Steve Smith Lab # 3

Honors Biology Mr. Collea

**Title**: How Many Drops of Water Can Fit on a Penny?

**Abstract**

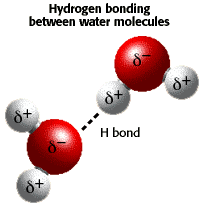
The purpose of this investigation is to determine how many drops of water can fit on top of a penny.

The procedure includes slowly dropping as many drops on the tail side of penny from a height of 3 cm above the penny at a 45o angle. The results below indicate that an average of 55 drops of water was able to fit on the tail side of a penny.

**Introduction**

The purpose of this investigation is to determine how many drops of water can fit on top of a penny. Water is a **polar molecule** which means it has an unequal charge distribution. The oxygen part of the molecule has a slightly negative charge and the hydrogen part of the molecule has a slightly positive charge. Due to this unequal charge distribution, the hydrogen atom of one water molecule is attracted to the oxygen atom of another water molecule forming an intermolecular bond called a **hydrogen bond** (Figure 1.). This hydrogen bonding between adjacent water molecules make water “sticky”. **Cohesion** is the property by which water molecules stick to each other and may play a role in the shape the water droplet takes while sitting on the penny and the number of drops of water than can fit on a penny. Based upon this information, my hypothesis is that approximately 25 drops of water can fit on top of a penny.

**Figure 1.**

[](http://www.google.com/url?sa=i&source=images&cd=&cad=rja&docid=eYeo72vDZLrfEM&tbnid=dKK06kQXCuGPvM:&ved=0CAgQjRwwAA&url=http://www.biology.arizona.edu/biochemistry/tutorials/chemistry/page3.html&ei=H9lBUqjGA9Gt4AO2rIDIDA&psig=AFQjCNEQjvOUTUAWBvrzGDwausqDkWrp3Q&ust=1380)

The dependent variable in this investigation is the number of drops of water and the independent variable is the number of trials. Some of the controlled variables include: dropping instrument, side of penny, height of instrument, location of drop and time between drops just to name a few.

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**Methods**

The materials used in this investigation are: US penny, 2mL dropper, 500mL beaker of water and a paper towel. The procedure includes slowly dropping as many drops on the tail side of penny from a height of 3 cm above the penny at a 45o angle. The drops should hit in the center of the penny and counting should stop when the drop over flows off of the penny. This procedure should be repeated 5 times by each member of the group.

**OR**

**Materials**: US penny, 2mL dropper, 500mL beaker of water and a paper towel

**Procedure**:

1. Fill a 500mL beaker ¾ full of water and use this water to refill your 2mL dropper.

2. Fill a 2mL dropper with water.

2. Hold dropper 3cm above the penny at a 45o angle.

3. Slowly and carefully drop water onto the penny in 2 second intervals.

4. Count the number of drops until the water spills off the penny.

5. Record date in Table 1.

6. Repeat 5 times.

**Results**

The results below indicate that an average of 55 drops of water are able to fit on the tail side of a penny.

**Table 1.**

|  |  |
| --- | --- |
| **Trial** | **Number of Drops** |
| 1 | 55 |
| 2 | 59 |
| 3 | 52 |
| 4 | 54 |
| 5 | 56 |
| **AVG.** | **55** |

**Graph 1.**



As you can see, the number of drops per trial was inconsistent with a range from 52 - 59 drops.

**Discussion**

The results indicate that the average number of drops that can fit on the tail side of a US penny was 55 drops so the original hypothesis of approximately 25 drops is rejected. The range between the highest and lowest value was 7. The number drops seems high and can be explained by the fact that water is a polar molecule that possesses hydrogen bonds creating cohesive forces that allow the water molecules to stick to one another on top of the penny. It was not possible to compare our results with any other group as no other group used the same instrument.

Problems encountered during this investigation include: **(1)** holding the instrument too high thus creating drops that would not stay on the penny. This was resolved by holding the 2mL dropper much closer to the penny at a height of 3cm above the penny. **(2)** when to stop counting the number of drops. The group agreed that counting would stop when the water spills off the penny and the last drop would not be counted. **(3)** dropping the water too fast was also an issue which made counting very difficult. This was resolved by dropping the water in approximately 2 second intervals in the center of the penny.

**Conclusion**

During this lab I learned that more drops of water (55) can fit on top of a penny than expected (25) due to the fact that water is a polar molecule and displays cohesive properties. I also learned the importance of controlling variables and how a well written procedure will eliminate the effects these variables may have on the reliability and validity of the experiment. Most importantly, this lab taught me how to design an experiment along with the necessary elements required for each section of a well written lab report.