**How many drops fit on a penny?**

**INTRODUCTION**

Although a water molecule has an overall neutral charge, the actual structure of a water molecule makes it a **polar molecule** (it has a positive end and a negative end). The two hydrogen atoms are slightly positive, and the oxygen atom is slightly negative. These different charged ends cause a weak attraction between an H from one water molecule to the Oxygen of a neighbouring water molecule. This attraction is called a **hydrogen bond**. The polarity of the water molecule can also cause it to be attracted to molecules of other polar substances.

The attraction from one water molecule to the next due to Hydrogen bonding makes water molecules “stick” together in a property called **cohesion** and results in **surface tension**. Surface tension is the name we give to the cohesion of water molecules at the surface of a body of water. The cohesion of water molecules forms a surface “film” or “skin.” Some substances, such as soap, may reduce the cohesive force of water, which will reduce the strength of the surface “skin” of the water

Because water molecules at the surface of the water puddle are attracted more to each other than to the air molecules above them, they cling together and form a dome shape on the coin. Surface tension prevents the water molecules from falling out and spilling.

You can keep adding water drops until the surface tension is not strong enough to counter the gravitational pull on the water.

Different liquids will have different molecular structures and therefore different intermolecular forces (attractions). So the surface tension of each liquid is different. The number of drops you can put on a coin without spilling is also different.

**What To Do**

1. Predict how many drops you think you can fit on the penny. Write you’re your prediction on the next page.
2. Rinse a penny in tap water. Dry it completely with a paper towel.
3. Examine the penny and consider how many water drops you think will fit on the penny. Write down your prediction on the next page.
4. Place the penny on a flat surface that can get wet.
5. Fill a small beaker with water.
6. Use a pipette to draw water and carefully put individual drops of water onto the penny. Make sure not to touch the tip of the pipette to the penny.
7. Count the water drops as you add them, one at a time, until water runs over the edge of the penny.
8. Repeat the experiment with a different liquid. Pay attention to the shape of the liquid puddle on the penny and the number of drops before it spills over

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**Extensions**

1. Add a drop of soap/detergent to the beaker of water you use. It reduces the surface tension causing a dramatic reduction in the number of drops that will fit on the coin.
2. Start with a full glass of plain water (with a dry rim to prevent the water from dripping down the side of the glass). How many coins can we add to the water without the glass overflowing?

Gently add coins one by one. Because of surface tension, the water will rise above the rim of the glass before it spills (just like the initial experiment). Compare your original prediction with the number of coins you were able to add.

**HOW MANY DROPS FIT ON A PENNY? Name: \_\_\_\_\_\_\_\_**

**Prediction: \_\_\_\_\_\_\_\_\_\_\_\_\_ drops**

**Observations:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Liquid** | **Trial 1** | **Trial 2** | **Trial 3** | **Average** |
| **Tap Water** |  |  |  |  |
| **Other** |  |  |  |  |

**Questions**

1. Were your predictions correct? By what percentage were you off?
2. Why was it necessary to perform multiple trials on the same liquid?
3. What are the variables in this experiment?

Independent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Control: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Does it matter if the coin is heads or tails? Why do you think this?
2. Explain in your own words and using scientific terminology why the different liquid held less drops than water?
3. Explain in your own words, using scientific terms how it is possible to get so many water drops on a coin.
4. Would a dime coin hold more or less drops? Why?
5. Predict what you think you results would be if you added a drop of dish soap to the water before dropping onto the coin.