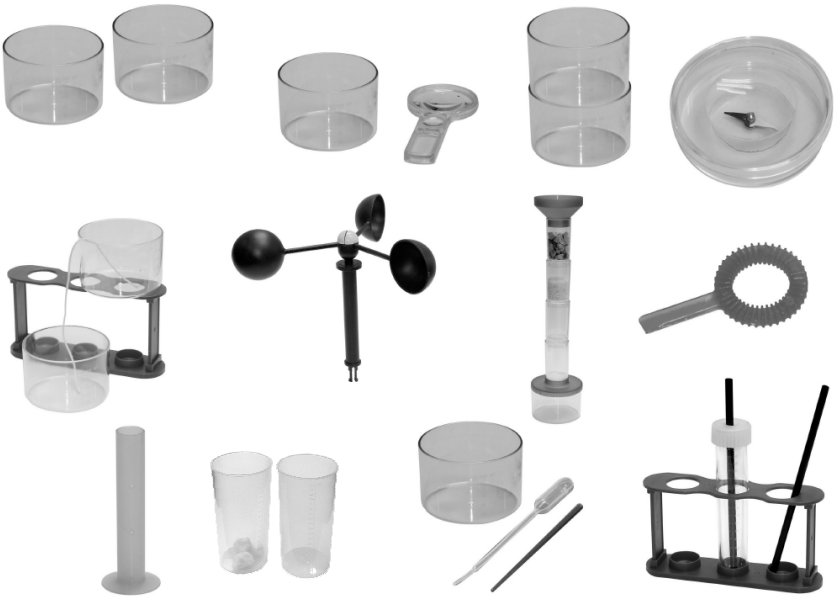
12-IN-1 Water experiment set

(8082053)

Instruction manual



Water experiment set

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 before storing.

Contents

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

Instructions for use

Activity 1 - Water spray

Materials:

1 x Test tube (9) 1 x Stopper with hole (10)
1 x Test tube rack (11) 2 x Straws (12)

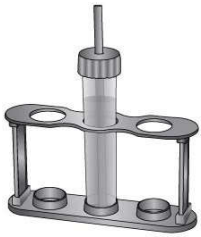
Steps:

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

Fig. 2

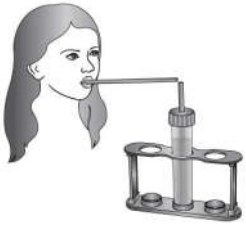
2. Fill the test tube with water and cover it with the stopper with hole (10). Insert a straw (12) vertically into it. Do not let the straw reach the bottom of the test tube otherwise it may block the flow of water in the straw. (Fig. 3)

Fig. 3



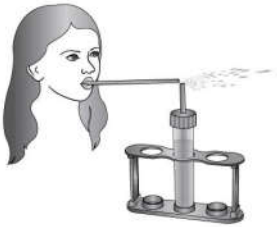
3. As shown in (Fig.4) while holding the vertical straw, put the other straw horizontally with one of its tips meeting the vertical straw, making a 90 degree angle and the other tip should be inserted into your mouth.

Fig. 4



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

Fig.5



Explanation:

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 changes the water into very small water droplets or water mist.

Activity 2 - Water pressure

Material:
1 x Measuring cylinder with holes (13)

Extra items you will need:
Some sticky 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 sticky tape.
3. Fill the measuring cylinder (13) all the way with water. Make sure it covers all the three holes. (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 (Fig. 7).

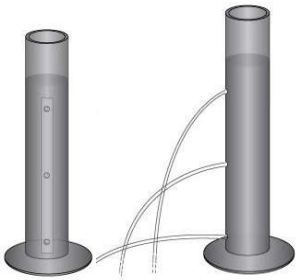


Fig. 6 Fig.7

Explanation:
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 a deeper level, 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

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

Fig. 8

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

Explanation:
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.

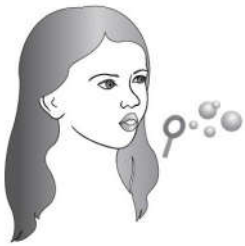
Activity 4 - Bubble maker

Material:
1 x Measuring cup (20)
1 x Bubble wand (25)

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 (20) and dip the bubble wand (25) into the liquid.
3. Blow gently through the bubble wand and see lots of bubbles coming out! (Fig. 9)

Fig. 9



Explanation:
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 bursting when it moves.

Activity 5 - Water transfer

Materials:
2 x Plastic cups (19)
1 x Test tube rack (11)
1 x Cotton string (22)

Fig. 10

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 string (22) in the wet cup and move one end of the string to the empty cup. (Fig. 10)
4. Leave the set up overnight.

Explanation:
You will note that some water appears in the empty cup overnight. This is because the water will gradually rise up through the 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.

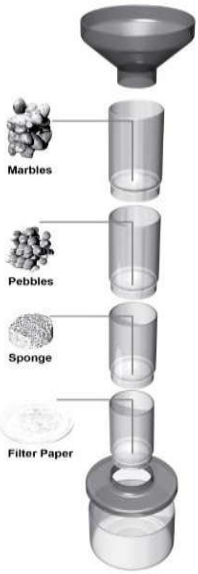
Activity 6 - Make a water filter

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.

Materials:

4 x Plastic tubes (1)
1 x Plastic cover (3)
1 x Bag of pebbles (5)
3 x Pieces of filter paper (7)
1 x Piece of sponge (8)
1 x Measuring cup (20)
1 x Plastic funnel (2)
1 x Plastic cups (4)
1 x Bag of marble stones (6)

Fig. 11



1. Get some dirty water into the measuring cup (20). 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 Figure 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 purposes 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 amounts of materials.

Explanation:

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 nor alkaline) water is needed.

Activity 7 - The 3 states of water

Materials:
2 x Plastic cups (19)

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. (Fig. 12).
2. Touch the ice, how do you feel? (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. (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. 12

Fig. 13

Fig. 14

Explanation:
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. In winter, you see a lot of solid water. Other examples of solid water are ice cubes and ice on a skating rink. When you touch the ice, heat is transferred from your finger to the ice to melt it. With less heat, the temperature of your skin drops and you feel cold.
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 vapour into the air. We breathe out water vapour.
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 Water and ice

Most materials will shrink when they freeze. How about water? Let's find out in this experiment!

Materials:

1 x Measuring cup (20)

Steps:

Fill the plastic cup with water up to the top. (Fig. 15).
Put the cup of water in the freezer compartment of the refrigerator. Be careful not to spill any water.
Leave it in the freezer overnight. The cup of water should have frozen into ice. Take the cup out and note the level of the ice. Is it higher or lower than before?

Fig. 15

Explanation:

Water expands when it turns into ice. Since the cup is already full and there is no more space inside the cup, the ice will expand upwards and rise above the top level. (Fig. 16). This and other special properties of water are the results of the arrangement of the hydrogen and oxygen atom

Fig. 16

Activity 9 - Artificial rain

Materials:
2 X Plastic cups (19)

Extra items you will need:
Hot water, some ice cubes and 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 not get burnt by the hot water or vapour. (Fig. 17).

Fig. 17

2. Use the other plastic cup to completely cover the cup with hot water. (Fig. 18).

Fig. 18

3. Put some ice cubes in the top cup and add some salt. See (Fig. 19).

Fig. 19

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. (Fig. 20).

Fig. 20

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 base 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 vapour condenses and forms precipitation that falls to the Earth as rain, sleet, hail, or snow.

Activity 10 - Snowflakes under a magnifier

Materials:
1 x Measuring cup (20)
1 x Magnifier (23)

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. Wrap the ice within the cloth and use a hammer to crush the ice into small pieces. (Fig. 21).

Fig. 21

2. Fill the measuring cup (20) up to about 3/4 full with the crushed ice. (Fig. 22).

Fig. 22

3. Add salt into the cup to almost full, the ice should start to melt. (Fig. 23).

Fig. 23

4. Stir the ice and salt mixture very rapidly with a spoon for at least 15 minutes. (Fig. 24).

Fig. 24

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 (23). You can see the crystal structure more clearly if you place the cup near a desk lamp. (Fig. 25).

Fig. 25

Explanation:
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 11 - 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 this 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.

A watermill can also 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.

Material:

3 x Wind cups (16)
1 x Wind cup holder (17)
1 x Wind cup handle (18)

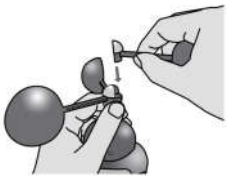
Steps:

1. Insert the wind cup holder (17) into the wind cup handle (18). (Fig. 26).

Fig. 26

2. Install the three wind cups (16) into the holder. This is your watermill. (Fig. 27).

Fig. 27



3. Hold the watermill by the handle 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.

Fig. 28

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. (Fig. 28).

Activity 12 - Water acidity test

We use the pH scale, which ranges from 1 to 14 to measure if a substance is 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.

Material:
3 x Plastic cups (4, 19)
1 x Measuring cup (20)
1 x Pipette (21)
1 x Stirring rod (26)

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.

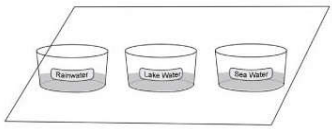
Steps:

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 (20) and label it clearly as INDICATOR. (Fig. 29)

Fig. 29

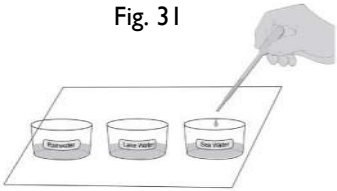
5. Gather as many water samples as possible: water from the tap, rainwater, water from an aquarium, a lake, a river, the sea.
6. Put a piece of white paper under the plastic cups (4, 19). Pour about 20ml of each sample into the plastic cup (4, 19) and label the cups. (Fig. 30.)

Fig. 30



7. Using the pipette (21), add 5 drops of the red cabbage indicator into each cup of water sample and stir well with the stirring rod (26). Remember to wash the stirring rod before putting it in each sample. (Fig. 31).

Fig. 31



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:

Table 1

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.

Please retain this information leaflet for future reference.

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