

2010 Everyday Science Questions

1. Magic Floating Pasta

Needed: Two large (tall) clear drinking glasses or jars, several pieces of dry (uncooked) spaghetti, several pieces of elbow macaroni or other odd shaped pasta, 2 tablespoons baking soda, ½ cup of vinegar, tap water.

What to do: Fill the glasses $\frac{3}{4}$ full with water. Break the spaghetti into lengths approximately 2 cm. (half inch). Place the glasses in the kitchen sink (They may foam over.) Put about a dozen pieces of spaghetti into one glass and about a dozen of the odd shaped pasta into other glass. A) Observe what happen in each glass. B) Add a tablespoon of baking soda to each glass, stir and observe what happens. C) Next, add 1/4 cup of vinegar to each glass and observe what happens.

Answer: A) The pasta in each glass: Rises to the surface **X Stays on the bottom** Rises and sinks

B) The pasta in each glass: Rises to the surface **X Stays on the bottom** Rises and sinks

C) The pasta in each glass: Rises to the surface Stays on the bottom **X Rises and sinks**

D) Which rise and sink longer: The spaghetti pieces **X The odd shaped pieces**

Explanation: The combination of baking soda and vinegar produce a gas (carbon dioxide). The gas clings to the pasta pieces as bubbles and causes them to rise. When the pieces reach the surface the gas escapes into the atmosphere and the pieces sink. The odd shaped pieces have a larger surface area and, therefore, trap more bubbles and hold them longer causing them to rise and sink longer than the spaghetti.

2. Holes, but no Leaks

Needed: Zip-closed plastic food bag, several pencils (round pencils work better than six sided ones), pencil sharpener, paper towels, tap water.

What to do: Sharpen the pencils. Fill plastic bag half full of water and close it. Hold the bag over the kitchen sink and quickly puncture the bag all the way through both sides with a pencil. Leave the pencil sticking through the bag. Stick more pencils through the bag.

Answer: The bag tore and the water spilled out. **X The bag did not tear and no water leaked out.**

Explanation: The bag did not burst or leak because it is made of plastic molecules that form long chains. The bag is flexible because the molecule chains can flex and bend. The pencils push these long chains aside but then the chains pull together again tightly sealing the plastic against the pencil and thereby preventing leaking.

3. Nervous Colors

Needed: Food coloring, lukewarm milk, several bowls, dishwashing detergent, several Q-tip cotton swabs.

What to do: Put some lukewarm milk to the depth of about 2 cm. (half-inch) in the bowl. Place a drop of food coloring in the center of the milk. Dip the Q-tip into the dishwashing detergent. Then dip the Q-tip into the center of the food coloring patch on the milk. Observe what happens. Try it with different colors.

Answer: A. Nothing happened. **X The food coloring quickly spread away from the Q-tip.**

B. Did all the colors react the same way? **X Yes.** No.

Explanation: Look at a drop of water on a piece of aluminum foil and see how it retains a “sausage shape.” The “skin” is called surface tension. The detergent destroys the surface

tension at the point it touches. Surface tension remains on the rest of the milk surface and this surface tension pulls the food coloring towards the side of the bowl.

4. Blowback

Needed: Empty narrow necked plastic soda or water bottle, a piece of paper about 8 cm. (2 inches) square.

What to do: Wad the paper up into a small ball. Place the bottle on its side. Hold the bottle still so you don't blow it away. Place the wad of paper just inside the mouth of the bottle. Try to blow the wad of paper into the bottle. Observe what happens to the wad of paper.

Ans. The wad of paper: Goes into the bottle. **X Flies out of the bottle.**

Explanation: Before you blew into the bottle the air pressure was the same inside and outside of the bottle. When you blew into the bottle the air pressure within the bottle increases and caused the wad of paper to fly out.

5. Dissolve Some Sugar

Needed: Two clear glasses, sugar, measuring spoon, hot tap water, cold (refrigerated) water.

What to do: Fill one glass with cold water and allow it to cool a few hours in the refrigerator. When the cold water is ready place it on the kitchen counter and fill the other glass with hot water from the tap. Slowly add measured teaspoons of sugar to each glass and stir. Keep adding more sugar to each glass until the sugar will no longer dissolve and just sinks to the bottom. **Take note of the amount of sugar that can be dissolved in each glass.**

Ans. Which dissolved the most sugar: Cold water. **X Hot water.**

Explanation: Heat speeds up the electrons of the H₂O (water) molecules and permits the sugar molecules to dissolve more rapidly. This is not a chemical reaction. The sugar molecules have not changed.

6. Yummy Cold Stuff

Needed: One 1 pint Ziplock bag, one 1 gallon Ziplock bag, 1 tablespoon sugar, ½ cup milk, ¼ teaspoon vanilla, ½ cup of salt, a bowl, a coffee can or other large can or jar that has a lid.

What to do: Mix the milk, sugar and vanilla in the bowl. Pour the mixture into the 1 pint Ziplock bag and seal it carefully. Place a gallon size Ziplock bag inside a coffee can. Put the small Ziplock bag in the can or jar and pack ice around it. Sprinkle the salt onto the ice and close the lid. Shake vigorously for about 5 minutes. Take the small Ziplock bag out of the can and bag of ice, and taste the contents.

Ans: What did you just make? **Ice Cream**

Explanation: This is a lesson in thermodynamics: For ice to melt, it has to get heat from something. In our ice cream project, it gets the heat from the ice cream mixture. When the ice is melting, it is at 0 degrees Celsius (32 degrees Fahrenheit). But when ice is melting, it can only barely cool something to the freezing point of water. So, we need to do something to make it much colder than that, since our ice cream mixture freezes at a lower temperature than water. The ice cream freezes because the salt and the ice mix to make a substance with a lower freezing point than ice alone. This means that the ice and salt mixture must get even more heat from somewhere in order to melt. Salty water freezes at a lower temperature than plain water. But the ice is made of plain water, so it melts at 0 degrees Celsius. Since the ice keeps melting, but the water no longer freezes (because there is only salt water, which doesn't freeze at 0 degrees), the temperature goes down.

The heat gained by the ice as it melts is no longer offset by the heat given up by freezing water (since the water is no longer freezing back onto the ice). The heat gain has to come from somewhere else. It comes from the ice cream mixture which freezes.

When people put salt on the ice on a sidewalk or a road, the ice mixes with the salt, and the mixture of the two solids (ice and salt) produces a liquid, but the sidewalk actually gets colder than it was before.

Now wasn't that a fun lesson?

7. The Falling Ruler – How Fast are Your Fingers?

Needed: A flat 12 inch ruler and a partner

What to do: Have your partner dangle the ruler by holding it at the twelve inch mark. Hold your index finger and thumb about 4 cm. (1 inch) apart down at the lower end of the ruler and be prepared to pinch the ruler between your fingers together to stop it from falling. When you are both ready, your partner is let go of the end of the ruler. Your task is to pinch your thumb and finger together on the falling ruler to stop it from falling to the floor. Try three times and record the points on the ruler at which you pinched the ruler.

Ans.: First try: _____ inch mark , Second try: _____ inch mark , Third: try: _____ inch mark

Explanation: time. **The ruler may fall faster than your reaction time. Everyone has a different reaction time.**

8. The Soap Powered Boat

Needed: A 3" X 5" card, scissors, liquid hand soap or dishwashing detergent, a sink or bath tub of water about 20 cm. (5 inches) deep.

What to do: At a point about 2 cm. (half inch) from one end of the card cut a slot about 1 cm. (1/4 inch) by about 4 cm. (1 inch). Make sure the card is perfectly flat. Carefully place the card on the surface of the water. Put a drop of liquid soap in the slot. Observe the motion of the "boat."

Ans.: The boat: Stayed in the same place. **X Was propelled along by the soap.**

Explanation: **The detergent breaks the surface tension of the water and propels the boat along.**

9. The Naked Egg

Needed: One raw egg in the shell, a clear glass that the egg will fit into, vinegar.

What to do: Carefully place the egg in the empty glass being careful not to crack the shell. Fill the glass with vinegar to cover the egg (the egg may float a bit). Observe the egg in the vinegar. Leave the egg in the vinegar for 72 hours occasionally turning it over. Be careful not to break it. After 72 hours observe the "shell" and note whether the egg is larger or smaller in diameter.

Ans.: After 72 hours: A. **X The shell was gone and the egg was soft.** The shell had not changed.

B. The diameter of the egg was smaller. The diameter of the egg was the same as with the shell on. **X The diameter of the egg was larger.**

Explanation: **The shell of the egg is made of calcium carbonate, which is a base. Vinegar is an acid. It reacts with the calcium carbonate causing it to dissolve. The tiny bubbles rising from the shell are carbon dioxide. The membrane under the shell is not calcium carbonate and does not dissolve. The egg increases in size because of osmosis, which is the movement**

of water through a membrane. Osmosis causes water to move through a membrane from a place with fewer molecules to a place with more molecules. The egg has more dissolved materials than the vinegar, so the water flows through the membrane into the egg causing it to swell.

10. The Shrinking Naked Egg

Needed: The naked egg from Experiment 9 above, a clear glass that the egg will fit into, clear corn syrup.

What to do: Carefully place the naked egg in the empty glass being careful not to break it. Fill the glass with syrup to cover the egg (the egg will float a bit). Leave the egg in the vinegar for 72 hours occasionally turning it over. Be careful not to break it. After 72 hours observe whether the egg is larger or smaller in diameter.

Ans.: After 72 hours: A. **X The egg had shrunk.** The diameter of the egg was the same as before. The diameter of the egg was larger.

Explanation: Osmosis causes the naked egg to shrink. The syrup has more dissolved molecules than the water filled egg. This causes the liquid inside the egg to flow through the membrane into the vinegar and the egg shrinks.