THE LIFE OF WATER

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ROYAL SOCIETY OF CHEMISTRY

Experiments and investigations involving water in the context of space

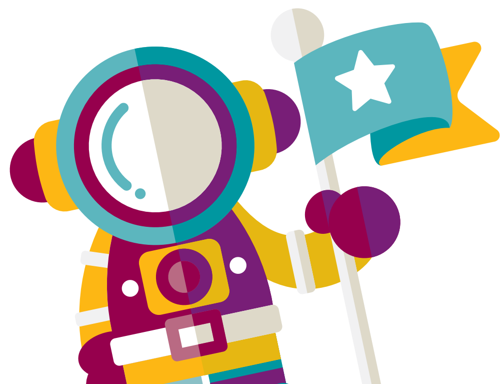
Inspired by the planetarium show 'The life of water'

from the:
Royal Society of Chemistry
and **Explorer Dome**

Get hands on with H_2O, changing states of matter and the water cycle

Water is life – our most precious resource

Chemistry is everywhere!



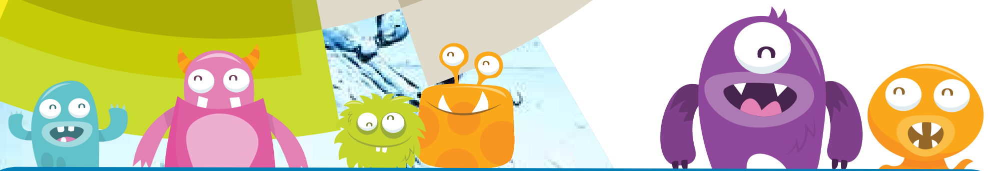
THE LIFE OF WATER – Experiments and investigations involving water

Teacher guidance:

The resources in this pack detail a series of experiments you can run with your class when learning about water. There is no recommended sequence, although some of the experiments are linked. We leave it up to you to decide how many of these experiments to run, and in what order they should be run in.

There are two pages to each experiment.

- The first page lays out the details of the experiment, gives the context and recommends questions to explore. This page has been written for use by the children in your class as well as by yourself.
- The second page suggests ways to record the outcomes of the experiment, introduces the scientific understanding behind the experiment, suggests extension activities and leaves space for notes on class outcomes to be made. This page has been written specifically for teachers.



About this resource:

This resource pack was made to coincide with the launch of 'The life of water' planetarium show developed between the **Royal Society of Chemistry** and **Explorer Dome**.

Visit other educational material from the Royal Society of Chemistry here: **www.rsc.org/learn-chemistry**

Visit Explorer Dome here: **www.explorerdome.co.uk**

The content of the resource was created by TeachEco Ltd.

List of activities

- Plants in space
- The danger of the dripping tap (cross-curricular maths opportunity)
- Cleaning dirty water
- Thermometer needed
- A dissolving discovery
- Separating rock salt
- Changes of state (whole class activity)
- Space craft survival (assessment opportunity)
- Acids and alkalis
- How much sugar is in a drink? (cross-curricular maths opportunity)

PLANTS IN SPACE

Use your knowledge of what plants do, to find the minimum amount of water needed for growth

SET IN SPACE

The space craft crew need to eat fresh plants along with their dried food rations to get vital vitamins. Their water supply is precious and they can only use a small amount to grow plants. Can you show them how they can grow some plants using only a small amount of water?

What do we need?

- An empty 2 litre plastic bottle
- Safety scissors
- Sticky tape
- Damp compost
- Gravel
- 4 bean seeds
- Grass seed
- 20 ml fresh water

What can we ask?

What does your seed need to survive? How will the plant get water in a sealed bottle? Are the roots and leaves the same colour (why/why not)? Compare the different types of seed/plant/roots.

If I take the lid off the bottle and leave a hole, what will happen to the water? What happens if I put my bottle somewhere too sunny/dark/cold?

What do we do?

- Cut bottle approx 15 cm down.
- Put a layer of gravel (approx 3 cm deep) in the bottom of the bottle.
- Add a layer of compost (approx 10 cm deep).
- Place 4 bean seeds on top of the compost.
- Cover the seeds with a layer of compost (approx 2 cm).
- Sprinkle some grass seed on top of the compost.
- Add the water.
- Turn the top of the bottle upside down and place on top.
- Seal the bottle up with some sticky tape.
- Leave your bottle somewhere light.
- Observe and record any changes on a daily basis.

Please note: 1 cm^3 is 1 ml.

PLANTS IN SPACE

Use your knowledge of what plants do, to find the minimum amount of water needed for growth

What's happening?

As the seeds germinate and grow, they will require the correct nutrients, water, temperature etc. The sealed bottle captures the water inside. As the temperature rises, the water heats to form water vapour. As it cools, condensation occurs. This creates a water cycle within the bottle. The same water is absorbed by the plants through their roots and is eventually passed out through their leaves. This joins the water vapour already in the air and the cycle continues.

Extensions and other activities:

What changes can be done to the experiment (eg water/light/soil/bottle shape and size/plants/seeds. Block the light around the roots).

To emphasise the water cycle and emphasise condensation place a sealed bag of ice cubes in the inverted top to act as a, 'cloud'.

Methods of recording:

Suggestions:

A free hand drawing of the bottle can be made on a daily/weekly basis to show changes.

Record the weight of the bottle on a daily/weekly basis.

A diary entry can be written from an astronaut's point of view on the changes.

A line graph can be made about the size of the plant over time, showing growth.

KEYWORDS

plant
evaporation
condensation
precipitation
transpiration
habitat
water cycle
changes of state
photosynthesis

NOTES

Health and Safety

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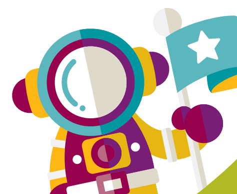

THE DANGER OF THE DRIPPING TAP

One drop of water is a tiny amount but what volume is lost if there is 1 drop each second for an hour? a day? a year?

SET IN SPACE

When the space craft was hit by a meteor in a storm, one of the water tank taps was damaged and is now leaking. The water is only dripping. Is this serious? How long will it be before the 500 litre tank empties? Can the crew ignore this dripping tap? What will happen if the leaks gets worse and it drips faster?

What do we need?

- Dripping tap (either actual tap or a container)
- Beaker/cup
- Measuring cylinder
- Clock/stopwatch

What can we ask?

Predict how much water will be lost in a day, a week, a year for a slow dripping tap.

Predict how much water will be lost in a day, a week, a year for a fast dripping tap.

What do we do?

- Set a tap dripping and ensure there is a constant drip.
- Catch the drips over a given period of time.
- Use a measuring cylinder to calculate the volume.
- Calculate what would be lost over longer periods of time – a day, a week, a year.
- Repeat the experiment with the tap dripping at a different speed.

THE DANGER OF THE DRIPPING TAP

One drop of water is a tiny amount but what volume is lost if there is 1 drop each second for an hour? a day? a year?

What's happening?

This activity is an excellent maths opportunity that links to a real life situation. Mathematical skills easily incorporated are: data handling, measuring volume and time, recording data, multiplication of a range of small and large numbers.

Extensions and other activities:

How much is lost from a faster drip? How many dripping taps are there in the school? How much water is the school losing?

Methods of recording:

Suggestions:

Write a report as the chief engineer of the space craft about the danger.

Create a warning poster to other crew members about water loss.

Produce a newspaper article or news report from Earth about the danger facing the crew.

KEYWORDS

measurement
volume
water usage

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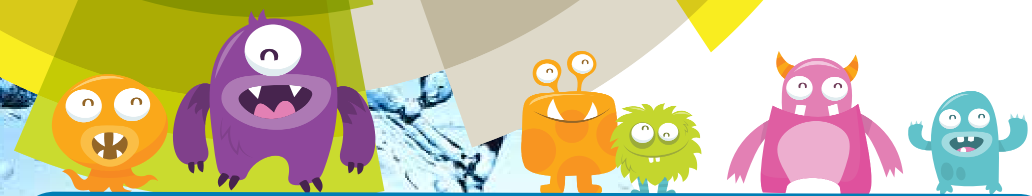
CLEANING DIRTY WATER

We need water to survive but drinking dirty water could make us ill. How can we make dirty water cleaner?

SET IN SPACE

The space craft has just been through a meteor storm. One meteor has hit the craft. The main water storage tank has been damaged. The damage report says the water has bits of plastic and metal of different sizes in it, some space dust from the meteor and waste water from a broken pipe. Can you help the crew clean the water so that it is safe to drink?



What do we need?

- Filter paper
- Coarse cloth (eg sackcloth)
- Funnel
- 3 beakers (plastic cup) labelled clearly, 'beaker 1', 'beaker 2', and 'beaker 3'
- Jug
- Food colouring
- Tap water
- Large contaminants eg bit of plastic or metal
- Small contaminants eg sand or soil
- Water filter cartridge (must be a filter that has easy access to the contents inside)

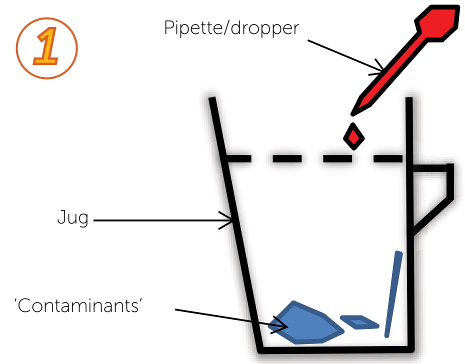
What can we ask?

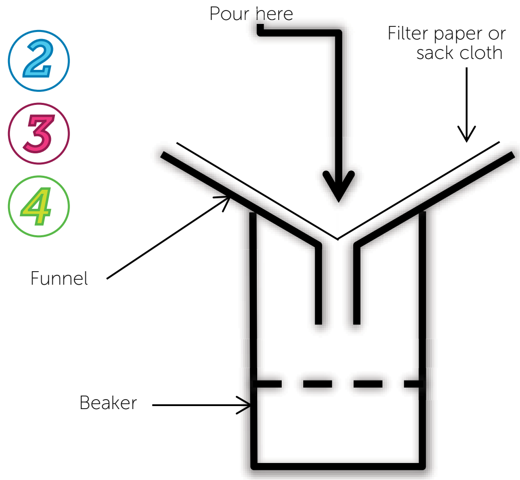
What do you think is needed to extract (take out) unwanted contaminants – both large and small – and dissolved substances?

What do we do?

1. 'Contaminate' a jug of water with the large and small contaminants mentioned. Add 2-4 drops of food colouring and mix.
2. Into beaker 1 place a funnel lined with the sack cloth. Pour some of the contaminated water into the filter until the beaker is half full.
3. Into beaker 2 place a funnel lined with a filter paper. Pour the water from beaker 1 through this filter.
4. Into beaker 3 place a funnel lined with filter paper. Put the contents of the water filter cartridge into the funnel. Pour the water from beaker 2 into the funnel in beaker 3.

The water should now **look** clean. (Children must **not** drink the filtered water – see, 'extensions').





CLEANING DIRTY WATER

We need water to survive but drinking dirty water could make us ill. How can we make dirty water cleaner?

What's happening?

The mixture created is separated out at different stages depending on the materials used to filter the starting mixture.

The cloth has gaps between the fibres which will let through the coloured water and very fine particles of sand or soil. The large items are too big to fit through the gaps in the cloth and are separated out.

The filter paper has very fine gaps within its structure which only allows water, and dissolved material to pass through thus removing sand or soil entirely.

The water filter works on an even smaller scale – it allows water through, but dissolved material is either too big or it becomes attached to the material inside the water filter (and what we're using to help separate the mixture). This filter doesn't remove bacteria or viruses however, so the water may still not be safe to drink until it has been boiled.

Extensions and other activities:

Although the water now appears clean, it is not safe to drink. Due to their small size, the harmful bacteria (micro-organisms) can pass easily through the filters used. Further treatment is required before it is safe to drink. In the home environment boiling is sufficient. In the water industry, there are a range of different treatment processes: chemical – eg chlorine, ultra-filtration amongst others.

Another scenario could be camping. Children have to get the water from a river to be clean. The equipment for filters could change to gravel, sand and crushed charcoal from the campsite.

Methods of recording:

Suggestions:

- Draw out the different stages of the separation as scientific diagrams and track observations.
- Show their understanding of the separation through a comic strip or drama explaining how the mixture is separated.

KEYWORDS

filter
solution
mixture
separate

NOTES

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THERMOMETER NEEDED

Can we use our knowledge of expansion to make a thermometer?

SET IN SPACE

The spacecraft has flown into a meteor storm, lots of equipment has been damaged. When the crew check they find that all of the thermometers are broken. Can you make a thermometer from what they can find in the space craft?

What do we need?

- A small travel bottle
- A narrow straw
- Some sticky tack
- Food colouring
- Water
- A container larger than the travel bottle

What can we ask?

How can a thermometer be made using a plastic bottle, some water, a straw and some sticky tack?

What do we do?

Put several drops of food colouring in a jug of water. Pour the water into the small bottle to the top, so there is no air.

Take the sticky tack and wrap it around the straw (approximately ½ way up).

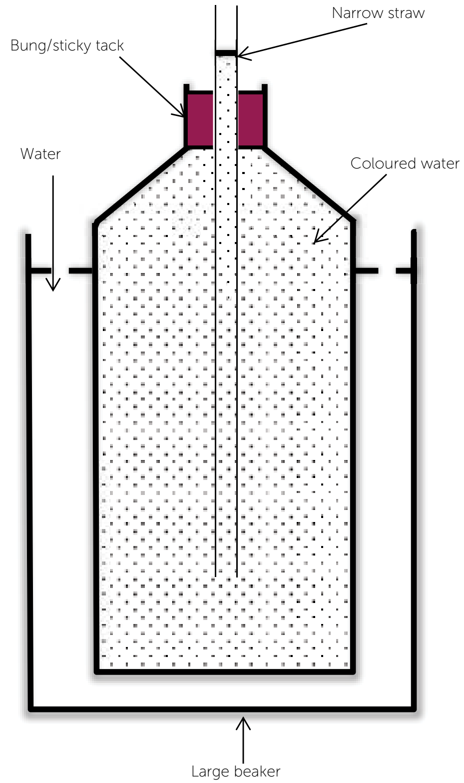
Put the straw into the top of the bottle and push the sticky tack around the neck of the bottle to form a water tight seal. The level of the coloured water should be just above the top of the sticky tack (see diagram opposite).

Put the bottle into a beaker and fill the surround with warm (as hot as is safe) water.

Observe the level of water in the straw, over 5 minutes.

Remove the bottle from the warm water and place into cold water (as cold as possible).

Repeat.



THERMOMETER NEEDED

Can we use our knowledge of expansion to make a thermometer?

KEYWORDS

contract
expand
thermometer

What's happening?

The heat from the hot water is transferred (conducted) to the liquid inside the bottle. The water inside the bottle warms and expands. The only place for the water to go is up the straw.

If the level of water inside the straw does not rise, check:

The sticky tack is forming a tight seal with the neck of the bottle.

Make sure the water in the container is as hot as it is safe to be in a classroom environment.

Extensions and other activities:

This can link with the, 'Changes of state' activity in this pack, to help reinforce learning.

Using the same travel bottle, empty it of water and place a small balloon over the neck. Now place the bottle in the warm water and leave it there for a minute. As the air inside the bottle warms, it will expand and fill the balloon. Place the bottle in cold water. The air inside the bottle will cool and contract and the balloon will deflate.

Can the children predict what will happen when heat is added to a solid?

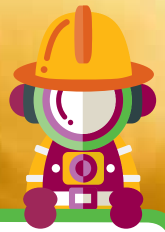
Methods of recording:

Suggestions:

Create a photo record of the class made thermometer in different containers of water at different temperatures, or in different locations.

As a next step, create a mini-film using the images to show how the water level in the straw changes.

Create a line graph tracking the height of the water above the bung against temperature outside. You can then create a scale for the class made thermometer.



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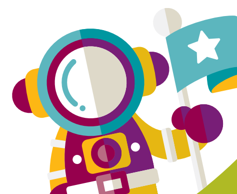


A DISSOLVING DISCOVERY

Can we discover how much salt can be dissolved in water? What factors make a difference?

SET IN SPACE

When the crew of the space craft were checking the craft after being hit by a meteor they found a piece of the meteor stuck to the craft. They want to keep it to take back to Earth to study but it is starting to break down. They are told that they can preserve it if they put it into a salt solution, the stronger the better. Can you help the crew by finding out how to get the maximum amount of salt to dissolve into some water?

What do we need?

- Containers x3 (large enough to hold approx. 200 ml liquid and they must be heat resistant)
- 100 ml of cold water (left in fridge)
- 100 ml of room temperature water
- 100 ml of hot water
- A teaspoon of salt
- Thermometers x3 (optional)

What can we ask?

Do you think the salt will dissolve in the water? How much salt do you predict will dissolve in each container? Will there be any difference? Will the different temperature water make the salt dissolve at different speed?

What do we do?

Label each container (eg '1/2/3' or, 'cold/ room temperature/hot')

Add 100 ml cold water to first container.

Add 100 ml room temperature water to second container.

Add 100 ml hot water to third container.

In each container, measure out 5 ml/teaspoon salt. Stir well until dissolved (Please note: make sure the 5 ml/teaspoon measure does not become wet, or the measurements will vary. Use a different stirrer).

Keep adding equal amounts of salt into each container. Make sure that all salt has dissolved before adding more.

MAKE SURE YOU RECORD THE AMOUNT OF SALT YOU ARE ADDING TO EACH CONTAINER!

Repeat until the salt doesn't dissolve when stirred (this is called the 'saturation' point. It means the water can't 'hold' anymore salt).

Please note: The water will cool quickly. Insulated cups may help.

Please note: 1 cm^3 is 1 ml.

A DISSOLVING DISCOVERY

Can we discover how much salt can be dissolved in water?
What factors make a difference?

What's happening?

More salt dissolves in hot water compared to cold water. This is because the water particles are moving quicker in hot water. This will mean more salt will dissolve as the faster moving water particles allow more salt to spread around. The colder the water, the slower the movement of the water particles and less salt will be dissolved.

Extensions and other activities:

Two peppermint teabags, one in hot water and one in cold water (but both in clear containers) is a visual demonstration of increased movement within water at different temperatures.

Children could measure temperature in each container and see how it changes over a period of time. (Possible questions: why does temperature change? Where does the heat go? Will the water in each container stay at different temperatures?)

Compare the results from each group. Is this a fair test? Were their predictions correct?

The children can show their results in a bar chart.

Is this a reversible change? Further experiment – make salt crystals (tie a piece of cotton thread to a twig/pencil and balance over container with highest salt content. Leave on a windowsill. Over time the water will evaporate and leave salt crystals on the cotton thread.

Talk about the dead sea – show photos/video. Mark on a world map – flotation/habitats/geography links.

Methods of recording:

Suggestions:

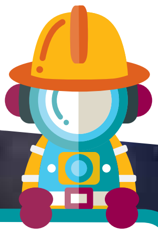
Using a table the children can monitor the maximum amount of salt that dissolves into water at various water temperatures.

This data can be made into a line graph, which can be used to quickly identify a trend and make predictions about how much salt dissolves at water temperatures not investigated.

KEYWORDS

dissolve
reversible change
temperature
measurement
fair test
saturation

NOTES



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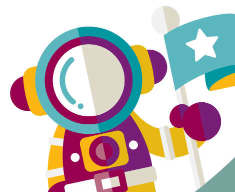
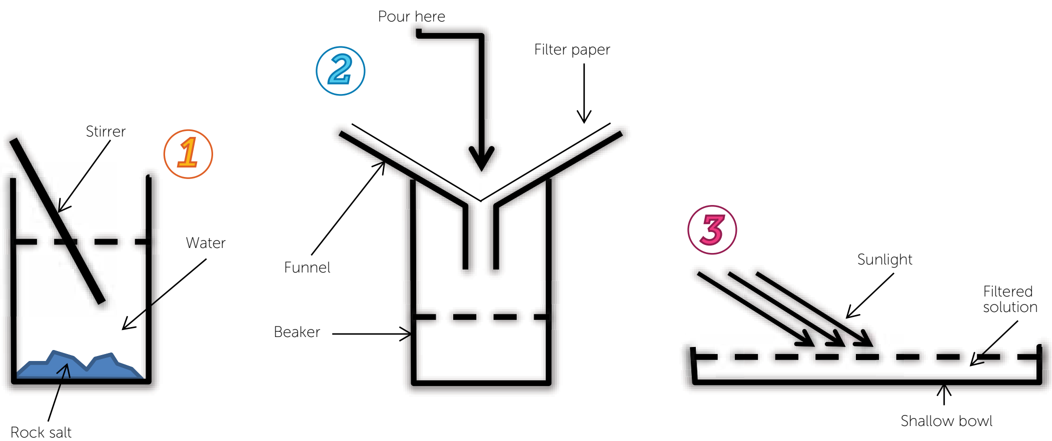


SEPARATING ROCK SALT

Rock salt is a complex mixture. Can we separate the salt out?

SET IN SPACE

The spacecraft supply of salt is getting low, the crew need more. Luckily a nearby planet has plenty of rock salt. When they get some, however, they find it is full of other bits of rock and dirt. Using what they can find on the space craft, can you help them to separate out the salt?



What do we need?

- Beakers x2
- Funnel
- Filter paper
- Stirrer
- Spoon
- Wide bowl
- Rock salt
- Goggles

What can we ask?

We can predict what may be in the rock salt and how best to remove it.

What do we do?

1. Into a beaker put several small spoonfuls of rock salt.

   Fill the beaker to three quarters full of water (this can be cold, warm or hot; an extension activity is to find out which one is the best).

   Stir thoroughly, if the container has a lid, shake for several minutes.

2. Pour the liquid through a filter paper (see diagram).

3. Pour some of the cleaned salt solution into a shallow wide bowl and place in sunlight (or a warm place).

   What happens?

   Wearing goggles will be safer.

SEPARATING ROCK SALT

Rock salt is a complex mixture. Can we separate the salt out?

What's happening?

Rock salt is a mixture; salt, stones, sand, soil etc. children can discuss where it comes from i.e. a dried-up sea bed.

They can discuss whether sieving is appropriate, it is not as some of the rock salt is the same size as the dirt.

Adding the water; the salt dissolves to form a solution, the dirt/rock does not, it is only a mixture.

The filter paper has tiny holes that take out the particles of dirt but the now dissolved salt in solution passes through.

In order to get the clean salt from the solution, the water must evaporate. This requires heat. The evaporation will happen slowly by leaving the solution in shallow trays in direct sunlight, or near a heat source (eg radiator). For a quicker result, the solution can be heated directly. (eg by placing the solution in a suitable container directly on a hot plate).

Extensions and other activities:

Link to the water cycle: can we obtain salt from the sea?

Is the purified salt safe to use? No, there could be bacteria present.

Discuss where is the best place to leave the solution to evaporate, i.e. warmer the quicker. A food hot plate will give a quick result but heat proof trays must be used eg aluminium pie containers are ideal. (shallow, not deep dishes – relates to surface area).

Methods of recording:

Suggestions:

Write out their findings as a scientific report to help other space ships that get in the same situation.

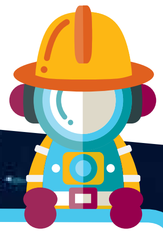
Take photos of the solution as it evaporates and collate the photos into a time-lapsed film.

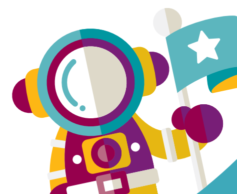
Record the rate of evaporation by monitoring the volume of solution over time. This can be recorded in a table and then converted into a line graph.

KEYWORDS

mixture
solution
dissolve
filter

NOTES





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CHANGES OF STATE

WHOLE CLASS/GROUP ACTIVITY

Can we explain and show our understanding of how materials can change state?

SET IN SPACE

The space craft is moving into orbit round a new planet. This planet is very hot and the space craft starts to warm up. The crew are worried that the increase in temperature could damage the craft and affect their water tanks. Can you think of a way to explain to the crew what will happen to the liquids and solids if the space craft gets warmer?

What do we need?

- Children

What can we ask?

How easily do you think the children will be able to move (at each stage)? Which stage do you think the children would be able to move the fastest? Is water changing state a reversible change (eg can an ice cube thaw and then freeze again? If you thaw and then freeze an ice cube, will it look the same as it did at the beginning? Why/why not?)?

What do we do?

Small group of children stand with hands together and moving slightly.

1. Making sure they stay together and without losing contact, children try to move. Like this they represent the solid form of water.

   ('add heat' – visual/vocal)

Children now let go of each other but need to be close enough to touch.

2. They can now move more freely, although they are still together. Like this they represent the liquid form of water.

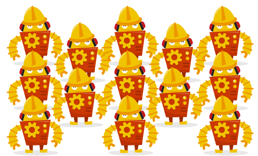
   ('add heat')

Children don't have to be near each other and they can move freely and more quickly.

3. Like this they represent water vapour.

Reverse the process by, 'cooling' (using either visual/vocal).

1



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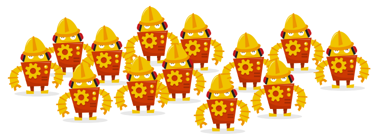

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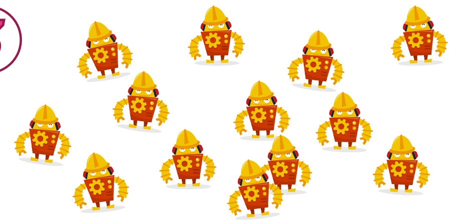


CHANGES OF STATE

WHOLE CLASS/GROUP ACTIVITY

Can we explain and show our understanding of how materials can change state?

What's happening?

The demonstration uses children to demonstrate particles of water.

In the solid form, although the children can move slightly, the particles are close together and will stay in that shape (eg ice cube).

As heat is added, the particles gain more energy and can therefore move more freely but they are still close together. They will then take the shape of the container they are in (eg glass of water).

As further heat is added, the particles gain yet more energy. They can move quickly and can escape from the surface of the liquid as a gas (evaporation). A gas will fill any container it is in (eg bathroom with steam).

Please note: Solid water is different to other solids – Ice occupies more space than the liquid and is therefore less dense. This is why ice floats and water pipes burst in very cold weather.

Extensions and other activities:

It can be developed into a PE session to demonstrate changes of state (i.e. solid, liquid, gas). Children in small groups act out 'changing' state when heat is added/taken away. The teacher could either give instructions verbally, hold up cards (+heat,-heat), or agree a signal with the children (eg 'shivering' for less heat, wiping forehead for more heat).

An extension question is: will rocks turn into a liquid if heated enough? (links to rock cycle/rocks).

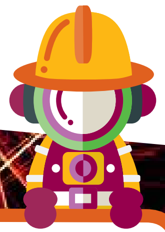
Methods of recording:

Suggestions:

Create a comic strip showing the changes of state of water.

Create a drama piece for filming or for an assembly.

Create a poster showing how water changes state and how the particles behave.



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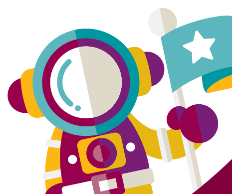
KEYWORDS

water cycle
changes of state
solid
liquid
gas
heat energy
expand
contract
evaporation
reversible change

NOTES



SPACE CRAFT SURVIVAL

Can we use our knowledge of reversible changes to save the water supply?

SET IN SPACE

Not one drop of precious water can be wasted on board the spacecraft. Unfortunately, a packet of salt has fallen and dissolved into the last container of fresh water. The crew cannot drink salt water. Using items they can find on the craft can they reverse this to get fresh water?

What can we ask?

How can we extract the water from the salt solution? What do we do?

What do we do?

Using problem solving skills and their knowledge of the water cycle, changes of state and reversible changes, you have the opportunity to plan how to use the equipment given to gain fresh water from the salt water.

What do we need?

- 1 larger bowl
- 1 smaller bowl
- 1 small weight
- Small amount of hot water
- Cling film

What else do you think is needed?

What's happening?

By placing the equipment as shown in the diagram on this page, the water in the solution evaporates and forms water vapour, leaving the salt behind. The water vapour then rises, meets the cling film and condensation occurs because the cling film is colder than the water vapour and lowering the temperature returns the water to its liquid state. As the water droplets form, they gather together at the lowest point on the cling film and drop into the smaller container beneath. This process is called distillation. This process can also be used in a survival situation in the desert where the water vapour can be gathered from the air, or even used to gather fresh water from urine (although this can't be recommended as a classroom activity)! The water that the spacemen drink on board a spaceship is actually partly recycled urine!

SPACE CRAFT SURVIVAL

Can we use our knowledge of reversible changes to save the water supply?

Extensions and other activities:

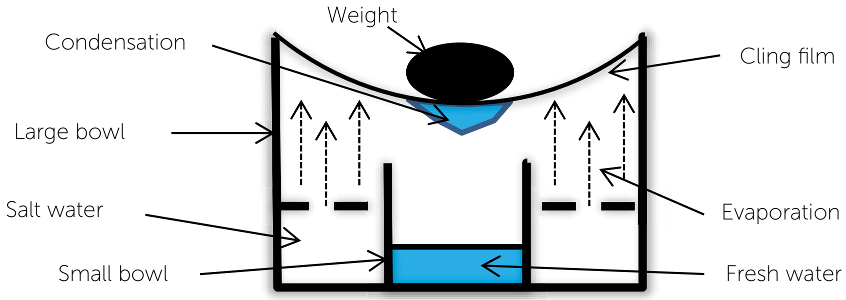
What would happen if we added hot salt water/made the pebble cold (perhaps in the freezer)?

As this is a science experiment, we can't test the water is fresh by tasting it as the equipment will not be sterile. What would happen if we took a small sample of salt water and a small sample of fresh, distilled water and left them to evaporate? If we left a small sample of tap water to evaporate, there may be a residue. (Visual aid of the scale in the kettle). Compare tap water and distilled water.

Could this process be used to get fresh water in the desert? How?

What we recommend:

The children may come up with variants of this set up or an entirely different idea! The children can also have flexibility in their recording to increase the amount of choice.



KEYWORDS

water cycle
condensation
evaporation
distillation

NOTES

Health and Safety

The Health and Safety of all participants has been considered throughout the development of this activity and reference has occasionally been made. It is, however, **essential** to follow your own school's policy when undertaking any scientific activity.

ACIDS AND ALKALIS

Can we work out what substances are acid and what substances are alkali?

SET IN SPACE

On a spacecraft some vital pieces of equipment need cleaning. The crew check and find that some needs to be cleaned with acid but other pieces need to be cleaned with alkali. Can you help the crew find out which substances on board are acid and alkali by making a colour change indicator?

What can we ask?

Predict what substances are acidic. Why do you think they are acidic?

What do we do?

1. Tear a red cabbage leaf into pieces, place into a heatproof container and fill with boiling water, allow the mixture to cool.

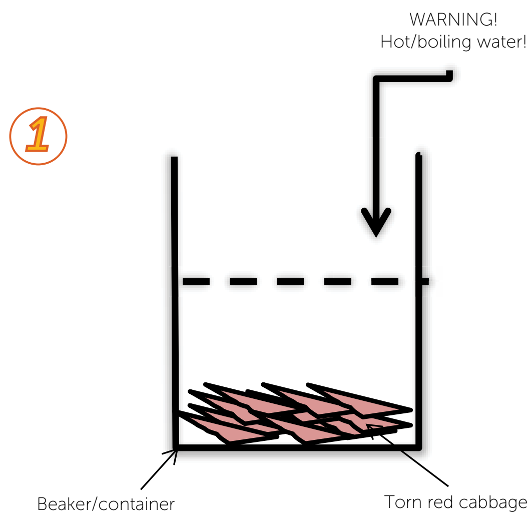
   Pour off the liquid to use and discard the pieces of cabbage. You will be left with water that has been coloured by the leaves.

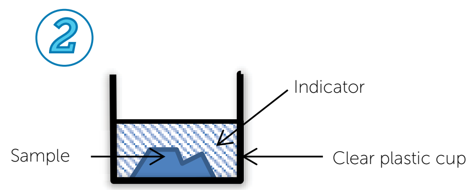
2. The coloured water can be poured into clear plastic cups to test various substances. Only a small amount is needed, about half a centimetre in a cup is sufficient.

   Place each cup onto a white piece of paper, this shows any colour change clearly.

   Now add one of the substances, use either a pipette to add a few drops of liquid or a wooden (lolly) stick for solids and stir.

   You will need to calibrate your indicator eg add some vinegar. A known acid to show the colour expected from an acid.





What do we need?

- Red cabbage (on the space craft it would be dried red cabbage)
- Clear plastic cups
- Heat proof container
- Pipettes
- Wooden lolly sticks
- White paper
- Safety goggles
- Range of substances (e.g: vinegar, bicarbonate of soda, lemon juice, orange juice, salt, sugar, washing powder, indigestion powder)

ACIDS AND ALKALIS

Can we work out what substances are acid and what substances are alkali?

KEYWORDS

indicator
acid
alkali

What's happening?

The red colour comes out of the cabbage. This cabbage water will change colour depending upon whether the substance added is acid or alkaline. The red colour from the cabbage water does not change the substance it only indicates whether each substance is acid or alkaline by changing its colour.

The colour observed can also let you know whether it is a strong or weak acid/alkaline.

Extensions and other activities:

Put about 5 cm depth of red cabbage indicator in a clear plastic cup, tell the children to blow through it for several minutes. It changes colour. This is due to us breathing out CO_2 gas; the CO_2 dissolves in the water to form a weak acid (carbonic acid).

You could repeat the experiment with a different indicator; try using dried yellow onion skins instead of red cabbage.

Indicator result guide may – vary slightly

Strong acid		Weak acid		Weak alkali		Strong alkali	
pH 0	pH 2	pH 4	pH 6	pH 8	pH 10	pH 12	pH 14

Methods of recording:

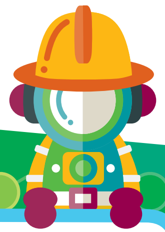
Suggestions:

Children could show their results by drawing their own colour chart based on the substances they test.

Children could make up a table to show which substances are acidic/alkaline and track each pH result. This can then be used to create a bar graph of substances against their pH.

Children can make warning posters for the space ship crew about highly acidic or highly alkali substances (both can be very dangerous).

NOTES



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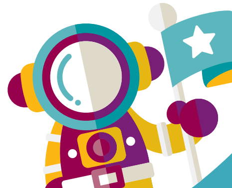


HOW MUCH SUGAR IS IN A DRINK?

Can we work out just how much sugar is dissolved in a drink?

SET IN SPACE

The crew of the space craft have jobs everyday pulling and pushing pieces of equipment. All this activity needs energy. The crew have decided a sugary drink (sugar provides energy) should be available. However, they have several choices of which drink to take on board. Can you help the crew find which drink contains the most sugar and will give them the most energy?

What do we need?

- Empty cans of common soft drinks (must be 330 ml) All sharp edges to be covered (eg by sellotape)
- Sugar cubes
- Squared paper

What can we ask?

We can predict the drinks that contain the least to the most amount of sugar. Can we re-order a list of brands in order of sugar content?

What do we do?

Look at the side of the can and find the data for the amount of sugar (often listed as, 'carbohydrate') per 100 ml.

Round the number up to the nearest whole number.

Put in a result table.

Make a bar chart using sugar cubes on squared paper.

Draw around the line of cubes.

Please note: 1 cm^3 is 1 ml.

HOW MUCH SUGAR IS IN A DRINK?

Can we work out just how much sugar is dissolved in a drink?

What's happening?

The drinks contain dissolved sugar to sweeten the taste. Some drinks need a lot of sugar to sweeten them (eg ginger beer). The sugar does not settle at the bottom of the drink as it has dissolved to form a solution.

Maths:

1 small sugar cube = 3.1 g (see packet).

Cola has 10.6 g of sugar per 100 ml.

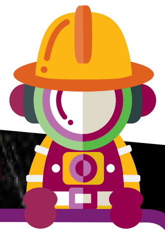
A can has a volume of 330 ml.

The total amount of sugar in the can is:
10.6 x 3.3

To find the number of sugar cubes then divide this by 3.1

10.6 x 3.3 ÷ 3.1

Therefore there are nearly 11 sugar cubes in that can.



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Extensions and other activities:

This links well with healthy living/how much sugar do you need?

To explore dissolving/solutions further, see the, 'dissolving' activity in this pack.

Buy some 330 ml bottles of water. Add the equivalent amount of sugar cubes to the water that the soft drinks have. Allow the pupils to taste. (This also demonstrates displacement, dissolving and saturation levels.) How sweet is the water? Why do soft drinks not taste this sweet?

Methods of recording:

Suggestions:

Create a table and bar graph about the amount of sugar in the drinks tested.

Show the data collected through a public information campaign to be used on ship (and in school). Posters, videos, podcasts and news articles can be made.

Show their understanding by writing letters to drink manufacturers (real or fictional to suit the setting) about their findings. Potential for linking to persuasive text writing.

KEYWORDS

dissolve
solution
energy
displace
saturation

NOTES