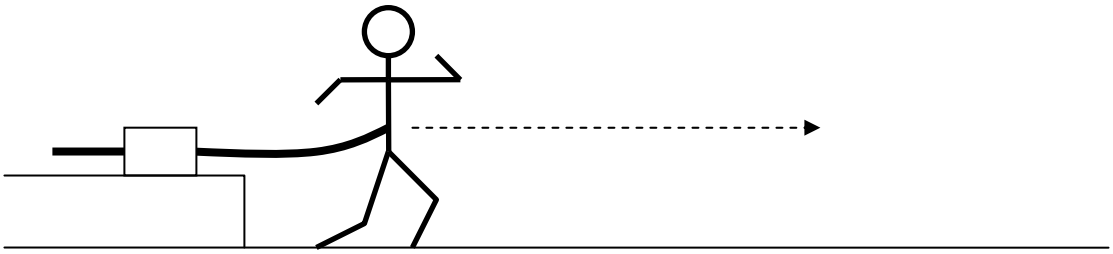
PHYSICS **Reiner, Hutchison, Vourgourakis**

Lab 1-2: Acceleration

An important distinction in the analysis of moving objects is between motion at a ***constant velocity*** and motion with a ***changing velocity***. An object whose velocity is changing is said to be in "***accelerated motion***." The rate at which an object accelerates can be constant or non-constant. In this experiment, we will try to make the distinction between constant and non-constant acceleration by analyzing the motion of 3 objects: 1) an accelerating person (you!), 2) a spring-loaded toy car, and 3) a falling object.

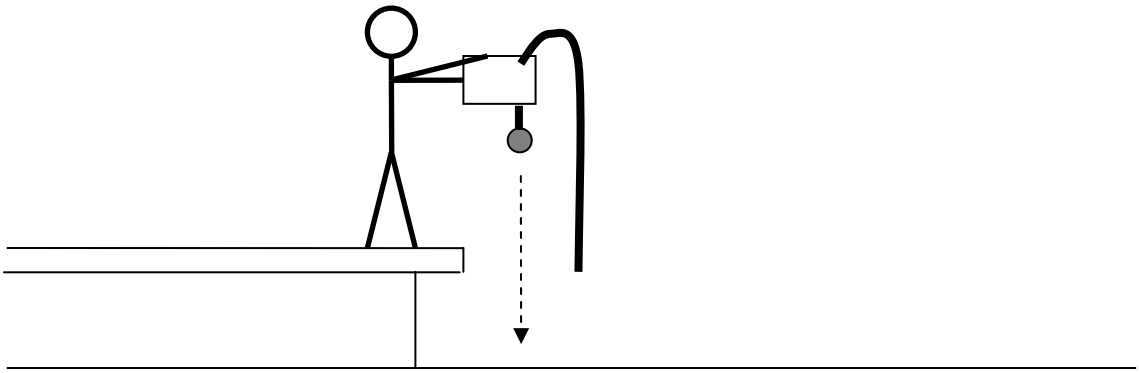
Instead of metersticks and stopwatches, you will use spark-timers and paper tape this time to obtain your data. The spark-timer is a simple device with an electrical circuit which makes sparks jump between 2 metal electrodes 10 times per second. If a piece of spark-sensitive tape is pulled through the opening between the two electrodes, the sparks will make black dots on the paper which show the position of the tape at $1/10^{th}$ of a second intervals. The distance between the dots can then be measured and show how far the tape moved during each $1/10^{th}$ of a second interval. In all three parts of this lab, it is important that there be no slack in the tape at the start, so that the dots accurately represent the distance moved by whatever was pulling the tape. You will thus end up with an accurate representation of the distance moved by an object every $1/10^{th}$ of a second. Your tapes will end up looking something approximately like this:

PROCEDURE:



Part A: Plug in a spark timer and clear an area in which you can accelerate for a few meters without hurting yourself. Cut or rip a piece of spark timer tape somewhere around one and a half to two meters in length (you don't need to measure it). Thread one end of the timer tape through opening between the hammer and the carbon paper and attach the other end to the small of your back using scotch tape. The tape should be pulled through so that when you run, you will pull at least a meter of tape through the dot timer. Have your partner stand behind you and hold the timer at approximately the level of the spot where it is attached on your body so that the tape may be pulled straight through when you run. Have your partner turn on the timer using the black switch and run like an antelope.

Part B: Basically the same as part A: attach the tape to the toy car, wind the toy car up all the way, get the slack out of the tape, turn on the timer, and let her rip.



Part C: This time, attach the tape to some object which is to be dropped, ideally something fairly dense, such as a lead fishing weight. Since falling objects accelerate rather quickly, you will need to stand on a desk and hold the timer as high as you can in order that your tape ends up with an adequate number of data points (should be at least 5 intervals). Put some kind of cushioning below the object to be dropped so that it will not dent the floor. Turn on the timer and drop the object.

YOUR REPORT FOR THIS LAB SHOULD INCLUDE:

- **Data tables for each part of the three accelerating objects.**
- **For each data set, a graph accompanied by a best-fit equation.**
- **An estimate of the average acceleration for each of the 3 objects, along with a brief explanation and/or calculation of how this value was obtained (Microsoft Excel can determine these for you if you ask in the right way ☺).**

  For the falling object, you should calculate a % error between your experimental result and the accepted value for acceleration due to gravity.

- **A conclusion in which you discuss your results. How were your three accelerations similar and/or different from each other? What do you think were the major sources of error in this experiment and how might they have affected your results?**