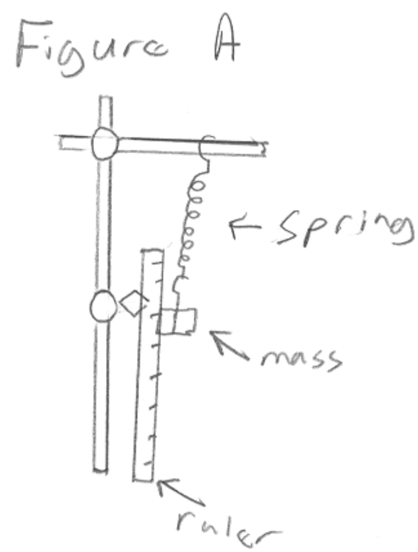
# Laboratory #7
# Springs and Solids

## Part A. A Springy Day

**Concepts**
Elasticity; Hooke's Law; Force of Gravity

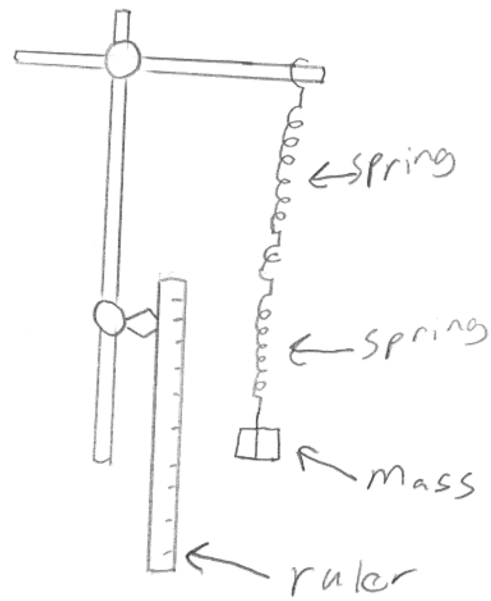
**Introduction**
Captain Hook was Peter Pan's archrival, and the alligator that swallowed a clock terrified him. Professor Hooke, however, learned the characteristics of springs that enabled clocks to keep time accurately! Hooke's Law is very straightforward and simple. In this lab you will learn how Hooke's law applies to everything from your ballpoint pen to the playground toys that bobble back and forth. If only we had some pixie dust, we could learn how to fly like Peter Pan!

**Procedure**
- Hang a mass hanger from a spring as shown in figure A.
- Adjust the top bar so that this is the 0 location. Since this is the 0 location, the mass hanger is also considered 0g.
- Add 100g to the mass hanger and notice how far the spring stretches.
- Record the information on the chart provided.
- Using the spring constant that you determined from the first hanging, predict how far the spring will stretch with 250g. Then do it.
- Record the information.



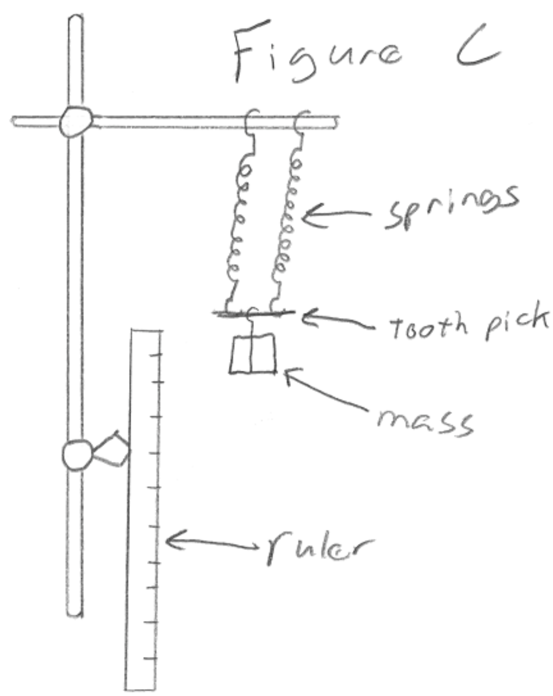
- Hang two springs end to end as shown in Figure B.
- Hang the mass hanger from the spring system and adjust top bar so that this is the 0 location.
- Based on the information from figure “A” and some common sense, predict how far the spring system will stretch with 100g.
- Hang 100g and record the chart information.

Figure B.




- Hang two springs side by side as shown in Figure C.
- Hang the mass hanger from the spring system and adjust the top bar so that this is the 0 location.
- Based on the information from figure “A” and some common sense, predict how far the spring system will stretch with 100g.
- Hang 100g and record the Chart information.

Figure C



# Part B. Super Airplane Launch

**Concepts**
Elasticity; Hooke's Law; Force; Acceleration; Velocity; Aerodynamics

**Introduction**
Ever launched a paper airplane with a rubber band? Sometimes you can get them to stay in the air for as much as 1 minute and some designs can be launched for lengths as much as a football field. This experiment will test your paper airplane building skills and you learn a little bit of physics too!

**Procedure**
- Repeat the first 4 (with more weight) steps of Part A. "A Springy Day," with a rubber band instead of a spring.
- Determine the spring constant of your rubber band.
- Build the best paper airplane you can, and attach the popsicle stick as a launching hook.
- Weigh your paper airplane.
- Determine how far you will stretch your rubber band to launch your airplane.
- Determine the velocity with which your airplane will be launched.
- Launch your airplane, and go for max distance or max time aloft!

# Part C: “You’ll Shoot Your Eye Out!”

**Concepts**
Volume; Area; Height

**Introduction**
How accurately can you measure the diameter of a BB without actually measuring it? This experiment will step you through how to do just that. Check your accuracy when you get done!

**Procedure**
- Using the graduated cylinder determine the volume of your batch of BBs.
- Lay the BBs flat on a piece of paper and determine the area that they take up.
- Now that you know the volume and area that your batch of BBs take up, find the height (which is the diameter) of the BBs.
- Using a micrometer measure 3 BBs and get an average diameter.

# Lab Reporting Sheet
# Laboratory #7

Name:____________________

Date:____________________

## Part A: A Springy Day

| | Mass | Predicted Stretch Distance | Actual Stretch Distance | Actual Spring Constant |
|---|---|---|---|---|
| Fig. A | 100g | | | |
| Fig. A | 250g | | | |
| Fig. B | 100g | | | |
| Fig. C | 100g | | | |

- **How can you predict how far the 250 grams will stretch the spring in figure "A"?**

- **Why does Figure "B" stretch the way it does?**

- **Why does Figure "C" stretch the way it does?**

# Part B: Super Airplane Launch

**Chart for determining Spring Constant K**

| Mass | Stretch Distance | Spring Constant |
|---|---|---|
| | | |

- **What is the mass of your airplane?**

- **How far will you stretch your rubber band when you launch the airplane?**

- **What will be your airplane's launch velocity?**

- **What was your airplane's maximum distance flown?**

- **What was your airplane's maximum time aloft?**

## Part C: "You'll Shoot Your Eye Out!"

- **What is the volume of your BBs?**

- **What is the area of your BBs?**

- **What is the calculated diameter of a BB (V=AxH)?**

- **What is the average measured diameter of a BB (use a micrometer)?**

- **What is the percent error of your calculated diameter?**

- **Why don't you have to take the space between the BB's into account?**

- **What is the surface area of a BB?**

- **Which would fall faster: a BB or a 2 inch metal ball?**