DIY Air Force Activities:

Breaking the Tension

Materials:

- cereal bowl
- 2 cups water
- 1 tsp pepper
- dish soap
- toothpicks (2-5)
- small bowl
- 1 cup milk
- various colors of food coloring

Bubbles are whimsical and FUN! They are like magic, floating through the air. You can get hours of entertainment blowing and chasing them trying to pop them. Have you ever wondered how the bubble is formed and holds its shape? The answer is surface tension! Surface tension is the measure of the attraction between the same molecules. The following activities will allow you to experiment with surface tension. Then you can make your own bubble solution and blow bubbles with a better understanding of the phenomena that allows them to exist.

Experiment 1: Pushing Pepper

1. Fill a bowl with water. Sprinkle some pepper on the surface.
2. Take the toothpick and dip the tip in the dish soap.
3. Put the soapy end of the toothpick in the center of the bowl. What happens to the pepper?
4. If you repeat the experiment without soap, how does this result differ?

Experiment 2: Milky Way

1. Fill a small bowl with milk. Be careful not to let it spill over the edge.
2. Add a few drops of different colored food coloring. Make an observation.
3. Take your toothpick and dip it in the dish soap. Then touch it to the surface of your milk where the food coloring drops are. What do you observe? Repeat the experiment with different types of milk (i.e. whole, 2%, 1%, skim, lactose free). Will this alter your results? Make a prediction and test your hypothesis!

Both of these experiments show the results of breaking surface tension. Water molecules like to organize and stick together. They will attempt to exclude other molecules. When the soap is added it disrupts this and breaks the surface tension. Do you notice any similarities in the results of the two experiments?

Air Force Associations:

Unlike water, oils have an extremely low surface tension, allowing them to spread easily over a surface. This makes them very difficult to clean up in the event of an oil spill catastrophe. Researchers at the Air Force Research Labs (AFRL) are using their knowledge of surface tension, in combination with nanotechnology, to create oil-repelling materials. This technology will be used to help make cleaning up oil and fuel leaks significantly easier! Similar coatings can be applied to airplane parts to help prevent the leaks from occurring in the first place! See our Magic Sand DIY for more information on nanotechnology!

Fantastic Homemade Bubbles:

When you blow a bubble, the molecules of water and soap form a thin, delicate, skin around the air to create a bubble. Soap has a hydrophilic, or water loving tail, and a hydrophobic, or water fearing, head (for more on this check out our marble print demo). To minimize energy, the soap molecules align on the inside and outside, with the water molecules in the middle like a sandwich. The surface tension of water provides the wall tension to form the bubble. This is what causes the spherical shape! A sphere minimizes that tension (lowest energy shape), which is why no matter what shape wand you use to blow the bubble, the result would be a sphere! You can test this by making different shape wands out of craft sticks and pipe cleaners.

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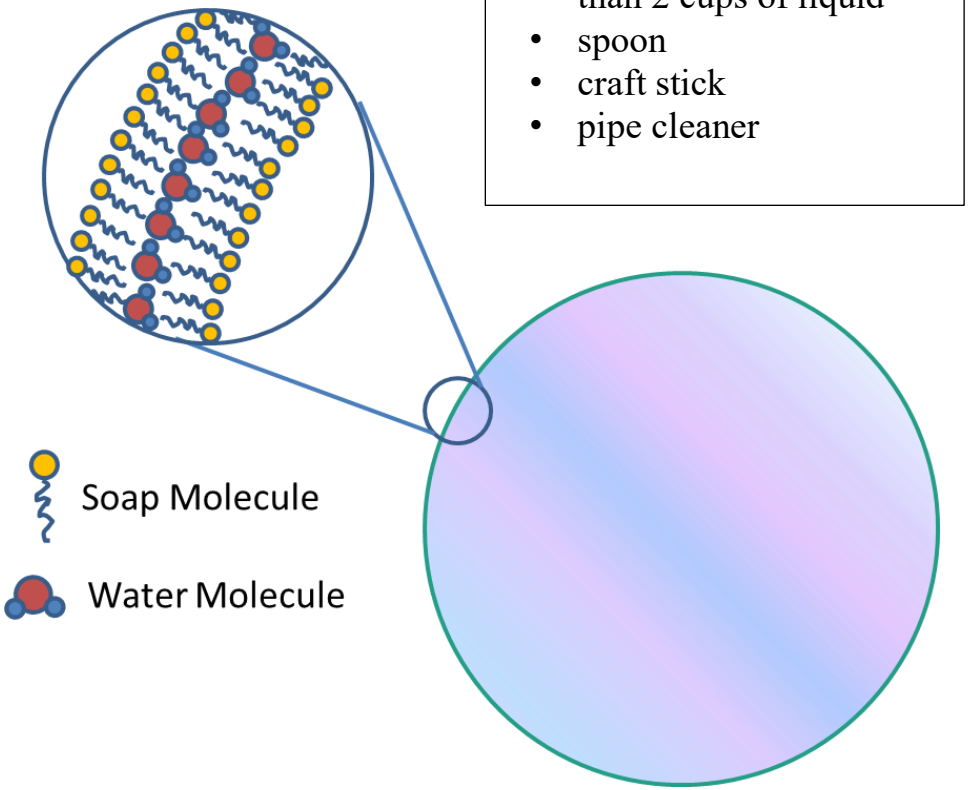

Materials:

- ½ cup dish soap
- 1 ½ cups warm water
- 2 teaspoons sugar
- large drinking glass capable of holding more than 2 cups of liquid
- spoon
- craft stick
- pipe cleaner

Bubble solution:

1. Pour 1 ½ cups of warm water into your glass. Add the 2 teaspoons of sugar. Stir with the spoon until the sugar is totally dissolved.
2. Add the ½ cup of dish soap
3. Slowly stir the solution until it is well mixed.

Bubble wand:

1. Use the templates below to form a shape with the pipe cleaner. Feel free to create your own! Just remember to leave a "tail."
2. Wrap the "tail" around one end of the craft stick. You now have a bubble wand! Enjoy blowing bubbles!