

GK-12 Sensors! Module

**Title:** “Sinkin’ Lincoln” Lab

(adapted from E. S. Belasic (<http://www.middleschoolscience.com/surface.htm>))

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**Discipline:** Chemistry (Middle School)

### **Introduction**

The objective of this module is for middle school students to learn about water molecule cohesion. They will use visual observations to determine how many drops of fresh water and soapy water can rest on top of a penny. Students will average the class results and graph their results using Microsoft Excel.

This module consists of two 45-minute class meetings.

### **Objectives**

- Describe water cohesion and surface tension
- Determine what factors affect surface tension
- Collect data on how many drops of water a penny can hold
- Graph data
- Interpret results

### **Associated Maine Learning Results**

#### SCIENCE AND TECHNOLOGY

#### F. STRUCTURE OF MATTER

Students will understand the structure of matter and the changes it can undergo. Students will be able to:

#### MIDDLE GRADES 5-8

2. Describe the evidence that all matter consists of particles called atoms that are made up of certain smaller particles.

4. Describe how a substance can combine with different substances in different ways, depending on the conditions and the properties of each substance.

#### K. SCIENTIFI REASONING

Students will learn to formulate and justify the ideas and to make informed decisions.

### **Required Equipment**

- 2 Paper clips
- Pennies, 1 per student
- Paper cups with water
- Dropper bottles with clean water
- Dropper bottles with soapy water
- Paper towels

## **Activities**

Begin this lab by “floating” a paperclip in a cup of water, and having a second cup of water with a paper clip at the bottom. Generate a class discussion about why similar bodies of water could have a paper clip sink or float. You may want to shake the cup with the floating paper clip, or add a few drops of soap to make it sink.

Many students will already have ideas about surface tension. Use this discussion to refine their understanding of hydrogen bonding. You will want to use visual aids for this. Three-dimensional models or chalkboard illustrations will help with this. By the end of the discussion, have the class work together to write a concise definition of water cohesion, using their own words.

Next, pass out the 3-page lab instructions and questions (below). Give students enough time to answer the pre-lab questions while you pass out the remaining materials. Students may work individually or in pairs.

The timing should work so that students can collect data on day 1 and then share results, create graphs, and interpret results on day 2.

## **Additional notes**

My 8<sup>th</sup> grade students had vastly different levels of understanding for this concept, but those who appeared to know more, had many misconceptions. Be aware of this and be careful to clarify misconceptions without confusing the students who are new to the topic.

This is a great opportunity to discuss how we can use our own senses (in this example, sight) in a scientific experiment.

## **Other resources**

<http://www.middleschoolscience.com/surface.htm>

[http://www.biology.duke.edu/cibl/exercises/how\\_many\\_drops.htm](http://www.biology.duke.edu/cibl/exercises/how_many_drops.htm)

"Sinkin' Lincoln" Lab  
Adapted from E. S. Belasic

Name \_\_\_\_\_

**Objectives**

- Describe surface tension
- Determine what factors affect surface tension
- Collect data on how many drops of water a penny can hold

**Materials**

- Pennies
- Paper cups with water
- Dropper bottles with clean water
- Dropper bottles with soapy water
- Paper towels

**Pre Lab Questions**

1. What is surface tension? (Write your answer using complete sentences.)
2. How many drops of clean water do you predict a penny can hold? \_\_\_\_\_
3. Soapy water? \_\_\_\_\_

## Experimental Procedures

1. Take your penny and rinse it well in the paper cup with clean water.
2. Dry it very thoroughly!
3. Place your penny flat on the table.
4. Begin to add drops of clean water. Record # of drops in Table 1.
5. Clean penny. Repeat 2 more times.
6. Repeat the 3 trials for both heads up and tails up.

Repeat steps 1 – 6 using soapy water.

Write your data on the board.

Table 1.

|                   | Trial 1 | Trial 2 | Trial 3 | Average |
|-------------------|---------|---------|---------|---------|
| Heads Clean Water |         |         |         |         |
| Heads Soapy Water |         |         |         |         |
| Tails Clean Water |         |         |         |         |
| Tails Soapy Water |         |         |         |         |

## Graphing Results

1. Type the class results into an Excel table using the following pattern:

| <b>Experiment</b>    | <b>Average number of drops</b> |
|----------------------|--------------------------------|
| Heads up Clean Water |                                |
| Heads up Soapy Water |                                |
| Tails up Clean Water |                                |
| Tails up Soapy Water |                                |

2. Click and drag over the data cells so that they are selected.
3. Go to Insert > Chart
4. Choose the 2-D “Column” style graph. (This should be the automatic selection.)
5. Click “Next”
6. Click “Next” again
7. Type in a title and label your x and y axes. For example, you may type “Experiment” for the x axis and “Average number of drops” for the y-axis.
8. Click on the “Legend” Menu
9. Check the box for “Show legend” so that it is NOT checked.
10. Click “Next”
11. Select “As new sheet:” and type in the name of your graph. This will create a new worksheet in your Excel file.

**Analysis/Results** (Use complete sentences to answer the following questions.)

1. Describe your findings using class data. Refer to your graph.
2. How would you explain what happened?
3. Does soap make a difference?
4. Do you think we'd get the similar results if we used nickels? dimes? quarters? oil? maple syrup? Explain.

**Conclusion**

In 2-3 sentences, explain what you learned in this lab.