proceed to step 2 if already setup.
    a. Do not turn on anything yet.
    b. Plug your calculator into your CBL unit using the connector cable provided.
    c. Plug the motion detector into the red SONIC port of the CBL.
    d. Turn on your calculator.
    e. Turn on CBL (red button)
    f. Press PGRM button on the calculator
    g. Select 1: PHYSICS; press enter
    h. Press enter again
    i. Press enter again
    j. Select 1: SET UP PROBES; press enter
    k. Select 1: MOTION; press enter
    l. Select 2: COLLECT DATA; press enter
    m. Select 2: Time Graph; press enter
    n. Enter 0.5 for "Time between samples in seconds"; press enter
    o. Enter 8 for "# of samples"; press enter
    p. Press enter.
    q. Select 1: Use Time Setup; press enter
    r. Select 1: Non-live display; press enter
2. Press enter on the calculator, when the motion detector starts clicking, hold it for 1 second and then release the car.
3. Be sure to remove your hands quickly so that they do not interfere with the motion detector.
4. Once the clicking stops; press enter.
5. Select 1: DISTANCE; press enter
6. A graph will appear on the graphing calculator after transferring the data. Analyze the graph as described in the next step. To continue taking data, hit enter while on the graph screen of the calculator and select repeat sample.
7. Calculate the slope of the line by examining the distance versus time graph.
    a. Position the cursor near the beginning of the incline. Record the time (x) and the distance (y) in the data table.
    b. Position the cursor near the end of the incline. Record the time (x) and distance (y) in the data table.



Data for Procedure 3:

Start		Finish		Speed (m/s)	Speed (cm/s)
Time (s)	**Distance (m)**	**Time (s)**	**Distance (m)**		

Calculate speed in m/s. Converting speed in m/s to speed in cm/s:

Conclusion:

1. What two factors were measured to determine the speed of the toy car in both procedures?

2. How was the speed determined (calculated)?

3. Calculate the % difference between the speed of the toy car from Procedures 1 and 2, then calculate the % difference between the speed calculated from Procedures 2 and 3. Show all work.

4. Which procedure is the most accurate? Explain your reasoning.

5. Name three sources of error .