Science Time™

ENG

Activity 9 Snowflakes under a Magnifier

In this activity we will make and look at snowflakes in detail.

Material: - 1 Measuring cup (21) - 1 Magnifier (24)
Extra items you will need: - A Hammer - Some ice cubes - A large piece of cloth - Some salt - A spoon - A desk lamp
**** This activity must be performed under the supervision of an adult.**

Steps:

1. Put some ice cubes on a large piece of cloth. Warp the ice within the cloth and use a hammer to crush the ice into small pieces. See Fig. 19

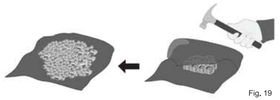


Fig. 19

2. Fill the measuring cup (21) up to about 3/4 full with the crushed ice. See Fig. 20.

Fig. 20

3. Add salt into the cup to almost full, the ice should start to melt. See Fig. 21.

Fig. 21

4. Stir the ice and salt mixture very rapidly with a spoon for at least 15 minutes. See Fig. 22.

Fig. 22

5. There should be some dew on the outside of the cup at first, observe what is produced if you wait a few minutes longer. They become crystals of ice. Examine carefully with the magnifier (24). You can see the crystal structure more clearly if you place the cup near a desk lamp. See Fig. 23.

Fig. 23

Explanations:

As the cup cools, the moisture in the air condenses on the cool surface. As the cup becomes colder, the water on the surface of the can freeze causing the formation of ice crystals.

Activity 10 Make a Watermill

A watermill is a structure that uses a water wheel or turbine to drive a mechanical process like flour or grain grinding, or metal shaping and rolling. The ancient Greeks and Romans are known to have used the technology . The watermill was also known in China during the Han dynasty (202BC – 220AD) in order to pound grain and to help in metal works.

Material: - 3 Wind cups (16) - 1 Wind cup holder (17) - 1 Wind cup handle (18)

Steps:

1. Insert the wind cup holder (17) into the wind cup handle (18). See Fig. 24.

Fig. 24

2. Install the three wind cups (16) into the holder. This is your watermill. See Fig. 25.

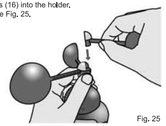


Fig. 25

3. Hold the watermill by the holder so that the cups can freely rotate vertically. Put it under running tap water so that the water falls directly on the cups when they are in the horizontal position.

4. When the water falls on the cups, it drives the watermill to rotate. Force is transferred from the water movement to the rotary motion of the watermill. See Fig. 26.

Fig. 26

Explanations:

A watermill can be used to drive a generator to produce electricity. This is called hydroelectricity, or hydropower.
Since no fossil fuel is consumed, emission of carbon dioxide (a greenhouse gas) from burning fuel is eliminated.

Activity 11 Make a Hygrometer

Material: - 2 Thermometers (20) - A cotton ball (25)
- Relative humidity table (Table 1)

Extra items you will need:
- A rubber band
- An electric fan

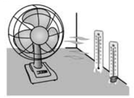


Fig. 27

Steps:

1. Use a rubber band to tie a thoroughly wet cotton ball (25) to the bulb of one thermometer (20). This is the wet thermometer.
2. Place the wet and dry thermometers side by side against the wall or one side of a box. You can use a piece of tape to secure them so they will not fall. See Fig. 27.
3. Turn on the fan and blow on the thermometers until the temperature readings stop falling. it may take several minutes.
4. Write down the temperature on both thermometers, for example 19°C and 15°C.
5. Subtract the temperature on the wet thermometer from that of the dry one, e.g. 19°C – 15°C = 4°C.
6. Use the table provided, find the dry thermometer temperature on the left and follow it to the right. Find the difference between the two temperatures on the top, and follow it down, The number where the row and column intersects is the relative humidity, e.g. 65%. See Table 2.

Seco menos mojado

Seco °C	1	2	3	4	5	6	7	8	9	10
10	88	77	66	55	44	34	24	15	6	
11	89	78	67	56	46	36	27	18	9	
12	89	78	68	58	48	39	29	21	12	
13	89	79	69	59	50	41	32	22	15	7
14	90	79	70	60	51	42	34	25	18	10
15	90	81	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	67	59	53	46	39	32	26
21	91	83	75	67	60	53	46	39	32	26
22	91	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

Table 1

Seco menos mojado

Seco °C	1	2	3	4	5	6	7	8	9	10
10	88	77	66	55	44	34	24	15	6	
11	89	78	67	56	46	36	27	18	9	
12	89	78	68	58	48	39	29	21	12	
13	89	79	69	59	50	41	32	22	15	7
14	90	79	70	60	51	42	34	25	18	10
15	90	81	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	67	59	53	46	39	32	26
21	91	83	75	67	60	53	46	39	32	26
22	91	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

Tabla 1. Mesa de Humedad Relativa

Table 2

Explanations:

Humidity refers to the concentration of water vapour in the air, Measuring the humidity helps meteorologists forecast the weather, A relative humidity of 100 percent is when the air has as much water vapour as it can hold at a particular temperature, and mists or fogs form, When the air is very humid, the chance of raining is higher, In hot and humid weather, we feel uncomfortable because perspiration on our skin does not evaporate as quickly, hampering our body's effort to cool down,

Meteorologists use a device called a hygrometer to measure humidity, One type of hygrometer is the wet-and-dry bulb thermometer, which contains two different thermometers,

Activity 12 Water acidity test

We use the pH scale, which range from 1 to 14, to measure if a substance is an acid or an alkaline. Acidic substances taste sour and have a pH value lower than 7, the pH 1 being the strongest acid. Alkaline substances normally taste bitter and feel soapy. They have a pH value higher than 7, with pH 14 being the strongest alkaline. Substances with a pH of 7 are said to be neutral.

Special substances called indicators are used to determine whether things are acidic or basic by changing colour. You will make your own indicator from a red cabbage in this activity and find out which types of water are acidic and alkaline.

All rainwater contains some level of acidity. Normal rainwater has a pH of 5.6. When the pH level of rainwater goes below 5.6, it is considered as acid rain. Acid rain is caused by chemical changes which occur in the atmosphere, and are produced by the air pollution. Under the action of these chemical changes, certain gases become acidic. Acid rain is very harmful to the environment. Acid rain damages everything over a period of time because it makes the living things in the environment die. Acid rain affects the lives in the water as well as the lives on land. It is almost worse in water than on land because fishes need the water to breathe. When the water gets polluted, then the fish gets sick and ends up dying.

Material: - 3 Plastic cups (4,19) - 1 Measuring cup (21) - 1 Pipette (22) - 1 Stirring rod (27)
Extra items you will need: - Red cabbage - 1 piece of A4 size white paper
**** This activity must be performed under the supervision of an adult.**

Steps:

1. Cut the red cabbage up, put it into a saucepan and cover with boiling water. Please make sure you are supervised by an adult when handling boiling water.
2. Stir it around and then leave it to soak for 15 minutes,
3. Using a sieve, separate the liquid from the cabbage pieces,
4. Keep the liquid in the measuring cup (21) and label it clearly as INDICATOR. See Fig. 28.
5. Gather as many water samples as possible: water of the tap, rainwater, water of an aquarium, a lake, a river, the sea.
6. Put a piece of white paper under the plastic cups (4,19). Pour about 20ml of each sample into the plastic cup (4,19) and label the cups. See Fig. 29.
7. Using the pipette (22), add 5 drops of the red cabbage indicator into each cup of water sample and stir well with the stirring rod (27). Remember to wash the stirring rod before putting it in each sample. See Fig. 29.
8. Observe the colour change of the red cabbage indicator and the sample mixture. Determine the pH of each sample using the cabbage indicator pH table: (See Table 3)

Fig. 28

Fig. 29

Fig. 30

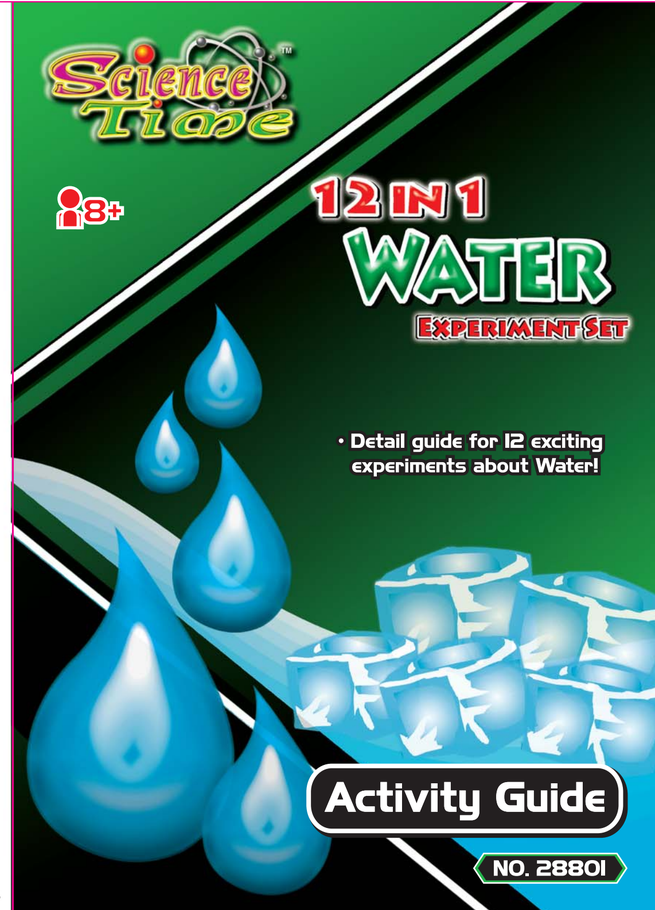
Table 3

pH	2	4	6	8	10	12
Colour	Red	Purple	Violet	Blue	Blue-Green	Green

9. When done, pour all the sample mixtures and indicator into the kitchen sink and wash them clean with tap water, The indicator should not be kept overnight due to bacterial growth,

Explanations:

If the pH of rainwater is 5, it is considered as acid rain. Acid rain is dangerous. If the pH of rainwater is below 5, this water is not viable.



12 in 1
Water Experiment Set
Activity Guide

WARNING!

Only for use by children over 8 years old. To be used solely under the strict supervision of adults that have studied the precautions given in the experimental set. Not suitable for children under 36 months because of small parts and because of long cords – choking and entanglement/strangulation hazard. Keep small children and animals away from experiments. Use with care and only under supervision of adult.

Water toys sometimes get messy. Protect play surface before use. Drain, rinse, clean and dry all items thoroughly befoe storing.

Components:

1. 4 Plastic tubes
2. 1 Plastic funnel
3. 1 Plastic cover
4. 1 Plastic cup
5. 1 Bag of Pebbles
6. 1 Bag of marbles
7. 3 Filter paper
8. 1 Sponge
9. 2 Test tubes
10. 1 Stopper with hole
11. 1 Test tube rack
12. 2 Straw
13. 1 Measuring cylinder with holes
14. 1 Petri dish
15. 1 Water compass
16. 3 Wind cups
17. 1 Wind cup holder
18. 1 Wind cup handle
19. 2 Plastic cups
20. 2 Thermometers
21. 2 Measuring cups
22. 1 Pipette
23. 1 Cotton string
24. 1 Magnifier
25. 3 Cotton balls
26. 1 Bubble wand
27. 1 Stirring rod

Fig. 1

Activity 1 Water Spray

Material: - 1 Test tube (9) - 1 Test tube rack (11) - 2 Straws (12) - 1 stopper with hole (10)

Steps:

1. Setup the test tube(9) in the test tube rack(11) as shown in Fig.2.


Fig. 2

2. Fill the test tube with water and cover it with the stopper with hole (10). Insert straw (12) vertically into it. Do not let the straw reach the bottom of the test tube otherwise it may block the flow of water in the straw. (Fig. 3)


Fig. 3

3. As shown in Fig.4, put the other straw horizontally with one of its tips meeting the vertical straw, making a 90 degree angle, and the other tip should be inserted into your mouth.

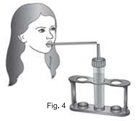


Fig. 4

4. Make sure the straws are set up properly, now blow hard into the straw. You will see the water rises up inside the vertical straw. When the water reaches the top, it disperses into a water mist in the direction you blow. See Fig. 5.

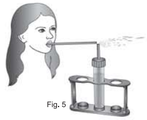


Fig. 5

Explanations:

When you blow air over the vertical straw, its high flow speed creates a low pressure over the tip. The higher pressure at the test tube water surface pushes the water up towards the tip. When the water overflows at the tip, the air current carries the water into very small water droplets, or water mist.

Activity 2 Water Pressure

In this activity, you will learn about water pressure.

Material: - 1 Measuring cylinder with holes (13)
Extra items you will need: - Some tape

Steps:

1. Perform this activity in a sink or tray to contain the water spill.

2. Cover the three holes of the measuring cylinder (13) with a piece of scotch tape.

3. Fill the measuring cylinder (13) all the way with water. Make sure it covers all the three holes. See Fig. 6


Fig. 6

4. Remove the tape covering the holes. Observe and compare the "range" of the water jets flowing out from the holes at the top, middle and the lowest position. See Fig. 7.


Fig. 7

Explanations:

The water will flow out fastest and farthest from the hole at the bottom, less in the middle and a lot less from the top. When water is filled up in the measuring cylinder, the water at the surface is pressed by air pressure only. At deeper level below, the water is also pressed by the weight of the water column above and is forced out through the hole. The higher the force the farther the water is squirted out. Therefore, the water at the bottom has the greatest pressure and squirts out farther than the higher holes.

Activity 3 Water Compass

In this activity, you will find out how a compass works.

Material: - 1 Petri dish (14) - 1 Water compass (15)

Steps:

1. Half filled the Petri dish (14) with water so that the compass will float freely. Put the compass (15) in the water. (Fig.8)


Fig. 8

Explanations:

The earth has a magnetic field and acts like a huge bar magnet. It has one "end" near the North polar region and the other end near the South polar region. A compass is a small piece of magnet, the RED pointer of the compass is the north pole of the magnet and the WHITE pointer of the compass is the south pole of the magnet. When this magnet is free to move, such as when suspended in water, it will align to the earth magnetic field and point to the North and South respectively.

Activity 4 Bubble Maker

We will make some bubbles in this activity.

Material: - 1 Measuring cup (21) - 1 Bubble wand (26)
Extra items you will need: - Bubble liquid

Steps:

1. Get ready some bubble liquid (not included). You can buy it from local toy store or make your own by mixing a teaspoon of liquid soap or dishwashing detergent to a cup of water.

2. Pour some bubble liquid into the measuring cup (21) and dip the bubble wand (26) into the liquid.

3. Blow gently through the bubble wand and see lots of bubbles coming out! See Fig. 9

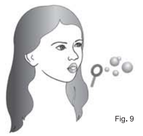


Fig. 9

Explanations:

A bubble is a thin film of liquid surrounding a pocket of air. Water itself is not flexible enough to hold the air. By adding some soap into it, the liquid can form an elastic film and trap the air inside without getting bursted when it moves.

Activity 5 Water Transfer

You will move some water from one cup to another using a piece of string.

Material: - 2 Plastic cups (19) - 1 Test tube rack (11) - 1 Cotton string (23)

Steps:

1. Fill one plastic cup (19) with water and leave the other cup empty.

2. Put the plastic cup filled with water on the test tube rack (11) and the empty cup next to it on the table. (Fig. 10)

3. Put the cotton string (23) in the wet cup and move one end of the string to the empty cup. (Fig. 10)

4. Leave the set up over night.


Fig. 10

Explanations:

You will note that some water appear in the empty cup over night. This is because the water will gradually rise up through the cotton string, moves along it and finally reaches the empty cup. This happens very slowly so it takes some time to see the effect. Initially the water will fill up the spaces inside the string. Once the part of the string at the empty cup is wet, the water can cling to the already present water molecules and slide down the string to the empty cup. This is called "capillary action". Plants get water from their roots to their leaves using this phenomenon. Capillary action happens when water molecules are more attracted to the surface they travel along than to each other. In the cotton string, the water molecules move along tiny fibers. In plants, they move through narrow tubes that are actually called capillaries. Plants couldn't survive without capillaries because they use the water to make their food.

Activity 6 Make a Water Filter

More than one billion people – that's 1,000,000,000! , about one in six people in the world – do not have access to clean water. As a result, many people, especially children in developing countries, get water-borne diseases, which can be fatal. Clean water is the earth's most valuable resource. If it is not properly restored and returned after use, it will eventually disappear. Fortunately, the United Nations and other organizations have built many treatment plants throughout the world which are designed to recycle clean water. In this activity, we demonstrate how dirty water can be made clean again using a filter system.

Material: - 4 plastic tubes (1) - 1 plastic funnel (2) - 1 plastic cover (3) - 1 plastic cups (4) - 1 bag of pebbles (5)
- 1 bag of marble stones (6) - 3 pieces of filter paper (7) - 1 piece of sponge (8) - 1 measuring cup (21)

Steps:

1. Get some dirty water into the measuring cup(21). If you can't find any you can make it by adding pieces of paper, seasoning sauce, cooking oil, food colouring to water.

2. Put the filtering stones, sponge and filter paper in individual filter tubes. Set up the filter column as shown in Fig.11: the tube with marbles on the top, followed by pebble tube and sponge tube, and the tube with filter paper at the bottom.

3. Slowly pour half of the dirty water through the top funnel. What does the water collected in the cup at the bottom look like? Do not drink the filtered water, it is for demonstration purpose only. Compare it with the unfiltered water in the measuring cup.

4. Take the filter column apart and look at each layer. What different materials in the water are removed from each layer?

5. This four stage filtering column removes large and small size impurities step by step. First, marble stone is used for filtering coarse impurities in the water (e.g. stones, paper) and the pebbles are used for filtering medium size particles in the water (e.g. dust). The sponge filters the water further by removing smaller impurities and colour. Filter paper is used for filtering very fine impurities in the water.

6. Clean each layer and try again. Try changing the order of the layers or using different amount of materials.

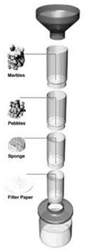


Fig. 11

Explanations:

The gravity fed system provides physical filtration, removing large particles with a marble chips filter, medium particles with a pebble filter, small particles with a sponge, and finally minute impurities with filter paper.

Technical notes:

The marble stones provide a coarse filter for the water, removing large particles. But marble will also raise the pH of water, reducing its acidity. Marble filters are especially useful for fish tanks where a more neutral (neither acidic or alkaline) water is needed.

Activity 7 The Three States of Water

We will investigate the three states of water and their properties.

Material: - 2 Plastic cups (19) - 1 Thermometer (20)
**** This activity must be performed under the supervision of an adult.**

Steps:

1. Ask an adult to get some ice cubes from the refrigerator and put them inside the plastic cup (19). Observe the appearance of the ice, See Fig. 12.


Fig. 12

2. Put the thermometer (20) in the cup with ice, note the change in temperature reading.See Fig. 13.


Fig. 13

3. Half fill another plastic cup with water and put one ice cube inside. Does it float or sink?

4. Ask an adult to pour some hot water into the plastic cup. See Fig. 14.
Caution: Pay attention not to get burnt by the hot water and vapour. Observe the gas state of water and the formation of water drops on the inside of the cup.


Fig. 14

Explanations:

About 70% of the earth is covered with water, mostly in oceans and other large water bodies. The clouds in the sky are also made up of water. Water exists in three states: Solid, liquid and gas. We usually refer to its liquid form or state when we use the word "water". Liquid water is found in many places. You see liquid water coming out of the tap, when it rains, and running in a river. Pure liquid water is colourless, free of rocks, soil, minerals and other pollutants. Ice, snow, and frost are examples of water in the solid state. Liquid water freezes at 0 degrees Celsius. Celsius is scale that measures temperature. We use a thermometer to measure temperature. In winter, you see a lot of solid water. Other examples of solid water are ice cubes, and ice on a skating rink. Water is unusual in that the solid form, ice, is less dense than the liquid form, which is why ice floats. Water contracts until it reaches 4 degrees Celsius then it expands until it is solid. Solid water is less dense that liquid water because of this.

When we boil water, it turns into a gas, you can see steam rising from boiling water. Water in the liquid state may change to water in the gaseous state. Water evaporates to turn into a gas. Water can evaporate or disappear with the help of heat. Changes in temperature can increase the rate or how long it takes water to evaporate. Evaporate means to disappear. Water can evaporate from soil. It evaporates off wet clothes hanging on a clothesline. Plants release water vapor into the air. We breathe out water vapor.

Water changing from solid to liquid is said to be melting. When it changes from liquid to gas it is evaporating. Water changing from gas to liquid is called condensation. Frost formation is when water changes from gas directly to solid form. When water changes directly from solid to gas the process is called sublimation.

Activity 8 Artificial Rain

Make it rains! Learn how rain works.
Material: - 2 Plastic cups (19)
Extra items you will need: - Hot water - Some ice cubes - Some salt
**** This activity must be performed under the supervision of an adult.**

Steps:

1. **Ask an adult to do this step for you.** Pour about 2cm of very hot water into the plastic cup (19). Pay attention and be very careful when pouring the water. See Fig. 15.

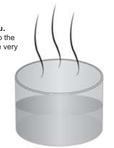


Fig. 15

2. Use the other plastic cup to completely cover the cup with hot water. See Fig. 16.


Fig. 16

3. Put some ice cubes on the top cup and add some salt. See Fig. 17.


Fig. 17

4. Wait and watch. In about 15 minutes you will see "rain" falling from the base of the upper cup to the water inside the lower cup. See Fig. 18


Fig. 18

Explanations:

The ice with the salt makes the base of the upper cup very cold while some of the hot water turns into vapour inside the lower cup. The bottom of the cold cup causes the warm water vapour condensed and form water droplets. This is the same thing that happens in the atmosphere as warm, moist air rises and meets colder temperatures high in the atmosphere. Water vapor condenses and forms precipitation that falls to the Earth as rain, sleet, hail, or snow.