WHAT HAPPENS WHEN SALTY WATER IS LEFT IN THE OPEN AIR?

What you need: A colored plastic plate, several strong water mixtures: e.g salt, Epsom Salts, sugar, baking soda, juice, very strong tea, coffee, in plastic cups, a straw or dropper in each one of four mixtures, tape and pen/pencil, a magnifying glass.

What you do:

• Choose which of the four mixtures you will use.

• Get four small pieces of tape for labels, write your four choices, one on each, and place them on the evenly around the edge of the plastic plate.

• Using the dedicated dropper, put one or two drops of each mixture on the plate in front of each label.

• Carefully, so as not to mix the drops, put the plate on a table in a warm sunny spot to be left for a couple of hours or so.

• Look at the drops again after a good while; use a magnifying glass to see better.

• Compare the dried-up drops with the original solids.

[Modifications: use larger drops and leave overnight]

What you see and notice:

How to explain what was going on:

1. We could not see the materials that were mixed/dissolved in the water; the solids broke up into the tiniest pieces – so tiny that we can not see them at all. They are scattered throughout the water in the cups.
2. After a little time, the water has disappeared from the drops. The water has gone somewhere and left the solid that was dissolved in it behind.
3. There really is only one place the water could have gone, and that is into the air; But we don't see water jumping up into the air; so, tiny tiny pieces of water must have jumped out of the drop and up into the air.
4. The left-behind solid looks different from the original ones. As the tiny pieces of water jumped up into the air, the extremely tiny pieces of the solid begin to find themselves and are attracted to each other in special ways so they build tiny castles on the plate.

HOW MANY DROPS OF WATER CAN WE GET ON A PENNY?

What you need:
A penny, a dropper, a cup of water, paper towels

What you do:
• Predict how many drops of water you think you can put on the penny before it all runs off.
• Put the penny close to the edge of the table. Carefully put one drop of water at a time on to the top of the penny: count each one. It's best to hold the dropper very close to the water on the penny so the next drop of water doesn't fall with too big a plop, but not too close so that it touches the water on the penny.
• Bend down to look at the penny at eye level, so you can see what the water looks like as it collects on the penny.
• Keep going until you think it can't hold any more, or until the water runs off.

What you see and notice:

How to explain what was going on:

1. The amount of water on the penny is a surprise – the water should have run off earlier.
2. Gravity doesn't turn off so it was pulling the water down. We can say that something was counteracting gravity, something was holding the water up on the penny preventing it from falling.
3. There was nothing touching the water; it must have been holding itself up, holding on to itself really tightly.
4. Kind of like magnets hold onto themselves tightly, we think that water is made of tiny bits (that we can't see) that are very attracted to themselves.

CAN YOU PUT MORE WATER IN A TUBE WHEN A TUBE IS FULL ?

What you need: A small glass tube, a lump of clay, a dropper, a cup of-water, paper towels.

What you do:

• Stand the tube up securely by jamming it into a blob of clay; make sure that the tube is truly vertical.

• Now, carefully pour water from the plastic cup into the tube all the way to the top.

• Fill the dropper with water and, holding the tip of the dropper very close to the top of the water in the tube but not touching it, squeeze out water drops one at a time into the tube. Work at eye level; you don't want the water drop to fall heavily on the surface from too far away, nor do you want to disturb the surface by inadvertently touching it with the dropper.

What you see and notice:

How to explain what was going on:

1. The amount of water on the top of the tube is a surprise – the muffin top shape of the water is really showing us that it should have fallen off earlier.
2. Gravity doesn't turn off; so it was definitely pulling the water down. We can say that something was counteracting gravity, something was holding the water up on the tube preventing it from falling.
3. There was nothing touching the water; it must have been holding itself up, holding on to itself really tightly.
4. Kind of like magnets hold onto themselves tightly, we think that water is made of tiny bits (that we can't see) that are very attracted to themselves. The tiny bits of water hold onto each other so tightly that they will not fall when they should.

EXPLORING FLOATING PEPPER GRAINS

What you need:
A plastic Petri dish or Tupperware, dropper, toothpick, liquid soap

What you do:
Put water into the Petri dish/Tupperware, to almost fill it. Let it sit for a minute or so to let it become still. Shake a little black pepper on to the middle of the water in sort-of one shake then another then another. Notice what the pepper grains do.
Now dip a toothpick into the soapy solution and touch the soapy end to the surface of the water. Watch what the pepper grains do, at first and then a little later.

What you see and notice:

How to explain what was going on.

1. First we see the pepper grains staying on the top of the water and they move around until they are evenly spaced out.
2. The water moved them around; maybe it has something to do with the attractions that water has.
3. When the soap touches the water, it hurled the grains as far away as possible.
4. Then the grains began to sink, so the water couldn't hold them up anymore.
5. The soap did something to the water that changed its ability to hold the grains up and to spread them apart.
6. The soap attracted the water to itself so greatly that the pepper flakes just are pushed out of the way.

INVESTIGATING THE WAYS IN WHICH WATER HOLDS ONTO ITSELF.

What you need:
Black plastic bag, piece of glass, newly soap-washed surface, classic formica table surface [or a new bamboo board surface], glass of water, plastic dropper.

What you do:
• On each surface, using the dropper vertically, make a very tight circle of 6-8 drops of water. Try not to bump the surface; just watch what they do. On the bamboo board you may have to watch for a good minute.

• On the plastic bag, take a straw and blow the drops about, use your dropper to drag the drops, and play etc.

What you see and notice:

How to explain what is going on:

1. On some surfaces the water holds itself in a tight, almost perfect sphere shape, trying its best not to be in contact with the surface. It is both strongly attracted to itself and strongly repelled by the surface.
2. On some surfaces the water just oozes along the surface and doesn't hold itself together much at all, it tries its best to be in contact with the surface as possible. The attraction between the surface and the water is stronger than the attraction of the water to itself.
3. On some surfaces when the water is holding itself almost like a bead, it will all of a sudden jump across the space between the drops and make a double sized drop. That the water jumps across space is powerful evidence that water is attracted to itself.

EXPLORING AN ALUMINUM FOIL BOAT WITH A CARGO OF PENNIES

What you need: A square of aluminum foil sort-of 6 x 4 inches.
A largish bowl to float the boat in.
Several pennies.

What you do:

1. Fold the foil in half once and flatten well. Then fashion it into a row-boat shape.
2. Put the boat into the tub/bowl of water and work with it until it floats upright; if necessary put a penny in the bottom of the boat to stabilize it.
3. Add one penny at a time, into the center of the boat, carefully and look for two things, a) how many pennies will it hold before sinking, and
   b) how big a wall of water you can make at the side of the boat as it sinks lower and lower

What you see and notice:

How to explain what is going on:

1. The water seems to get a skin on the top that doesn't burst for a long time, and that holds up the boat. It is the tiny pieces of water holding onto themselves so tightly that they do not give way until the force/weight against them becomes too strong.
2. Some call this "phantom skin" by a special scientific name; they call it ***Surface Tension***

HOW DOES WATER CHANGE WHEN IT GETS HOT?

What you need:
Ice cold water in a clear glass
Hot water in a clear glass
Food coloring – 2 colors

What you do:
- Put some ice cold water in one glass, and some hot water in the other glass and put them near the edge of a table.
- Leave to stand for several minutes so the water becomes still and isn't still swirling from being poured. Don't move the glass again.
- Hold one of the food colorings about 6-8 inches above one of the glasses and drop one drop of food coloring into the glass; as quickly as possible repeat with the other glass.
- Watch what happens for a few minutes.
- Now add one drop of the other color to each glass.

What out see and notice:

How to explain what was going on:
1. We see the food coloring has moved around more quickly and completely in the hot water.
2. It didn't just drop to the bottom of the glass; so something must be pushing it about.
3. Since we didn't shake or move the glass, the water must be moving the food coloring around.
4. So water is always on the move, and it moves faster and more strongly when it is hot.

DOES HOT WATER HAVE BITS THAT JUMP OUT OF IT?

What you need: An empty 2 liter plastic bottle with cap, some hot water [coffee maker temperature making some steam]

What you do:
- Pour about half a cup of water into the plastic bottle.
- Watch the steam rise out of the bottle for a minute or so ... don't wait too long.
- Quickly pour out the water and put the cap on tightly.
- Leave it to stand, by a cold window would be great, to cool down.

What you see and notice:

How to explain what was going on:

1. Something clearly pushed in the sides of the bottle and it wasn't us.
2. The only thing touching the bottle sides was air.
3. The air must have pushed the bottle in.
4. Why did the air do that, when it doesn't usually squash an empty bottle. Usually there is air inside the bottle as well as outside the bottle.
5. We didn't change the air on the outside of the bottle in any way, but we did change the air inside it the bottle. We put some hot water into it for a little while and we saw bits of water escaping from the bottle as steam. As the steam pushed upwards to get out of the bottle it pushed some of the air that was inside the bottle up ahead of it and pushed the air out. The we put the cap back on and prevented any air from getting back into the bottle; so, in the end when everything had cooled down, the air outside was touching the bottle sides but very little air was touching the bottle on the inside.
6. We have shown two things: a. that tiny pieces of hot water jumped out of the water up into the air and moved up and out of the bottle pushing air ahead of it, and b. that air can push really hard!