Scientist Badge
Pack Holiday 1997

Topics

The Natural World

Movement and Mechanics
Light
Electricity and Magnets
Floating and Sinking

The Natural World

Materials needed for natural world.

Glass jars.	Washing soda.	Nails.	Spoon
String.	Red food dye.	Cardboard.	Blotting paper.
Mustard seeds.	Cress seeds.	Carrot tops.	Hyacinth bulbs.
Toothpicks.	Radish seeds.	Sprouting potato.	Shoe box+lid
Empty box.	Small goldfish bowl.	Paper.	Soil.
Pea seeds.	Sand.	Leaves.	Earthworms.
Saucers.	Sugar.	Small pan.	Cotton.
Pencil.	Paper clip.	Piece of red cabbage.	Small bowl.
White vinegar.	Baking Soda.	Small Strainer.	Large jar with lid.
Chalk powder.	Balloon.	Elastic bands.	Candle.
Plastic Bottle.	Hot water.	Ice cubes.	

Evaporation and Diffusion

If you leave a bowl of water out overnight you will find that some of the water will have disappeared in the morning. Water does not really disappear when it dries up. Tiny droplets of water rise into the air, but they are so small that you cannot see them. It has turned into water vapour and we say the water has ***evaporated***. The air is full of water vapour because water evaporates from oceans, rivers and lakes all the time.

Stalactites and Stalagmites

Equipment: Two glass jars, washing soda, two nails, spoon, empty box, string.

Method: Fill both jars with hot water and stir in the soda. Keep adding soda until no more will dissolve. Twist the four pieces of string together, then tie each end to a nail. Make sure the string is long enough to reach from the bottom of one jar, over the box into the bottom of the other. The heavy nail should keep the string secure in each jar. Leave the experiment in a warm place. What do you think will happen?.

Expected Result: Soon you will see the solution soak along the string. When it reaches the box drips will fall into it. Then later you will have formed some stalactites and stalagmites.

Explanation: As the water evaporates from the box and the string, stalactites and stalagmites form from the salts that are left. Real stalactites and stalagmites are made from calcium-salt deposits caused by water, full of calcium from limestone rock, constantly dripping from the ceiling of caves. The stalactites hang from the roof and the stalagmites rise up from the floor of the cave.

Moving water

Equipment: Two glass jars (exactly same size), red food dye, cardboard.

Method: Fill both jars, one with hot water and one with cold water. Put a few drops of the dye into the hot water. Hold the piece of cardboard over the top of the cold water jar and turn it upside down over the other jar. Very carefully slide the cardboard out from between the jars, keeping the jars together. What happens to the dyed water?

Expected Result: You will see the dyed hot water rising up into the other jar.

Explanation: The cold water is heavier than the hot water and moved down into the bottom jar. The hot water is then pushed up the water in small currents.

Watching Plants Grow

Water is need to make all things grow. Plants and trees draw water up through their roots, stems and leaves.

Equipment: Blotting paper, saucers, mustard and cress seeds, carrot tops, hyacinth bulbs, glass jars, pea seeds, toothpicks. Radish seeds. A sprouting potato, shoe box with lid.

Method: Soak a piece of blotting paper with water and place it on a saucer. Sprinkle mustard and cress seeds on it. Keep the paper damp and see how quickly the seeds grow. After a few days they can be eaten in sandwiches.

Place carrot tops in a saucer of water and after a few days notice the 'fern' sprouting from the top of the carrots.

Hyacinth bulbs can grown in water in wide necked bottles or jars. You can then see the whole growth of leaves, roots and flower. Press toothpicks into the bulb so it can balance on the neck of the jar. The base of the bulb should just touch the water.

Soak the pea seeds in warm water for three hours. Line a jar with blotting paper and add water to about one-third of the way up. Put the soaked peas between the glass and the paper. Leave the jar in a warm, light place. Keep the blotting paper damp. When the peas begin to show roots, turn some of the upside down and see how they grow then. Also try putting some of the peas in a covered jar so that no light reaches them, and some without any water.

Make a small hole in the side of the box, Plant the potato in moist soil in the plant pot. Put the pot in the corner opposite the hole end. Place objects in the box then put the lid on. Leave the box on a sunny window ledge. Open the box after three days. What do you see?.

Expected Result: You will find that the peas soon turn themselves so that the roots point downward. The peas in the dark (if they grow at all) will also have shoots pointing downwards. Opening the box you will see that the shoot has found its way over the obstacles you left in its way and has reached the hole

Explanation: Plants need water and light to survive. They use the light energy to get energy from nutrients they get from the soil and water, in a process called ***photosynthesis.*** The roots will always grow to find water and food. On the earth this means downward into the ground. These types of plants are ***geotropic***, which means that they will grow towards the source of gravity, i.e. the roots will grow downward. Plants are also ***phototropic***, which means they grow towards sources of light. They have light-sensitive cells that show the plant which direction to grow in. This is why the potato shoots grew around the obstacles towards the light from the hole.

Worms!

If you look in any patch of soil you will probably find some worms. Worms are valuable creatures because they form a vital roll in the garden for plants and things that grow in the soil.

Making a Wormery

Equipment: A small goldfish bowl, white paper, string, soil, sand, earthworms, leaves.

Method: Put a layer of dark soil into a clean goldfish bowl. On top of the dark soil, put a thin layer of sand. Continue in this way until two-thirds full. Put the leaves on top. Leave a large empty space between the top layer and the paper lid. For the lid cut out a circle of paper about 3 inches bigger than the top of bowl. Cut out lots of tiny air holes. Carefully place the worms in the bowl. Put the paper lid on, bend down and surplus paper then tie the string on firmly around it. You now have a wormery. Water the soil each day through the holes.

Expected Result: After a few days the earthworms will have mixed up all the layers of sand and soil and will have pulled the leaves down.

Explanation: Worms burrow through the soil and this action mixed together the ***humus*** from the surface with the soil underneath. This provides air for the roots of plants. Worms are valuable creatures and you must return them to their natural environment.

Sugar Crystals

Certain substances, such as sugar, are able to ***dissolve*** in water. They mix with the water molecules to form a new liquid. Generally, you are able to dissolve more if the water is heated, because more energy is available to perform the chemical reactions necessary to dissolve the water.

Equipment: A drinking glass, sugar, small pan, pencil, cotton, paper clip, cup.

Method: Put ¾ of a glass of water into a small pan. Bring it to the boil then remove the pan from the heat. Stir three cups of sugar into the water, little by little, until no more will dissolve. Carefully pour this mixture into the glass. Tie a short length of cotton around the middle of the pencil. Attach a paper clip to the bottom of the thread to act as a weight, then lay the pencil across the top of the glass and adjust the thread until it almost reaches the bottom of the glass. Put the glass into a warm place for a day or two.

Expected Result: Soon you will find that the thread is covered with crystals of sugar.

Explanation: As the solution that you made cooled, it could no longer keep all its sugar and had to give some of it up in the form of crystals.

Magic Water

You may know what an acid is. In actual fact, substance can be classified as one of three things, ***acid***, ***alkali*** or ***neutral***. The definition is based upon the concentration of hydrogen ions in the liquid. There is a scale, called the pH scale, that goes from number 1 to 14, where 1 is a very strong acid, 14 is very alkaline, and 7 is neutral (like water), which is neither acid or alkali. Scientists can find out what type a liquid is by using detecting fluids, called ***indicators***, that change colour depending upon the pH of the liquid.

Equipment: Piece of red cabbage, small bowl, 4 glasses, white vinegar, baking soda, small strainer.

Method: Cut up the red cabbage and soak it in the bowl of very hot water for at least an hour. You now have violet water. Strain the liquid into a drinking glass. Place the three glasses on a table. Into the first glass put plain water. Into the second put white vinegar. In the third put water with about 2 teaspoons of baking soda mixed in it. Pour a little of the violet water into each glass.

Expected Result: You should see the plain water remain violet, the white vinegar turn red and the baking soda solution turn green.

Explanation: The violet cabbage dye has the property of turning red in acid liquids and green in alkaline liquids. It doesn't change in neutral water.

Making Clouds

Equipment: A very large jar with lid. Chalk powder. Round balloon with neck cut off. Thick rubber band.

Method: Pour a small amount of water into the jar. Put the lid tightly on and leave it for twenty minutes. Remove the lid and add some chalk powder. Immediately cover the jar with the balloon and put a rubber band around the neck of the jar to keep the balloon firmly stretched. Press the balloon down with your fist to compress the air. Hold it like this for about twenty seconds. Remove the balloon. What do you see?

Expected Result: You have made a cloud.

Explanation: Clouds form when air containing ***vaporised water*** cools. Cool air cannot hold much vaporised water so some of it ***condenses*** to form clouds. When you compress the air in your jar, the air becomes warmer and ***absorbs*** more vaporised water. When you remove the balloon cover, the air cools and some of the vaporised water condenses on the chalk dust to form a cloud.

The Air Around Us

We breathe the air around us to stay alive, but do you know what air is? Air is the mixture of gases that we breathe. It surrounds the Earth to a height of about 300 miles. It is often called the ***atmosphere***. Nearly four-fifths of the air is made up of nitrogen (78%) and more than a fifth is oxygen (21%). Most of the remainder is argon (0.9%). There are small amounts of many other gases in the air, including hydrogen, helium, neon and carbon dioxide. One important property of gases is that when they are heated they ***expand***. This is because the molecules move faster and hence take up more space.

Burning Air

Equipment: Glass jar, candle, two coins, large dish.

Method: Stick the candle to the bottom of the dish with a little melted wax and place the coins either side of it. Pour about 5cm of water into the dish and light the candle. When it is burning well, put a jar upside down over the candle, resting it on the coins and watch what happens.

Expected Result: The candle burns for several seconds and the water rises up the jar. Eventually the candle goes out, even without the water reaching the flame.

Explanation: Burning needs oxygen, so when the candle has used up all the oxygen in the jar, it goes out. If you measure the height of the water inside the jar, you will find that it is about one-fifth of the height of the jar. One-fifth of the air is oxygen, and most of the rest is nitrogen, which does not burn.

Hot and Cold

Equipment: Plastic bottle, balloon, large bowl, hot water, ice cubes.

Method: Empty a plastic bottle and fit a balloon over its mouth. Stand the bottle in a bowl of hot water and watch what happens. Then stand the bottle in a bowl of ice cubes and watch again.

Expected Result: When the bottle is in hot water, the balloon starts to inflate itself and when it is in the ice cubes, the balloon goes down.

Explanation: The air inside the bottle expands when it is heated and contracts when it is cooled.

An ordinary thermometer works on the same principle but using mercury or alcohol instead of air. DO NOT use a glass bottle for this experiment in case it breaks in the sudden temperature change.