2011 Science Treasure Hunt

Everyday Science Questions with Answers

1. The egg submarine
Needed: An egg (raw or hard boiled), a container of salt, a clear glass container, tap water.
What to do: Half fill the container with water. Place the egg in the water and observe the level where it stays. Remove the egg and add salt to the water until no more salt can dissolve. Place the egg in the salty water and observe the level where it stays.
Explanation: The specific gravity (density) of the egg is just slightly greater than that of tap water, so initially it will sink. As you add salt the specific gravity of the water increases. When the specific gravity of the egg and water are the same the egg will begin to rise from the bottom of the container. If more salt is added it may even float.

2. Salty sinking water
Needed: A transparent two cup measure (such as Pyrex), a small drinking glass, salt, food coloring, tap water.
What to do: Fill the two cup measure to about 1½ cups full. Fill the glass to about ½ full and add salt to the water until no more will dissolve, then add food coloring (any color). Slowly and carefully pour a small amount of the colored salty water into the ordinary tap water. Don't splash. Try to pour it down the side of the container. Observe for a minute or two. What happens to the colored salty water?
Explanation: This experiment, as with Experiment 1 above, has to do with specific gravities. The salty water has a higher specific gravity than the tap water so it will sink to the bottom of the container while the clear tap water remains on the top.

3. Is that egg hard boiled?
Needed: Two eggs.
What to do: Leave one egg raw. Hard boil the other egg. Hold each egg in a vertical position and try to spin it like a top.
Explanation: The raw egg will wobble and not spin. This is because the yoke inside moves around due to the motion. This upsets the balance of the egg and will prevent the egg from spinning. When the egg is hard boiled both the yoke and the albumen (white) are solid and, therefore, the egg can be spun like a wooden top.

4. **Blow that card over – or at least try**
Needed: A playing card or 3" X 5" card.
What to do: Lay the card on a table or counter. Try to turn the card over by blowing at the edge of the card
Explanation: The card is hard to blow over because the air passing under it is traveling at the same velocity (speed) as the air passing over the card. This means that there is no force to turn the card over. If the card was shaped like an airplane wing (with a curve on the top and a flat bottom) the "Bernoulli effect" would tend to lift the card up like an airplane wing and perhaps flip it over. The shape of an airplane wing is such that air flowing over the top of the wing must travel faster than the air flowing under the wing, so there is less pressure on the top than on the bottom, resulting in "lift". The card may press more firmly on the table surface, or it may flap up and down. (Suggestion look up Bernoulli effect on the Web.)

5. Water brimmeth over – but not spilleth
Needed: A water glass, some coins, salt, a flat bottom baking pan, tap water.
What to do: Place the baking pan on the kitchen counter. Be sure it is on a perfectly flat surface. Place the glass in the pan and fill the glass to the very brim. Now slide coins carefully into the glass one after another until a meniscus (dome of water) protrudes above the rim of the glass.
Explanation: The **meniscus** is the curve in the upper surface of a standing body of liquid. A meniscus can be either convex or concave. The meniscus formed in a vessel of water is concave. It which occurs

when the molecules of the liquid (water in this case) are attracted to those of the container. This causes the surface of the liquid to cave downwards. A convex meniscus occurs when the molecules have a stronger attraction to each other (cohesion) than to the material of the container (adhesion). This may be seen between mercury and glass in barometers and thermometers.

6. A Bright and Beautiful Egg
Needed: A small bowl or large cup, a hard boiled egg, food coloring, vinegar, tap water.
What to do: Place the egg in the cup or bowl and add water to just cover it. Add about ten drops of food coloring to the water. After about five minutes remove the egg and observe the color. Then place the egg back in the colored water and add about four tablespoons of vinegar. After several minutes remove the egg and observe the color.
Explanation: The egg shell is primarily calcium carbonate which is a base (as compared to an acid). The dye is neutral and is not strongly attracted to the egg shell. The addition of vinegar turns the dye slightly acidic. The acidic vinegar in contact with the basic egg shell turns the surface of the shell into a salt the color of the acidic dye. (Note: whenever an acid and a base are come together a compound called a "salt" is produced.)

7. Floating Liquids
Needed: Syrup, cool tap water, cooking oil, a clear drinking glass
What to do: Pour syrup into the glass to a depth of about one-inch. Next, add water to about the same depth. Finally, slowly pour in cooking oil to about the same depth. Observe the layers of liquid in the glass. (For extra fun, now add several drops of food coloring.)
Explanation: Back to our discussion of the specific gravity of liquids (Experiment 2 above). You will find the three liquids stratify with oil on top, water in the middle and the syrup on the bottom according to their relative specific gravities.

8. How to keep the heat in.
(Caution: requires adult supervision- boiling water)
Needed: Two identical cups, a saucer or another cover for one of the cups, tap water, a pan in which to boil the water.
What to do: Boil the water and fill both cups about three-quarters full. Cover one cup and leave the other uncovered. In fifteen minutes feel the temperature of the water in each cup.
Explanation: The water in the cup with the cover will be warmer. The water without the cover loses heat from convection of the air. The covered cup retains the heat. (Note: there are three ways to convey heat: convection, radiation and conduction. This is a fun subject to look up on the Web.)

9. Collapse that bottle
Needed: A plastic drink bottle, hot tap water, a space in your refrigerator or freezer.
What to do: Fill the bottle with hot water and let it set for a minute. Then, empty the water from the bottle and tightly cap it. Place the warm bottle in the refrigerator for an hour.
Explanation: Thermal energy (heat) causes air, as with most substances, to expand. When placed in the refrigerator the air cools and reduces its volume (shrinks). The reduced volume of the air causes the bottle to collapse.

10. How fat is that food?
Needed: Several sheets of paper, various bits or drops of food (suggestions: butter, peanut butter, honey, mayonnaise, mustard, ketchup, yogurt, lemon juice, others – at least six).
What to do: Make six circles on each sheet of paper. Drip or rub a bit of each food onto each of the circles and label each one. The water in each will make a circle that will evaporate in a few hours, but the oil in each will remain on the paper. Observe them a few hours after the water has evaporated.
Explanation: The greater the quantity of fat in each specific food will cause a stain on the paper proportional to the amount of fat.

2011 Science Treasure Hunt Official Answer Form

Please check one for each questions

1. In fresh water the egg:

A. ❑ Floated on the surface

❑ Sank to the bottom of the container.

❑ Sank only a ways into the water and remained suspended

In salty water the egg:

B. ❑ Floated on the surface

❑ Sank to the bottom of the container

❑ Sank only a ways in the salty water & remained suspended

2. The colored salty water:

❑ Just mixed with the ordinary water

❑ Stayed on top of the ordinary water

❑ Went to the bottom of the ordinary water

3. The raw egg:

A. ❑ Could be spun like a top

❑ Could not be spun.

The hardboiled egg:

B. ❑ Could be spun like a top

❑ Could not be spun

4. Blow that card over

❑ The card flipped over

❑ The card just flopped up and down

❑ The card held more tightly to the table surface

5. I could see the meniscus

❑ Yes ❑ No

6. **Which time was the egg more brightly colored?**

❑Without the vinegar

❑With the vinegar

7. Which liquid is:

on the top? ❑ Oil ❑ Water ❑ Syrup

on the bottom? ❑ Oil ❑ Water ❑ Syrup

in the middle? ❑ Oil ❑ Water ❑ Syrup

8. Which cup has the warmer water?

❑ The covered cup

❑ The uncovered cup

9. Upon being removed the bottle

❑ it had swelled up

❑ it had stayed as it was before

❑ it had collapsed

10. List below each of six foods you used and indicate the amount of fat you feel each has:

❑ None ❑ Some ❑ Quite a bit.

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(Fill in your answers on Pages C- 4 & C-5)

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