WONDERFUL WATER

EXPLORATIONS IN CHEMISTRY
FOR GRADES 1 TO 3

This booklet has been designed to introduce children to the science of water in a relaxed and fun way. The target group is grades 1 to 3, although most of the activities will also spark the interests of older children.

The activities have all been selected to introduce scientific concepts, and allow discovery through observation and explanation. It is hoped that they will encourage wonder and curiosity about the world around us. These activities can be enhanced by encouraging children to record observations in a science journal.

The central material in all of the experiments is water. You and your students are sure to be surprised that such an everyday liquid can have so many exciting properties.

Each activity has been coded for use with individuals, small groups or for demonstration in a large class setting. This is to help the teacher to determine the supply requirements for the class. The "needs list" for each experiment reflects the requirements for one set-up (individual, group or demonstration) of each experiment.

Teachers may not be the only ones who find this booklet useful. It may be helpful to parents, those leading activity clubs (Brownies, Beavers, 4-H, etc.) and anyone else who wishes to interest others in science.

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Have fun!

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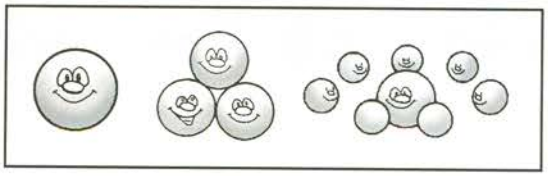
ICE FISHING



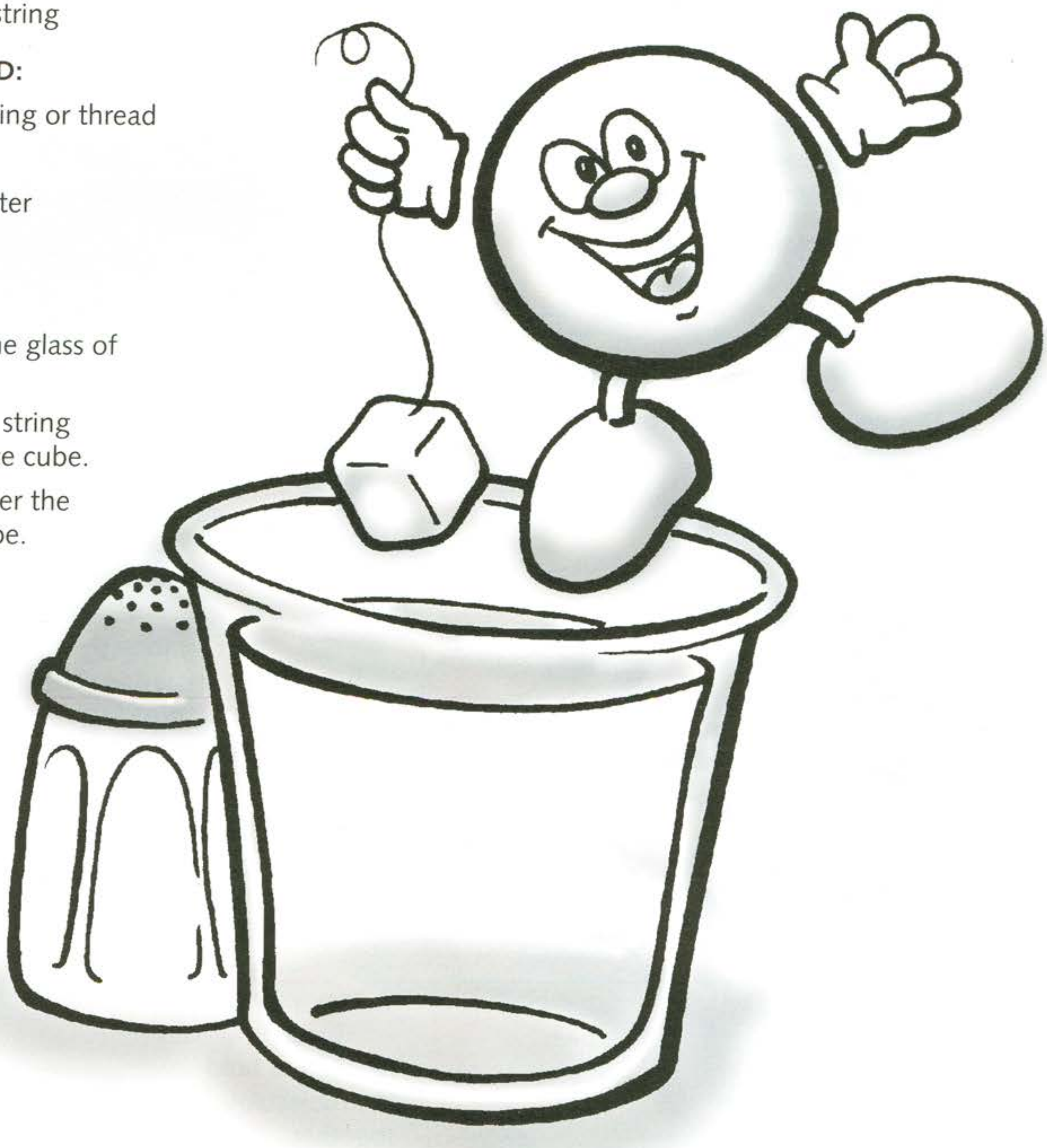
THE AIM: to lift an ice cube out of a glass of water using a piece of string

WHAT YOU WILL NEED:

- ❑ 15 cm piece of string or thread
- ❑ table salt
- ❑ 1 glass of cold water
- ❑ 1 ice cube

WHAT TO DO:

1. Put the ice cube in the glass of water.
2. Place one end of the string over the top of the ice cube.
3. Sprinkle some salt over the string and the ice cube.
4. Count slowly to ten.
5. Gently lift the ice cube out of the water.



Salt makes ice melt, and the string can sink into the ice cube a little. Because the ice is still cold it freezes again, trapping the string. This allows the ice cube to be lifted out of the glass of water by the string. This all happens very quickly.

Salt melts ice. This is why we put salt on the sidewalks in the winter.

THE THREE FACES OF WATER

SUPER SNOWFLAKES

THE AIM: to demonstrate what the smallest particle of water looks like and to use this to show how snowflakes are made

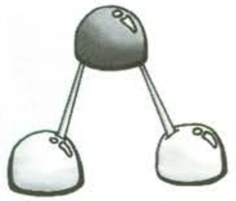
The smallest piece of water that is still water is called a water molecule. A water molecule is made up of one oxygen atom and two hydrogen atoms. In a glass of water there are about 10,000,000,000,000,000,000,000,000 water molecules. You would need a very special type of microscope to see an individual water molecule.

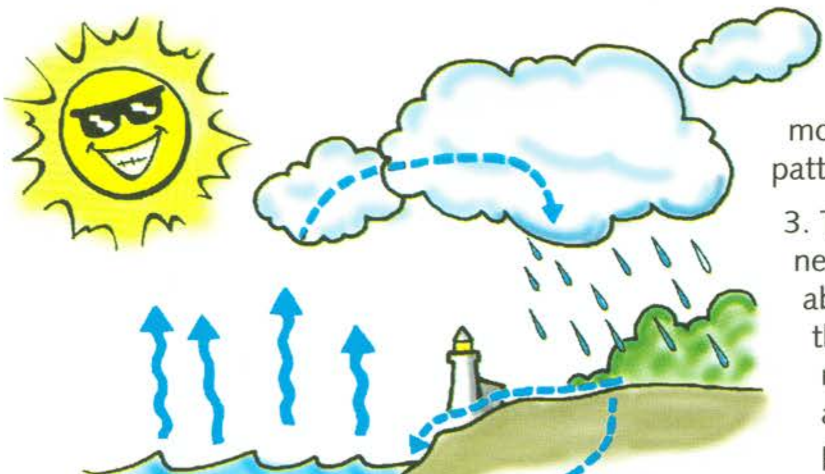
WHAT YOU WILL NEED:

- ❑ different colored gum drops (or colored marshmallows)
- ❑ toothpicks

WHAT TO DO:

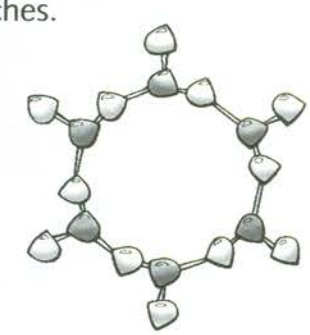
1. Designate one color to be a hydrogen atom and another color to be an oxygen atom.
2. Encourage the children to use the gum drops and toothpicks to make model water molecules, with one oxygen "atom" attached to two hydrogen "atoms". A picture of a model water molecule is shown here.





Snowflakes are made up of water molecules that arrange themselves in a very special way. Each snowflake has six points because the molecules "hold hands" in this six-sided pattern to give six identical branches.

3. To make snowflakes you will need the same materials listed above. It would be best to let the children make six water molecules and then arrange them in the pattern shown here. Toothpicks can be used to hold the molecules together.

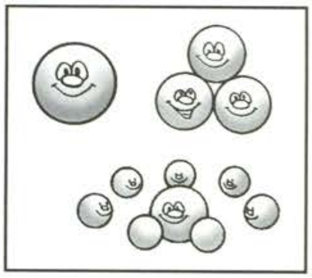


Water is always changing from the liquid form to the gas form and back again. Most evaporation takes place from large bodies of water around us like rivers, lakes and oceans. When water changes back from the gas form into the liquid form the process is called <u>condensation</u>. You can see condensation when you breathe on a mirror, or on the outside of a glass of ice water. Water vapour in the air can condense and fall as rain or snow. This is nature's water cycle.

To make a six-pointed snowflake model out of paper see page 13.

Water molecules in snow and ice will not pack together as tightly as they do in liquid water. To show this, take a number of model snowflakes and stack them up. Compare this pile with a pile made of the same number of model liquid water molecules. (For example, use 10 model snowflakes and 60 model liquid water molecules.) For the same number of water molecules, liquid water takes up less space than snow or ice. This is why ice cubes float.

EVAPORATION IN ACTION



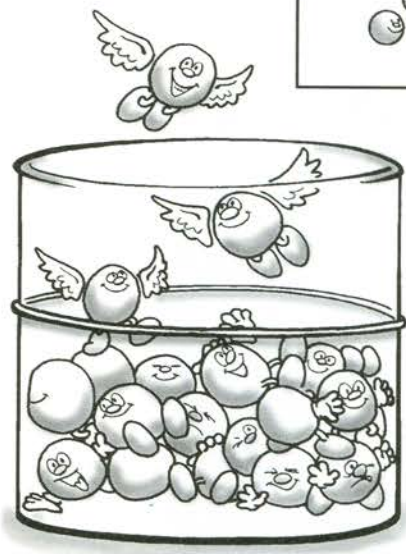
THE AIM: to observe the process of evaporation

WHAT YOU WILL NEED:

- ❑ 1 clear glass
- ❑ 1 rubber band

WHAT TO DO:

1. Fill the glass almost full with water.
2. Use the rubber band to mark the water level.
3. Place the glass of water on a window ledge and check it each day, observing the water level compared with the position of the rubber band.

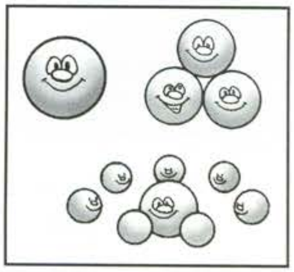


Another way to demonstrate evaporation is to put water on two separate sheets of construction paper. Let one sit undisturbed and fan the second one with a piece of cardboard. Notice the results.

Evaporation is the change from the liquid form to the vapour (gaseous) form. The water molecules are still there when the water evaporates, but they are now gas molecules in the air, not in the glass. Evaporation takes place faster when air is in motion.

Heating water causes it to boil (at 100°C) and evaporate. The cloud you see coming out of the kettle is condensation (water droplets) from the water vapour.

EXPANSION ON FREEZING



THE AIM: to show that water expands when it is frozen

WHAT YOU WILL NEED:

- ❑ 1 clear film canister or other small, clear plastic container
- ❑ water
- ❑ freezer
- ❑ 1 rubber band

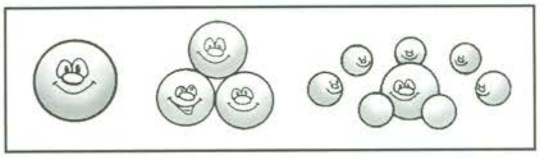
WHAT TO DO:

1. Fill the film canister with water until it is about 1/2 cm from the top.
2. Place the rubber band on the outside of the container at the top of the water level.
3. Place the film canister in the freezer.
4. When the water is frozen remove the film canister from the freezer.
5. Encourage observations.

When water freezes the distance between the water molecules gets a little larger and this causes the water to expand. Because frozen water has more space between its molecules than liquid water has, frozen water (ice) floats in liquid water. This is why ice cubes float.

SINK OR FLOAT?

AMAZING ICE



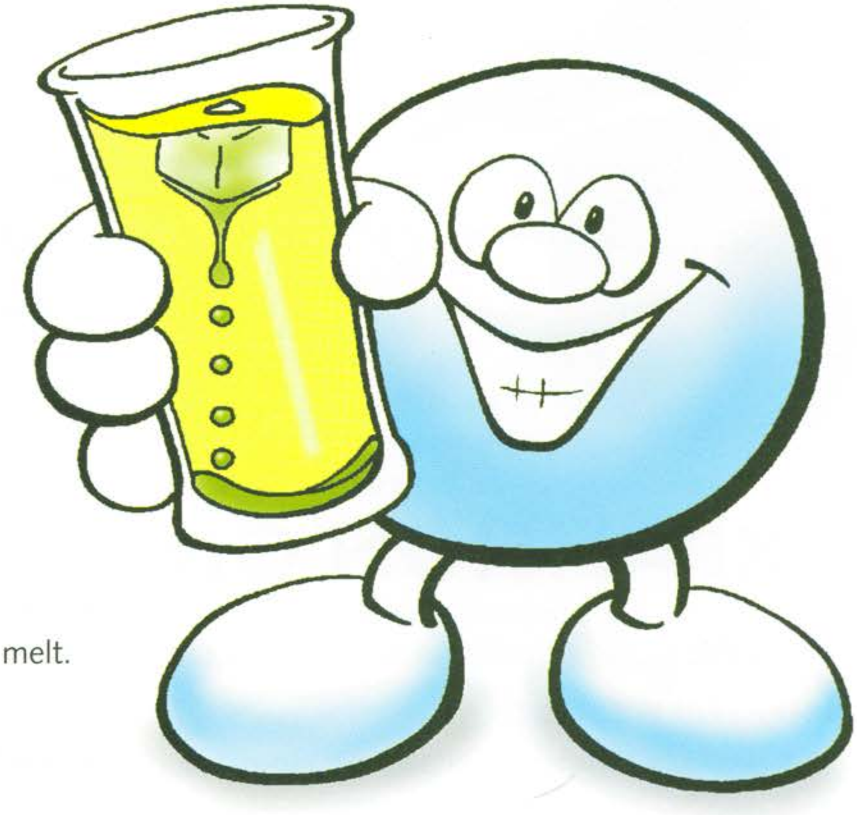
THE AIM: to examine what happens to the floating and sinking properties of water as it changes from a solid to a liquid in oil

WHAT YOU WILL NEED:

- ❑ 1 tall drinking glass
- ❑ water
- ❑ cooking oil
- ❑ freezer
- ❑ ice cube tray
- ❑ food colouring

WHAT TO DO:

1. Add food colouring to the water in the ice cube tray. One ice cube per glass is all that is needed.
2. After the ice cubes are frozen fill the glass $^3/_4$ full with cooking oil.
3. Gently place the ice cube in the oil.
4. Watch what happens as the ice starts to melt.
5. Encourage observations.

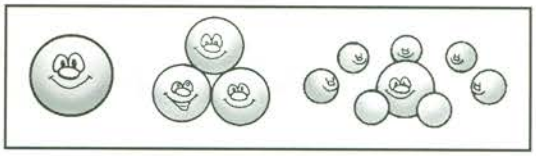


We saw in the experiment Expansion on Freezing that ice takes up more space than water. This is why ice floats in a glass of water. Here the ice floats on the oil and the denser liquid water drops sink to the bottom.

Notice that water and oil do not mix together.

The ice cube will appear larger in the oil because the oil in the curved glass acts as a magnifier.

GUESSING GAME



THE AIM: to demonstrate the difference between objects that sink and float

WHAT YOU WILL NEED:

- ❑ objects that will sink in water as well as objects that will float

  some suggestions:

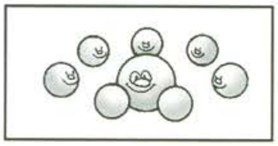
  - aluminum foil ball
  - aluminum foil boat
  - buttons
  - pumice stone (e.g. from stone-washed jeans)
  - plastic cap from a bottle
  - clay boat
  - chalk
  - clay ball
  - rock
- ❑ water table or large shallow bucket
- ❑ water

WHAT TO DO:

1. Ask the children to guess which objects will sink or float.
2. Place the objects in the water.
3. Make observations.

If they are the same size, heavier objects sink and lighter objects float. The pumice stone floats because it is full of tiny air bubbles. This is what makes it very different from other rocks. Air trapped in ducklings' feathers helps them float.

HOT SIPS



THE AIM: to observe hot water rise in cold water

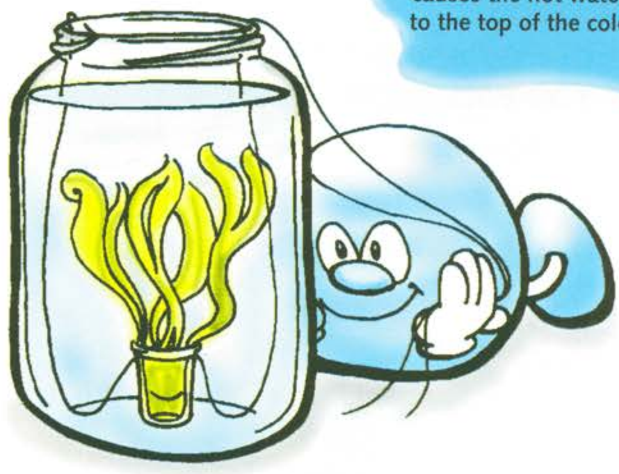
WHAT YOU WILL NEED:

- ❑ 30 cm of string
- ❑ 1 small bottle
- ❑ 1 large jar
- ❑ food colouring

WHAT TO DO:

1. Tie the string around the neck of the small bottle.
2. Fill the large jar with cold tap water.
3. Fill the small jar with hot water and add a few drops of food colouring.
4. Use the string to carefully lower the small jar into the larger jar.
5. Make observations.

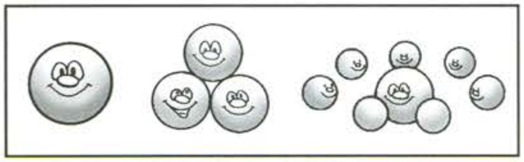
Hot water weighs less than cold water, for equal volumes. This is what causes the hot water to rise to the top of the cold water.



This experiment can also be done using cold water both in the large and small jars. Another variation is to reverse the first experiment by using warm water in the large jar and cold water in the small jar. The water in the small jar should be coloured with food colour in all three experiments to help see the effects. The class can make observations for all three situations.

A MATTER OF SPACE

MOVED BY MARBLES



THE AIM: to observe that two things cannot occupy the same space at the same time

WHAT YOU WILL NEED:

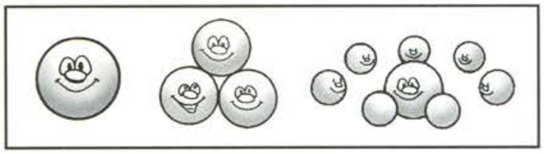
- ❑ 1 clear glass
- ❑ 6 small solid objects (e.g. marbles)
- ❑ masking tape or a rubber band

WHAT TO DO:

1. Fill the glass half full with water.
2. Place the masking tape or the elastic band around the glass to mark the water level.
3. Carefuly add the marbles to the glass of water.
4. Notice the change in the water level.
5. Encourage observations and questions.

Water and marbles both take up space. Since two things cannot occupy the same space at the same time, the water gets pushed out of the way by the marbles. The amount that the water rises corresponds to the volume of the marbles.

DRY PAPER



THE AIM: to keep a piece of paper towel dry even after placing it under water

WHAT YOU WILL NEED:

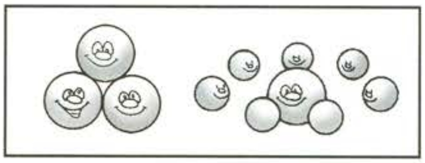
- ❑ 1 clear drinking glass
- ❑ 2 sheets of paper towel
- ❑ water table or a bucket taller than the glass

WHAT TO DO:

1. Fill the water table or bucket with water.
2. Wad the paper towel into a ball and push it down into the glass.
3. Turn the glass upside down. The paper towel wad should be wedged in the glass.
4. Keep the glass upside down and vertical while pushing it under the water.
5. Do not tilt the glass as you lift it out of the water.
6. Dry your hands and remove the paper towel allowing the students to observe that the paper towel is dry.

This glass is actually full before it even enters the water. It has paper and air inside of it. The air takes up the space that the water would like to get into. The air inside can be considered to be a guard that protects the paper towel. Since the air is already there taking up the space, the water is unable to enter the glass.

BRIM TO BRIM



THE AIM: to show that two pieces of matter cannot be in the same space at the same time

WHAT YOU WILL NEED:

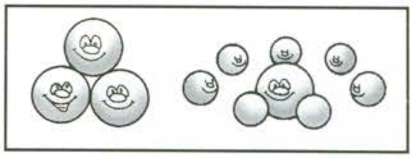
- ❑ 2 identical glasses
- ❑ water table or bucket
- ❑ water
- ❑ drinking straws
- ❑ 1 large saucer or pan

WHAT TO DO:

1. Immerse both glasses in the water and fill them both while they are still immersed.
2. Bring the glasses together at their brims, while still under the water.
3. Making sure to keep both glasses together, lift the joined glasses out of the water and place them in the pan.
4. Gently slide the glasses a few millimetres apart.
5. Allow the class to observe that no water falls out of the gap.
6. Take a drinking straw and point it at the gap between the two glasses and blow air through the straw.
7. Make observations.

On its own the water will not seep out through the gap because water likes to stick together. When air is blown into the gap the water moves out of the way to make room for the air, just like the marbles pushed the water up out of their way in the Moved By Marbles experiment.

WATER AND SAND



THE AIM: to show that a glass of sand has air in it

WHAT YOU WILL NEED:

- ❑ 1 glass
- ❑ sand
- ❑ water

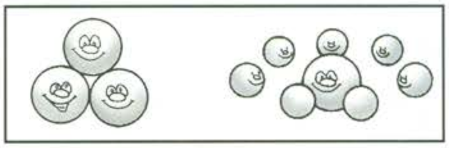
WHAT TO DO:

1. Fill the glass full of sand.
2. Ask the class if they think that the glass is full, and ask them what they think is inside the glass.
3. Begin to pour water into the glass.
4. Ask the class to observe what is happening.
5. Keep pouring water into the glass as long as there is room for it.

At the start there are sand particles and air in the glass. When water is poured in, bubbles are observed because the air moves out of the water's way.

WATER STICKS TOGETHER

OVER THE RIM



THE AIM: to show that water likes to stick together and can even rise above the edge of its container

WHAT YOU WILL NEED:

- ❑ 1 clear glass
- ❑ pennies (about 50 per glass)
- ❑ paper towels or a large pan

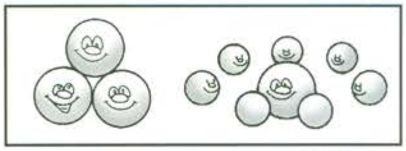
WHAT TO DO:

1. Place paper towels over your work surface. If a large pan is available, place the glass in it.
2. Fill the glass to the top with water.
3. Ask the class if they think that the glass is full. Ask them what they think will happen if you start putting pennies into the glass.
4. Proceed to gently slide pennies into the glass.
5. By looking sideways at the surface of the glass, observe that the water forms a bulge over the top of the container.

Many pennies can fit in the glass without any water spilling because water likes to stick together. When the bulge of water gets too high for all the water molecules on the surface to hold on any longer the water spills over the rim.

Insects can glide across the top of a pond without falling in because the water likes to stick together, forming a skin on the pond's surface.

"MAGIC" SCREEN



THE AIM: to show that water will not drip through fabric, even though the fabric is not water-proofed, because water likes to stick together

WHAT YOU WILL NEED:

- ❑ 1 15 cm x 15 cm piece of needle-point/cross-stitch fabric
- ❑ 1 mason jar (The lid should have 2 parts. The inner part of the lid is not needed, but the screw-on ring is.)
- ❑ water
- ❑ water table
- ❑ water jug (for pouring)

WHAT TO DO:

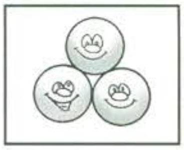
1. Put the fabric over the mason jar and screw the ring down over it so that it is secured.
2. Pour water right through the cloth into the jar, filling the jar $^{2}/_{3}$ full with water.
3. Over the water table or bucket, quickly invert the jar.
4. Encourage observations at this point. Allow the students to press a finger into the fabric and make further observations.

When the fabric is touched this provides an exit for the water, and breaks the "surface tension" causing a leak. This is why we are told not to touch a wet canvas tent; once touched the spot will continue to leak.

Water will not flow out of this fabric when the jar is inverted because the tiny holes in the fabric get filled with water. The water in these holes acts as a "skin" keeping the water inside the fabric.

You may also try this with construction paper. Invert the glass, holding onto the paper, and when you let go the paper will stay in place and the water will not spill out.

RACING WATER DROPLETS



THE AIM: to observe water droplets as they race down a hill

WHAT YOU WILL NEED:

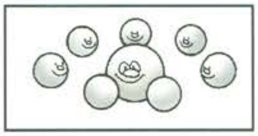
- ❑ 1 strip of waxed paper (50 cm long and 30 cm wide)
- ❑ 2 jacketed hard cover books (different sizes)
- ❑ 4 stick pins ❑ spoon ❑ water
- ❑ saucer ❑ food color

WHAT TO DO:

1. Arrange the books upright as shown.
2. Fold up the sides of the waxed paper strip so that water will not spill off the edges of the strip of waxed paper.
3. Pin the strip of waxed paper to the book spines pulling the paper taut between the books.
4. Place the saucer under the end of the waxed paper at the end of the last book as shown.
5. Add a few drops of food color to a cup of water.
6. Use the spoon to pour little drops of water over the larger book.
7. Watch the droplets race down the hill.

Surface tension is what makes the water form into droplets. These drops are firm and round because water likes to stick together. The water molecules on the surface of the drop hold onto each other acting like a skin that allows the water to stay in droplet form.

SOAPY STORIES



THE AIM: to demonstrate the effects of soap on water

WHAT YOU WILL NEED:

- ❑ liquid soap (e.g. Joy) ❑ green food color
- ❑ pepper ❑ shallow bowl of water or large glass baking pan

WHAT TO DO:

1. This experiment can be told to the class in a story format. Before proceeding, fill the bowl with water adding green food coloring to make it look like a field, and put a little soap on the tip of one finger.

"It is a warm late afternoon and the children in the neighbourhood decide that they will all go to the large field nearby."

2. Proceed to sprinkle pepper into the bowl.

"It is here that they play games and while away their free time after homework and before supper."

"After playing for awhile most of the children have realized that they are very hungry. They are all really hoping that their parents have prepared something tasty for supper. A short while later the parents are heard to open their front doors and yell out, 'Supper is ready'. Well, before you knew it all the children ran off home to enjoy a great supper."

3. Put your soapy finger into the middle of the water.

"The big green field was empty again until the next evening when the children would come out to play again."

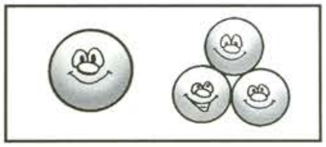
Water likes to stick together. The water molecules seem to form a skin on the water surface. Soap will spread and cover the surface of the water pushing the pepper to the edges.

Before repeating this, make sure the bowl is well rinsed to rid it of soap. Any soap that is left would coat the surface of the water and make it difficult to repeat this experiment.

This activity can be used to encourage the children's writing creativity by allowing them to think up their own stories to go with the actions.

SEEING THROUGH WATER

WATER MAGNIFIES



THE AIM: to show that looking at objects through water makes them appear larger

WHAT YOU WILL NEED:

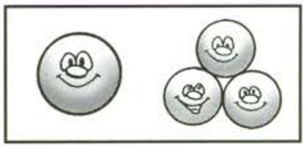
- ❑ 1 glass jar with curved sides
- ❑ water
- ❑ plastic wrap
- ❑ objects to be magnified (e.g. coins, leaves)

WHAT TO DO:

1. Pour water into the jar.
2. Drop the objects to be magnified in, one at a time.
3. Place a drop of water on the surface of the plastic wrap and hold it over the object to be magnified.
4. Make observations.

Light bends as it passes into the water and this causes the objects to appear larger. A drop of water on a small amount of plastic wrap makes an easy magnifier for exploration of the world around us.

BROKEN PENCIL?



THE AIM: to show that looking at objects through water makes them appear different

WHAT YOU WILL NEED:

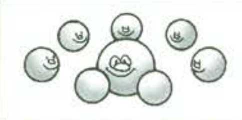
- ❑ 1 pencil
- ❑ 1 tall clear glass
- ❑ water

WHAT TO DO:

1. Fill the glass to 5 cm from the top with water.
2. Put the pencil into the glass of water.
3. Look down into the glass at the pencil. Then look at the pencil sideways through the glass.
4. Make observations.

The rays of light bend as they enter the water. The reason that light is bent in water is that water is denser than air. This is what causes the illusion of the broken pencil.

RAINBOW IN YOUR ROOM



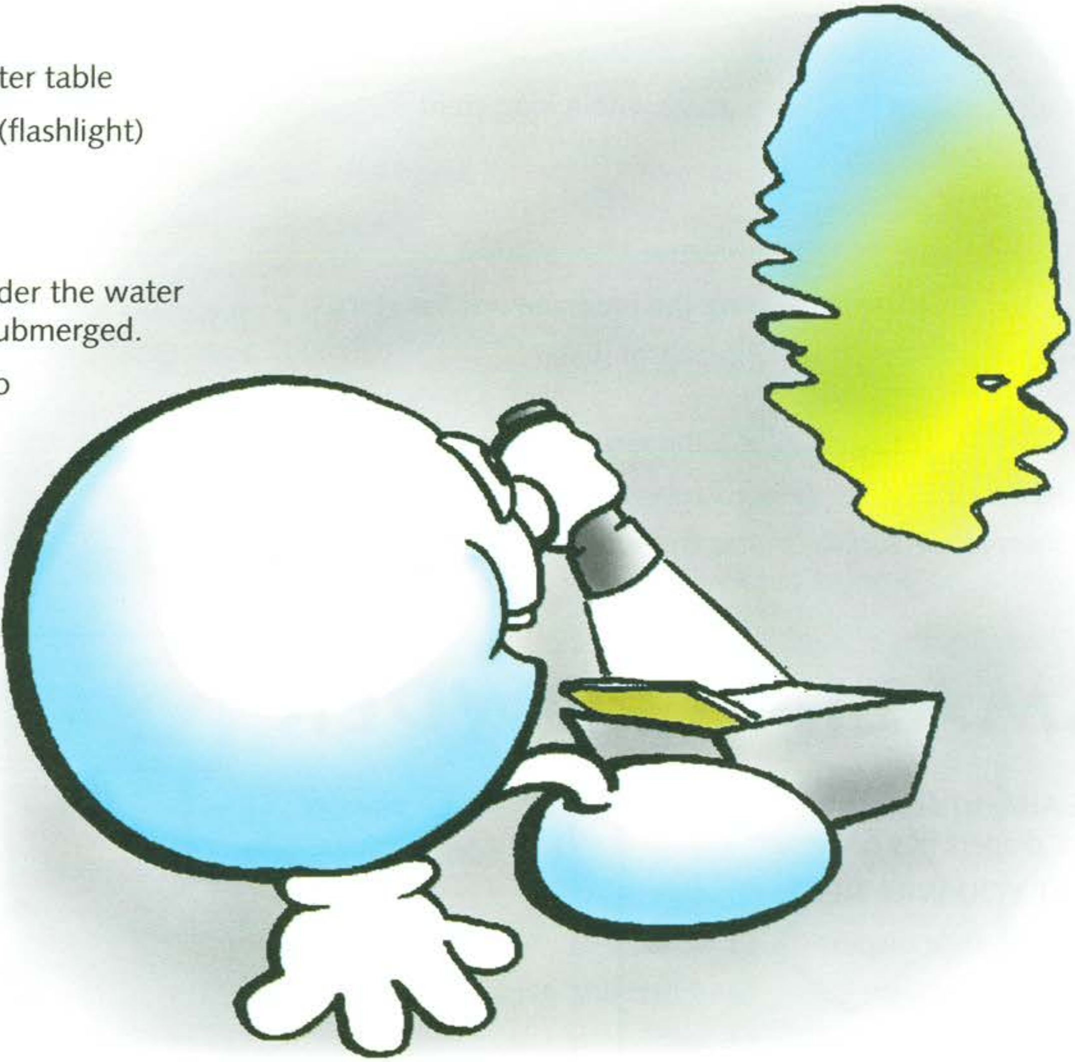
THE AIM: to observe the separation of colours in white light using water

WHAT YOU WILL NEED:

- ❑ flat mirror
- ❑ pan of water or water table
- ❑ strong light source (flashlight)
- ❑ dark room

WHAT TO DO:

1. Place the mirror under the water so that the end is submerged.
2. Use the flashlight to reflect light off the submerged mirror.
3. Look for the rainbow in the room. It could be on a wall or the ceiling.



The light that comes from the flashlight is made up of all the colours of the rainbow (red, orange, yellow, green, blue, violet). Water bends light that enters into it. Some colours of light are bent more than others. The result is a rainbow in your room.

When there is sunshine and rain at the same time, the water drops from the rain break the sunlight into its colors, and this is what causes a rainbow outside. You can make a rainbow outside on a sunny day by placing the sun at your back, and spraying a hose in front of you; a rainbow will be visible in the mist from the hose.

WATER WONDERS

MUSICAL GLASS

THE AIM: to cause a goblet of water to emit sound

WHAT YOU WILL NEED:

- ❑ a glass goblet (e.g. wine glass) with a long stem
- ❑ water

WHAT TO DO:

1. Fill the goblet $^{3}/_{4}$ full with water.
2. Steady the glass by holding the base and not the stem.
3. Dip your finger into the goblet of water to wet the finger tip.
4. Rub the wet finger around the rim of the glass.
5. Listen for the high-pitched sound that the glass makes.
6. Observe the surface of the water.

Rubbing your finger on the glass will cause it to vibrate emitting sound waves. Waves can be seen in the water in the glass. Try varying the amount of water in the goblet and observe the change.

AMAZING POWDER

THE AIM: to demonstrate the amazing effect that a powder from diapers has on water

WHAT YOU WILL NEED:

- ❑ 4 thin-style diapers
- ❑ piece of paper
- ❑ water
- ❑ spoon for stirring
- ❑ scissors
- ❑ 1 drinking glass
- ❑ salt

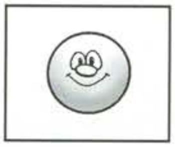
WHAT TO DO:

1. Cut open each diaper on the inside using a pair of scissors.
2. Remove the cottony stuffing and pull it apart over a piece of paper to collect the powder from inside the diaper. Pour this powder into a glass.
3. There should be about 5 mL (1 teaspoon) of powder at the bottom of the glass.
4. Place 45 mL (3 tablespoons) of water in the glass over the powder.
5. Swirl the water around slightly.
6. Make observations.

The water turns to a gel when it is mixed with even a small amount of this powder. This amazing powder makes water stick together quite well! This is why the diaper can be made so thin, yet absorbent.

To make the effect even more dramatic, the gel can be turned back into a liquid if table salt is added. Pour about 5 mL (1 teaspoon) of salt into the glass and stir the mixture. Notice what happens to the gel. Salt breaks apart the gel after a short time.

HOW TO MAKE SIX-SIDED SNOWFLAKES



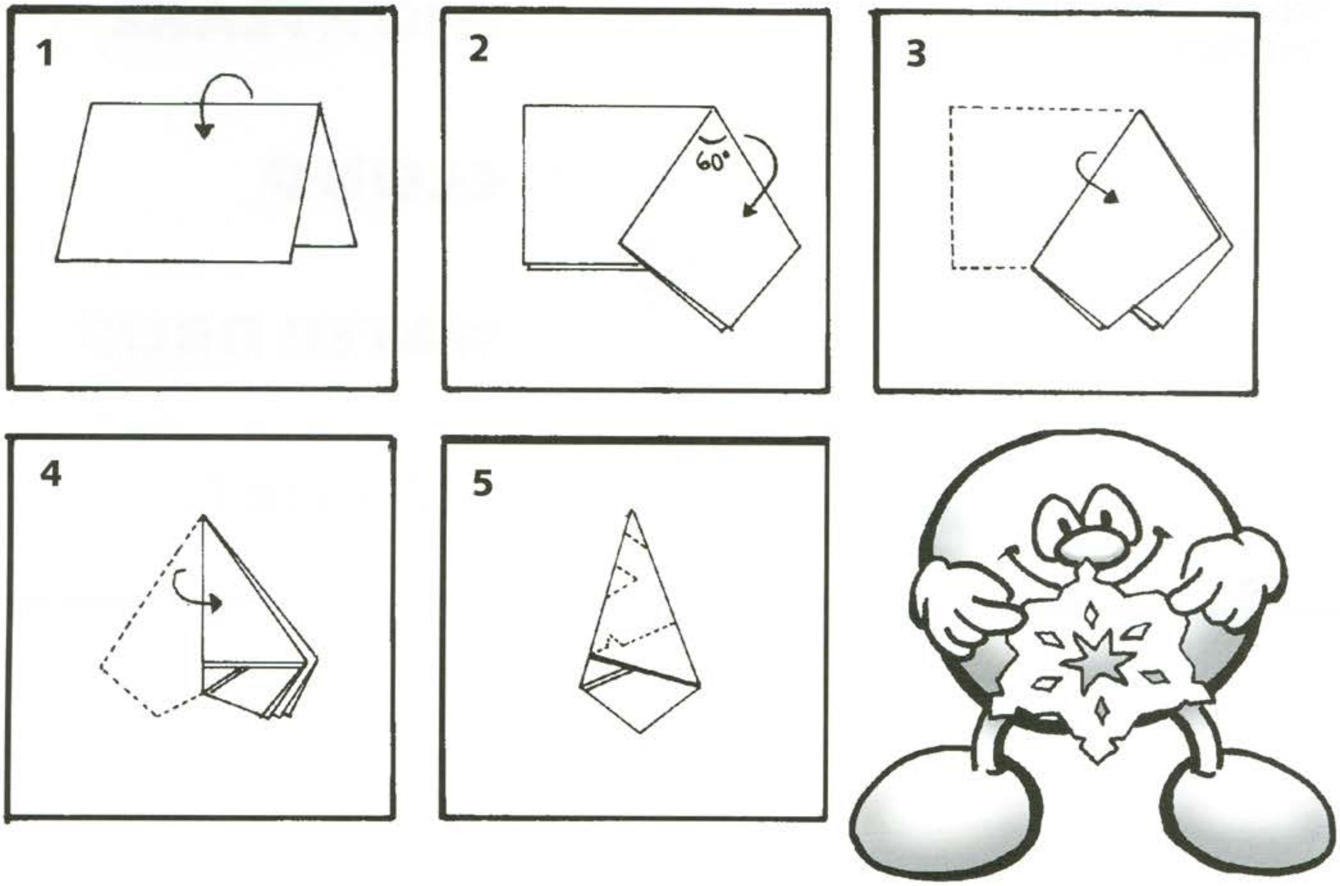
WHAT YOU WILL NEED:

- ❑ a 15 cm x 15 cm (or 15 cm diameter circle) piece of paper
- ❑ scissors

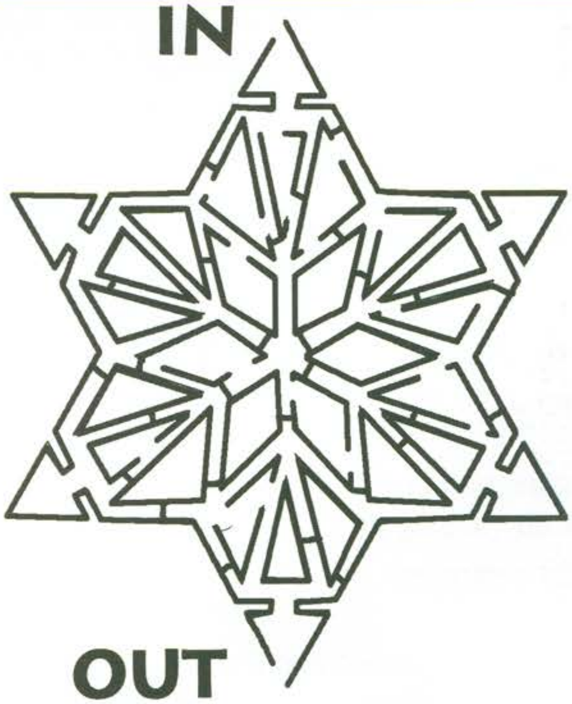
WHAT TO DO:

1. The first fold in the paper should be in half. See figure 1.
2. Fold one side of the paper over at an angle of 60°. See figure 2.
3. The next fold should be the same but on the other side making all the edges line up. See figure 3.
4. Fold the entire paper down the centre line. See figure 4.
5. You are now prepared to cut out your pattern and this is where the children's imaginations come in. See figure 5 and the illustration for a suggestion.

Snowflakes have six points because of the way water molecules "hold hands" inside snowflakes. This is also the way snowflake models were made on page 2.

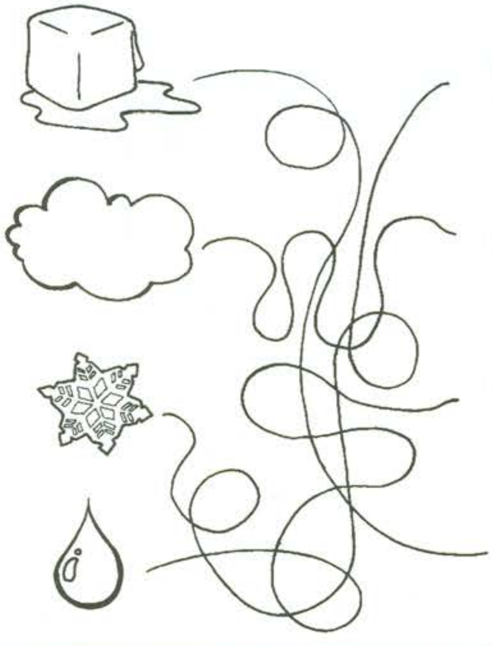


MORE FUN



CAN YOU FIND YOUR WAY THROUGH THE SNOWFLAKE?

MATCH THE WORD AND THE PICTURE.



SNOWFLAKE

CLOUD

WATER DROP

ICE CUBE

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