Lab: Abe Goes Swimming

FOR THE TEACHER

Summary
In this lab, students will investigate surface tension by comparing the number of liquid drops of water and of alcohol that can be held on the surface of a penny. An optional opportunity to investigate surfactants is also provided.

Grade Level
High or Middle School

Objectives
By the end of this lab, students should be able to
- Determine the relative surface tension of water and alcohol.
- Compare the abilities of water and alcohol to form “beads.”
- Discuss the role of surfactants (optional).

Chemistry Topics
This lab supports students’ understanding of
- Physical Properties
- Surface Tension
- Observations

Time
Teacher Preparation: 10 minutes
Lesson: 45 minutes

Materials
- 1 Penny
- 2 micro pipettes (labeled)
- Plastic cup
- Liquid soap
- 1 paper towel
- Water
- Rubbing alcohol
- Vinegar or Lemon Juice
- Salt

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students should wash their hands thoroughly before leaving the lab.
- Be careful not to get the alcohol near your eyes, nose, or mouth. It is poisonous.

Teacher Notes
- I use this lab experiment as a take home lab assignment. Find out more about my take home labs in the March issue of Chemistry Solutions or in the AACT Webinar archive.
- The materials are commonly found at home, so have students to check for availability. If this is difficult, allowing students to complete the lab in the classroom before or after school is a good option.
Teachers should provide the 2 micro pipettes for students to use. You can then use this experiment as the focus of a class discussion along with a lesson on intermolecular forces and their effects on the behavior of materials.

FOR THE STUDENT

Lesson

Abe Goes Swimming

Objectives

- To determine the relative surface tension of water and alcohol.
- To compare the abilities of water and alcohol to form “beads.”
- Optional: To discuss the role of surfactants.

Safety

- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Be careful not to get the alcohol near your eyes, nose, or mouth. It is poisonous.

Materials

- 1 Penny
- 2 micro pipettes (labeled)
- Plastic cup
- Liquid soap
- 1 paper towel
- Water
- Rubbing alcohol
- Vinegar or Lemon Juice
- Salt

Hypothesis

1. Predict how many drops of water will fit on the face of the penny before spilling over. __________
2. Predict how many drops of alcohol will fit on the face of the penny before spilling over. __________

Procedure

1. Prepare a Data Table in the space below and complete it as you go (read the procedures fully so you are aware of what needs to be recorded).
2. You must clean your penny. Use a few drops of vinegar or lemon juice and a pinch of salt to scrub your penny. Rinse with fresh water and dry.
3. Place your penny “Abe” side up on the paper towel. Be sure the surface underneath is flat.
4. Get 2 small cups out: 1 with water, 1 with alcohol. Be sure you have a micro pipette for each cup.
5. Holding your pipette vertically carefully put drops of water onto the penny. Keep adding drops until the penny over flows.
6. Record the number of drops of water the penny held in your data table. Also record your observations about drop size and the liquid “bead” that was formed on the surface of the penny. Pictures are helpful if you have difficulty with descriptions. Dry your penny.
7. Repeat steps 5 & 6 with water until you have completed 3 trials.
8. Repeat steps 3-6 with rubbing alcohol. Make sure to record the % of alcohol listed on the container.
9. Calculate the average result for the 3 trials for water.
10. Calculate the average result for the 3 trials for alcohol.

Data
Create a data table to record your results and observations.

Analysis
Please show work for your averages.

1. What was the average number of drops of water the penny would hold?
2. What was the average number of drops of alcohol the penny would hold?
3. Make a graph of your results. The minimum size is 5” x 5” and you must use graph paper. It should be a bar graph and have a legend indicating which bars represent water and alcohol. Be sure to graph each trial and the average. Color is appreciated but not required. Please do not cover any of your data, analysis, calculations, etc. with the graph.

Additional Activities: Choose either Activity A or Activity B

Activity A
1. Put 5 drops of water less than the average you calculated for your penny onto the surface of your penny. Observe the size and shape of the bead. Record your observations.
2. While observing the bead, drop 1 drop of liquid soap onto the bead. Describe what happens in the space provided below.

Activity B
1. Fill the plastic cup with water (almost to the top). Use a pipette to fill the rest until the surface is “barely beaded.” Carefully float a paper clip on the surface of the water. In the space below, describe the surface of the water surrounding the paper clip.
2. While watching the paper clip, drop liquid soap into the center of the cup, 1 drop at a time. Stop when the paper clip sinks. Record any observations and also how many drops of soap were required to sink the paper clip.

Results & Description of Activity A or B results:
Conclusions

Discuss the following questions in paragraph form:

1. How did your hypothesis compare to your actual results? Were there any surprising results?

2. How did the size of the drops and the size and height of the liquid “beads” compare for the alcohol and water?

3. Based on your observations, how do you think the surface tension of water and alcohol compare to one another?

4. Based on your thoughts about surface tension and your observations, which of the 2 liquids, water or alcohol, do you think would have the fastest rate of evaporation?

5. Have your parent sign your work:

Parent Signature _________________________________ Date _____________