# Resource Disclaimer

This resource was developed to support learning for remote mode students normally enrolled in distance education.

Resources are updated by the teacher to ensure currency and are not designed to be stand alone, but integrated into a blended learning environment where students' learning is supported with a range of peer to peer and teacher to student interactions. These can include interactive and collaborative technologies as well as a range of traditional communication methods such as email, phone and learning management processes.

This resource may contain distance education specific content / instructions and should be adapted and differentiated by the class teacher before distributing to meet the needs of their students and recognise their students' context.

These documents have been harvested from distance education resources on March 12, 2020 to support all teachers in providing a continuity of learning for their students in the event of student absence during this difficult time.

**Updated – 12 March 2020**

# Science
## Stage 4
# Enough Water Fit For Drinking
## Set 2

NSW GOVERNMENT Education & Communities

Distance Education Science Network

## Acknowledgments

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# Contents

# Outcomes

By completing this set, you are working towards achieving the following outcomes:

- describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system SC4-13ES
- explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management
- follow a sequence of instructions to safely undertake a range of investigation types
- process, analyse and evaluates data from first hand investigations and secondary sources to develop evidence based arguments and conclusions
- develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives now and in the future
- develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens
- develop interest and positive, informed values and attitudes towards science and technology
- recognise the importance and relevance of science and technology in their lives now and for their future
- develop knowledge, understanding of and skills in applying the processes of Working Scientifically

(Outcomes taken from the Board of Studies NSW Syllabus for the Australian Curriculum SCIENCE Years 7 - 10, 2013)

Content Statements:

ES3d, ES3e, ES4a, ES4b, ES4c, ES4d, CW3d, CW3d, SC4-3VA, ST1-3VA, SC4-4WS, SC4-6WS, SC4-7WS, SC4-9WS,

# Resources

To complete this topic you will need the following items:

**Materials in your kit**

- ☐ 2 pipettes or droppers
- ☐ hand lens or magnifier
- ☐ 2 pieces of different coloured modelling clay
- ☐ Toothpicks
- ☐ piece of cardboard
- ☐ sheet of graph paper
- ☐ strips of paper towel (different lengths and widths)
- ☐ powdered drink mix

**Materials to collect at home**

- ☐ a cup containing baby oil
- ☐ a cup containing water
- ☐ 5 clear plastic cups
- ☐ oil.
- ☐ spoon
- ☐ a five cent coin

# Icons

Here is an explanation of the icons used in Sets 1, 2, 3 and 4

Write a response or responses as part of an activity. An answer is provided so that you can check your progress.

Compare your answers with those in the suggested answers section.

Complete an exercise in the exercises section that will be returned to your teacher.

Think about information or ideas. You need to pause and reflect. You may need to make notes.

Perform a practical task or investigation.


Stop and consider the risks to safety for yourself and others.

Access the Internet to complete a task or to look at suggested web sites. If you do not have access to the Internet, contact your teacher for advice.

Represent information or ideas as pictures or visual composition of some kind.

Listen to an audio recording on CD or file.

# Glossary

The following words, listed here with their meanings, are found in the learning material in this unit.

| | |
|---|---|
| **Acidity** | A measure of how corrosive a substance is. Acidity is opposite to alkalinity. |
| **Adhesion** | The attraction between particles of one substance and another. The strength of the attraction depends on the properties of each of the substances. |
| **Aesthetic qualities of water** | The properties of water that affect how appealing it is to drink, such as colour, taste and smell. |
| **Algal bloom** | A sudden increase in the number of algae in a waterway. Algal blooms can release toxins that can cause sickness if consumed. |
| **Alkalinity** | A measure of how basic a substance is. Alkalinity is the opposite of acidity. |
| **Aquatic ecologist** | Studies the relationships among aquatic living things and between those organisms and their environment. |
| **Aquifer** | An underground layer of permeable rock, sand or gravel that holds water. Water found within an aquifer is called groundwater. |
| **Argument** | A statement of the reason/s supporting an opinion. An argument should include claims and evidence. |
| **Atom** | A microscopic piece of matter. Different types of atoms have different properties. Atoms can be joined to similar or different atoms through chemical bonds, forming molecules. |
| **Attraction** | A force between two objects drawing them together. |
| **Bond** | A strong attractive force holding atoms or molecules together. |

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| **Capillary membrane** | A membrane about the thickness of a human hair, used for reverse osmosis, nanofiltration, ultrafiltration and microfiltration. |
| **Catchment** | An area of land that collects rainfall and contributes to surface water (streams, rivers, lakes, wetlands) or to groundwater. |
| **Claim** | A statement said to be true. Claims should be supported with evidence as part of an argument. |
| **Coagulation** | The process through which fine particles are clumped together. Chemicals are often added to neutralise the charge on the particles. The resulting mass can be easily removed. |
| **Cohesion** | The attraction between particles of a substance. Some substances are more cohesive than others. |
| **Colloid** | A substance made up of particles that are relatively large. These particles are larger than those in a solution but are small enough to stay suspended in another substance. |
| **Compound** | A substance that contains at least two elements. Atoms of these elements are held together in fixed ratios by chemical bonds. Compounds have different properties to those of the individual elements. |
| **Condensation** | The change of state from a gas to a liquid. |
| **Contaminant** | Anything found in water (including microorganisms, chemicals, minerals etc.) that may be harmful to human health. |
| **Copper** | A type of metal. Particles of copper can dissolve in water and cause sickness in people if consumed in sufficient amounts. |
| **Data** | Information such as observations and measurements. |

**Desalination** The removal of salt from seawater or brackish water to produce drinking water. Modern desalination plants use a process called reverse osmosis. Desalinated water is often used to supplement drinking water supplies in many countries, including some Australian cities and towns.

**Disinfection** A chemical (commonly involving chlorine, chloramines, or ozone) or physical process (e.g. ultraviolet light) that kills microorganisms such as viruses, bacteria and protozoa.

**Dissolved solid** A solid material that is totally dissolved in water and cannot be removed by means of filtration.

**Dissolving** The process during which a solid mixes molecule by molecule with a liquid and appears to become part of the liquid.

**Distillation** A water treatment method where water is boiled and then condensed in a separate reservoir. Contaminants with higher boiling points than water do not vaporise and remain in the boiling flask.

**Drought** An extended period of less than average precipitation.

**Evaporation** The process of changing from a liquid to a vapour.

**Evidence** Data used to prove or disprove a statement. Scientific evidence includes measurements and observations.

**Fair test** A scientific investigation in which one variable is changed, one is measured or observed and all other variables are kept the same.

**Filtration** A process in which particulate matter in a liquid is removed by passing it through porous material.

**Flocculation** A process in which small particles clump together through gentle stirring.

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| **Flux** | The rate at which a reverse osmosis membrane allows water to pass through it. |
| **Grey water** | Domestic wastewater composed of wash water from kitchen, bathroom, and laundry sinks and from tubs, and washing machines. |
| **Groundwater** | Water contained in underground stores (aquifers) that can be accessed through a bore. |
| **Health qualities of water** | The properties of water that affect human health. |
| **Hydrogen bond** | A weak attraction between hydrogen and fluorine, oxygen or nitrogen. Hydrogen bonds form between the hydrogen and oxygen atoms in separate water molecules. |
| **Impermeable** | Not allowing substances including liquids and gases to pass through. |
| **Impurity** | Pollutant or contaminant in a substance. |
| **Indirect potable reuse** | The discharge of recycled water into surface water or groundwater (called managed aquifer recharge). The recycled water is mixed with the rest of the water in the source rather than being used directly from the treatment plant. |
| **Inorganic contaminant** | A mineral-based compound such as a metal or nitrate that occurs naturally in some water, but can also enter the water through human activities. |
| **Iron** | A type of metal. Particles of iron can affect the taste and appearance of water. |
| **Membrane** | A thin barrier that allows some materials to pass through and traps others. It is a semi-permeable skin—some particles can pass through depending on their size or other properties. Membranes are commonly used to separate substances. |
| **Micro filter** | A system for separating substances from water involving a semi-permeable material with very small pores. |

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| **Microbiological** | Relating to small living things that can only be seen using a microscope. |
| **Microorganism** | A living thing so small it can only be observed through a microscope, for instance bacteria, fungi or yeasts. Some microorganisms can cause extreme health problems when consumed in drinking water. |
| **Mixture** | A mixture is a combination of two or more different materials. They are not chemically bonded. A mixture can usually be easily separated back into its original components. |
| **Molecule** | A molecule is two or more atoms held together by chemical bonds. It may contain atoms from the same element or a variety of elements. |
| **Multiple barriers** | Using different types of water purification processes to increase the effectiveness of the treatment. |
| **Nitrate** | A substance containing nitrogen and oxygen. Nitrates can cause sickness in people and can also contribute to algal blooms in waterways. |
| **Non-polar** | Describing a molecule which has an even charge all over it. |
| **Non-solution** | A mixture in which substances are not dissolved. Non- solutions include suspensions and colloids. |
| **Organic contaminant** | A carbon-based chemical, such as a solvent or pesticide, which enters water through agriculture run off or factory discharge. |
| **Osmosis** | The process of water molecules passing through a membrane towards the side with the highest concentration of dissolved impurities. |
| **Particle** | An individual piece of matter. Particles include atoms and molecules. |
| **Pathogen** | A disease producing microorganism. |

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| **Permeable** | Able to pass a fluid under pressure. |
| **pH** | A measure of how basic or acidic a substance is. |
| **Physical and chemical treatment of water** | The processes generally used in wastewater treatment facilities. Physical processes include filtration. Chemical treatment includes coagulation, chlorination, or ozone treatment. |
| **Polar** | Describing a molecule which has a slight positive charge at one end and a slight negative charge elsewhere. |
| **Pollutant** | A contaminant at a concentration high enough to endanger the lives of living things. |
| **Pore** | A tiny hole or opening in a substance, allowing some materials to pass through it. |
| **Positive and negative charge** | A property of an object causing an attraction or repulsion of other charged objects. |
| **Potable water** | Water intended for human consumption—suitable on the basis of both health and aesthetic considerations for drinking or culinary purposes. |
| **Primary wastewater treatment** | The removal of suspended, floating and precipitated solids from untreated wastewater. |
| **Purified water** | Water without any contaminants. The highest grade of water, even purer than potable water, can be produced using technologies of microfiltration, reverse osmosis and ultraviolet light. It can be used for kidney dialysis and industrial processes such as pharmaceuticals or boiler feed water. |
| **Radiological** | Relating to nuclear radiation. |

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|---|---|
| **Rebuttal** | A statement disproving another in an argument. Rebuttals should be supported by evidence and reasoning. |
| **Recycled water** | Water that has been reclaimed from sewage, grey water or stormwater systems and treated to a standard that is appropriate for its intended use. |
| **Reservoir** | Any natural or artificial holding area used to store, regulate or control water. |
| **Reverse osmosis** | An advanced method of waste water treatment that works by forcing water molecules through a semi-permeable membrane to separate it from impurities. |
| **Safe water** | Water that does not contain harmful bacteria, toxic materials, or chemicals, and is considered safe for drinking. |
| **Sand filtration** | A frequently used method to remove suspended solids from water. The water is passed through multiple layers of sand with a variety in size and specific gravity. |
| **Screening** | The use of screens to remove coarse floating and suspended solids from sewage. |
| **Sediment** | Soil, sand, and minerals washed from land into water, usually after rain. When these particles settle to the bottom of a water body this is called sedimentation. |
| **Semi-permeable** | A medium that allows some substances to pass through, but rejects others based on their properties. A semi- permeable material can be used to separate solids from water. |
| **Separation** | The isolation of the various compounds in a mixture. |

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| **Settling** | The process of a substance sinking in water. This occurs when the substance does not dissolve in water and its density is higher than that of water. Material that has settled can easily be removed from water. |
| **Sewage** | Material from internal household and other building drains. It includes faecal waste and urine from toilets; shower and bath water; laundry water and kitchen water. Sewage can be treated and the water returned to the |
| **Sewerage** | The underground drainage system (pipes) that transfers the sewage mixture to treatment plants. |
| **Solubility** | A measure of the amount of a substance that will dissolve in a unit volume of water. |
| **Solute** | Matter dissolved in a liquid, such as water. |
| **Solution** | A mixture that contains one or more substances (the solute) dissolved in another (the solvent). |
| **Solvent** | A substance (usually liquid) capable of dissolving one or more other substances. |
| **Source control** | Managing potential pollution before it reaches the water storage. This includes reducing the use of harmful chemicals that can be flushed into the sewerage. |
| **Source water** | Water in its natural state, before any treatment to make it suitable for drinking. |
| **Stormwater** | Water that washes across roads and streets, picking up oil, petrol, grease, sediment, industrial waste, leaf and other litter and dog droppings on roads, streets and paths. |
| **Stormwater harvesting** | The collection and use of stormwater for irrigation of vegetation such as ovals and gardens. |

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|---|---|
| **Submicroscopic** | Too small to see directly through a microscope. For example, all matter is made up of submicroscopic atoms. |
| **Substance** | A type of matter. |
| **Surface tension** | The tendency of a liquid to minimise its surface area. Surface tension is related to cohesion and is sometimes described as being like a 'skin' on the surface. |
| **Surface water** | Water that comes from rainfall and its runoff into streams and rivers. Surface water can come from a river, lake or artificial dam. |
| **Suspension** | A mixture in which solid particles are not dissolved and do not immediately sink within the liquid. If left to stand, the particles would sink to the bottom and form a layer of sediment. |
| **Turbidity** | A measure of how cloudy a liquid looks because of solid particles suspended in it. |
| **Urban runoff** | Water from city streets and domestic properties that carry pollutants into the sewer systems and receiving waters. |
| **Vox pop** | Looking at the opinion or ideas of everyday people. Vox pop interviews are often conducted with people approached on the street. |
| **Waste water** | Water that has been used and contaminated. This includes water that is flushed down the toilet, emptied from the sink or used in manufacturing. |
| **Water cycle** | The process by which water moves through the environment. It includes evaporation, condensation, precipitation and runoff. It is also called the hydrologic cycle. |

| | |
|---|---|
| **Water quality analysis** | A series of tests to determine various chemical or physical characteristics of a sample of water. |
| **Water recycling** | A generic term for water reclamation and reuse. |
| **Water source** | A supply or store of water. Water sources include rivers, bores and desalination of ocean water. |

# Introduction

Water is a special substance with unique physical and chemical properties. These unique properties enable us to use the physico–chemical processes of separation science to provide us with water fit for drinking.

In this set you will be examining the unique properties of water.

## Activity 1 – Water Droplets

At the end of this activity you will be able to:

- make and record observations
- compare observations about the behaviour of water and oil drops.

What you will need:

This is what you should collect from your Science kit:

- 2 pipettes or droppers
- hand lens or magnifier
- 4 toothpicks (pre-soaked in water)
- sheet of graph paper

This is what you should collect from around your home:

- 2 x plastic cups
- sheet of greaseproof paper
- food colouring
- water
- cooking oil

What to do:

1. Place your sheet of graph paper under your sheet of greaseproof paper and place on a flat surface.

2. Using the dropper place a drop of oil and a drop of water onto the greaseproof paper. You may need to practice making equal size drops.

3. Use your hand lens to observe the drops. Describe what you see from the top view and the side view.

4. Try to split the drop into smaller drops using a toothpick. Describe what happens.

   _____

5. Try to move the two drops together using a toothpick. What happens?

   _____

6. Dip the toothpick into a drop of food colouring and mix it into the new larger drop. Describe what happens.

   _____

Record your observations in the table below

| Draw and describe the | Water | Oil |
|---|---|---|
| Bird's eye view | | |
| Side view | | |
| Split drop | | |
| Joined drop | | |
| Coloured drop | | |

Compare the behaviour of the water and oil drops:

How were the drops alike?

_____

_____

_____

How were they different?

_____

_____

_____

## Activity 2 – Modelling molecules

At the end of this activity you will be able to:

- build a model of a water molecule.
- identify the component parts of a water molecule.

In this hands-on activity you will be required to build a plasticine model of a water molecule. A molecule is the smallest particle of a substance that has all the characteristics of that substance. (If you kept dividing a millilitre of water in half you would eventually have only one molecule of water. If you could divide the molecule in half it would no longer be water.)

What you will need:
This is what you should collect from your Science kit:

- 2 pieces of different coloured modelling clay, each piece about the same size
- 2 toothpicks

What to do:

1. Divide one of the pieces of modelling clay in half and roll each half into a ball.

2. Roll the second piece of modelling clay into another ball.

3. Put one toothpick in each of the smaller balls.

4. Put the other end of each toothpick in the larger ball to form a 'V' shape.


After making your model of the water molecule draw your model in the space below or take some digital photos and send them to your teacher.

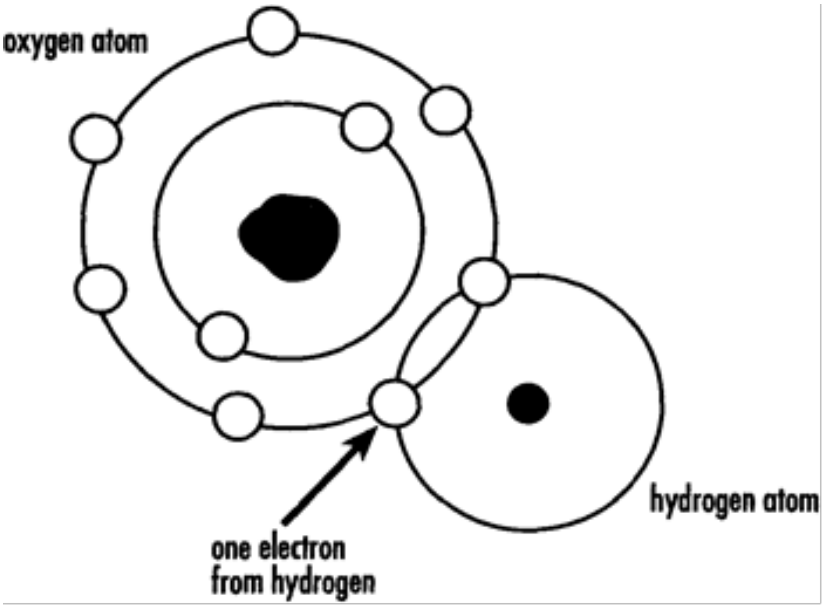
Make sure you label it.

## Activity 3 – Get to know the water molecule

At the end of this activity you will be able to:

- represent in drawing or text that, on an atomic level, water is a network of polar molecules linked together by hydrogen bonds.

Knowing the molecular structure of water, or any other substance, helps us in the understanding of many of their properties. In every water molecule, two hydrogen atoms are joined to one oxygen atom by forces called chemical bonds (the toothpicks in your model). The chemical bond between hydrogen and oxygen happens when the two atoms *share* two electrons between them, one electron from hydrogen and one from oxygen. This is shown in the figure below.




In this activity, you will learn how hydrogen and oxygen join and investigate some characteristics of the bond between them. This will help you understand the properties of water—many of which you will investigate in later activities.

What to do:

1. Locate the Water Molecule Pattern Sheet on the next page. Colour both hydrogen atoms and nuclei blue and the oxygen atom and nucleus red, leaving the electrons uncoloured. Cut out all the pieces (atoms, nuclei, and electrons) of the water molecule.
2. Remember that in every water molecule, two hydrogen atoms are bonded to one oxygen atom. Before gluing the hydrogen atoms to the oxygen atom, try different arrangements of the atoms and use a blank piece of paper to sketch out at least three different ways that the two hydrogen atoms and one oxygen atom could be joined to make a single molecule.
3. Based on this description, glue the hydrogen and oxygen atoms together on the blank page which follows. The glue represents the bonding between the hydrogen atoms and the oxygen atom.
4. Glue a nucleus in the centre of each atom so that the nucleus covers the letter representing the atom ("0" or "H").
5. Count the electrons you have cut out. You should have 10.
    a. Glue two of these to the oxygen atom, placing them on opposite sides of the dashed circle.
    b. Remember that each bond between hydrogen and oxygen is formed by sharing two electrons (refer to the figure above). At each place where the edge of the hydrogen atom crosses the edge of the oxygen atom, glue two electrons.
    c. Glue the rest of the electrons (you should have four left) to the oxygen atom spacing them evenly around the solid outer circle.
6. Due to the way hydrogen and oxygen bond, each hydrogen atom has a slightly positive charge, and the oxygen atom has a slightly negative charge. Draw a"–" sign on the oxygen atom and a "+" sign on each hydrogen atom. Did you notice that the "+" signs are on one end of the molecule and the''-" sign is on the other end? This roughly gives the molecule opposite charges on either end, similar to a bar magnet's north and south pole. Molecules with their"+" and"–" charges arranged like this are called polar molecules. Water is considered a strongly polar molecule. Because water molecules are

polar, they "stick" together much like magnets do. This sticking together is one reason why water requires so much heat to warm up and even more to boil. This property is called cohesion.

Use the information you have gathered in this activity to answer the following questions.

1. Name the elements found in a water molecule.

_____

_____

2. What is the ratio of hydrogen atoms to oxygen atoms in a water molecule?

_____

_____

3. If one object has a positive charge and one has a negative charge, what will they tend to do to each other?

_____

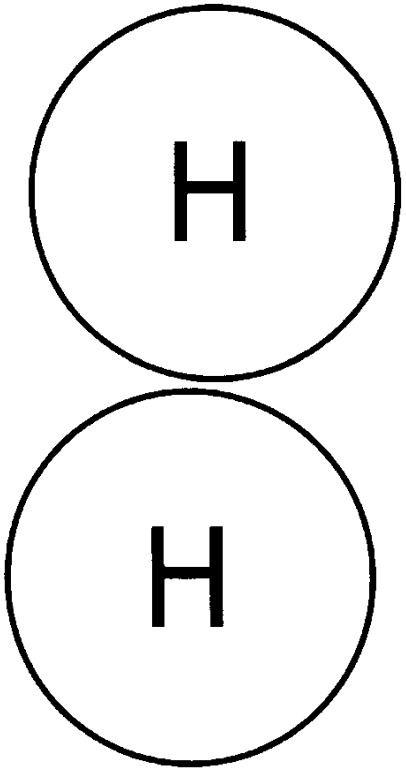
4. Using your answer to question 3, why do you think water molecules tend to "stick" together?

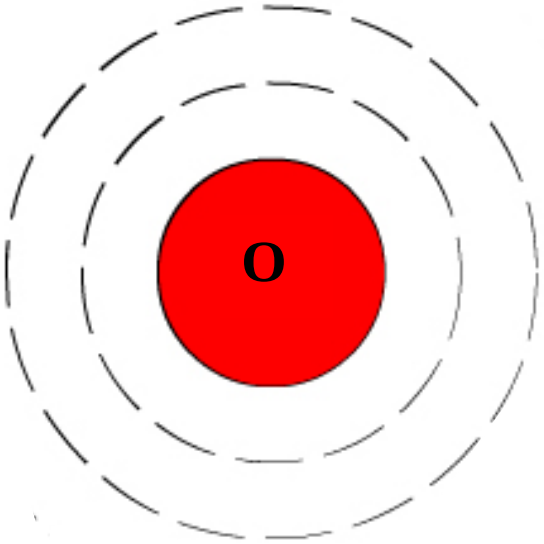
_____

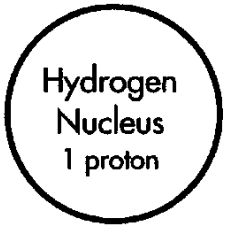
_____

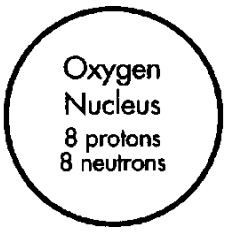
_____

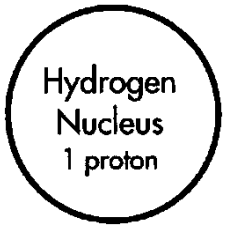
**WATER MOLECULE PATTERN SHEET**



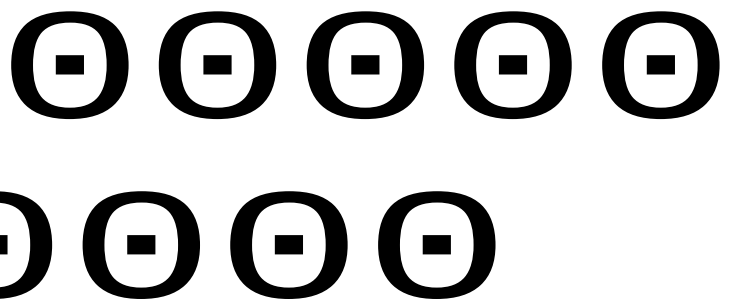




**Electrons**



## Activity 4 – Sticky water

At the end of this activity you will be able to:

- design and carry out a fair test
- observe and offer explanations
- explain the cohesive properties of water.

In his activity you will investigate surface tension further by investigating how many drops of water they can fit on a coin and explain their observations.
What you will need:

This is what you should collect from your Science Kit:

- eye dropper

This is what you should collect from home:

- one five cent coin
- a cup partially filled with water

What to do:
How many drops do you predict that you will be able to place on the coin before it overflows?

_____

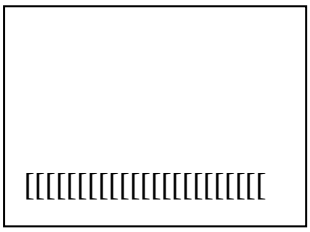
Now place the coin on a flat surface and try to fit as many drops of water on the coin as possible.

How will you ensure it is a fair test? For example at what height will you drop the water? Which side of the coin will be facing up? Should you carry out repeat trials? Place drops of water slowly on the coin and count and observe what happens.

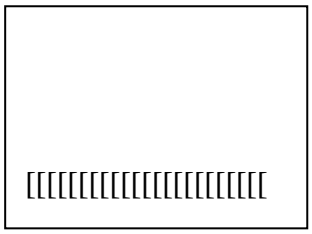
How many drops were you able to place on the coin before it overflowed?

_____

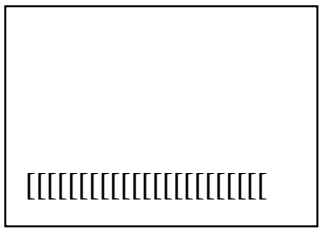
Collect data by drawing a diagram showing the shape of the water on the coin after one drop, when the coin is half full and just after it overflows.



**One drop on coin**



**Coin half full**



**Coin overflowing**

If the number of drops is very different from your prediction, explain what accounts for the difference.

_____

_____

_____

_____

Explain your results in terms of cohesion. The information below may help you.

The hydrogen bond between water molecules that we talked about in the first section is the reason behind two of water's unique properties: cohesion and adhesion.

**Cohesion** refers to the fact that water sticks to itself very easily.

**Adhesion** means that water also sticks very well to other things, which is why it spreads out in a thin film on certain surfaces, like glass. When water comes into contact with these surfaces, the adhesive forces are stronger than the cohesive forces. Instead of sticking together in a ball, it spreads out.

_____

_____

_____

_____

_____

# Activity 5 – How does water interact when it encounters paper?

At the end of this activity you will be able to:

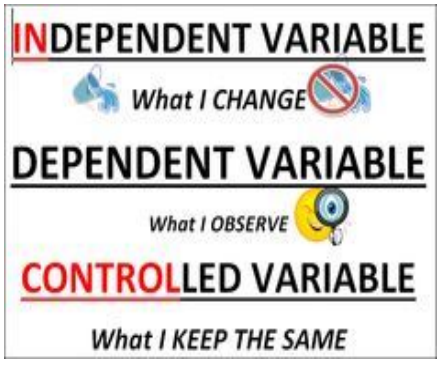
- design and carry out a fair test
- observe and offer explanations
- explain the adhesive properties of water in terms of molecular attraction.

In this hands-on activity you are going to design a fair test. You conduct a fair test by making sure that you change one factor at a time while keeping all other factors the same.

For example; let's imagine that we want to measure which is the fastest toy car to coast down a sloping ramp. If we gently release the first car, but give the second car a push start, did we do a fair test of which car was fastest? No! We gave the second car an unfair advantage by pushing it to start. That's not a fair test!

The only thing that should change between the two tests is the car; we should start them down the ramp in exactly the same way. You conduct a fair test by making sure that you change one factor at a time while keeping all other conditions the same.

Conducting a fair test is one of the most important ingredients of doing good, scientifically valuable experiments. To insure that your experiment is a fair test, you must change only one factor at a time while keeping all other conditions the same.




Scientists call the changing factors in an experiment variables.

What you will need:
This is what you should collect from your Science Kit:

- strips of paper towel (different lengths and widths)

This is what you should collect from home:

- clear glass of water
- ruler to measure millimetres

What to do:

Design a fair test to see what happens when you hold the paper upright and dip it into the water.

List the variables you will change.

_____

_____

List the things you will keep the same.

_____

_____

What is the thing you are going to measure?

_____

_____

Now draw a series of labelled diagrams in the boxes below to show how you are going to do your fair test.

Step 1

Step 2

Step 3

Step 4

In the space below design a table that will allow you to record your results. Usually you record the thing you are keeping the same and the thing you are measuring.

Complete your fair test and record the results in your table.

**Results table:**

Based on the evidence from your fair test and what you know about the water molecule:

How can you explain the behaviour of the water?

_____

_____

_____

_____

Why doesn't rain fall as individual molecules instead of raindrops?

_____

_____

_____

_____

Use your understanding of the properties of water to explain the images below.

Match each image with one of the terms below and explain your thinking.

**Cohesion** **Surface tension** **Adhesion**

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## Activity 6 – Different types of mixtures

At the end of this activity you will be able to:

- make and record observations
- sort mixtures based on observable properties

In this activity you will be making and sorting mixtures based upon their observable properties.

What you will need:

This is what you should collect from your Science kit:

- powdered drink mix
- piece of cardboard

This is what you should collect from home:

- water
- milk
- sugar
- salt
- torch
- pencil
- cooking oil
- spoon
- 5 clear plastic cups

What to do:

Step 1

- In separate beakers, prepare these five mixtures. Stir each one well to ensure it is completely mixed.

- Mixture 1:

  Add ¼ teaspoon of powdered drink mix to 50 mL of the purest water possible.

- Mixture 2:

  Add 2 or 3 drops of milk to 50 mL of the purest water possible.

- Mixture 3:

  Add ¼ teaspoon of sugar to 50 mL of the purest water possible.

- Mixture 4:

  Add 3-4 drops of oil to 50 mL of the purest water possible.

- Mixture 5:

  Add ¼ teaspoon of salt to 50 mL of the purest water possible.

Step 2

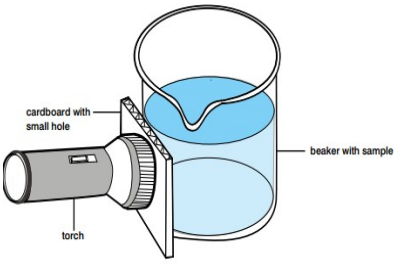
Compare each of the mixtures. How are they similar? How are they different? Record your results in the observation table on the next page.

Step 3

Prepare the piece of cardboard by cutting a small neat hole in it with the pencil. Make sure the hole is no bigger than 0.5 cm.

Step 4

Place the cardboard over the torch so that the only light you can see comes through the hole.



Step 5

Press the torch and the cardboard tightly against the container holding the mixture. What does the mixture look like from above? Can you see the path of the light through it?

Record your results in the observation table.

| Mixture | What does the mixture look like from above? | Can you see the path of the light through it? |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

Use your observations from above to place the mixtures into groups based on similar characteristics. Write the groups below.

_____

_____

Why did you group them this way?

_____

_____

_____

## Activity 7 – How will you know a solution when you see one?

At the end of this activity you will be able to:

•define key words associated with mixtures including colloid, dissolve, suspension, solute, solution, non-solution, solvent

•describe the Tyndall Effect at the particle level.

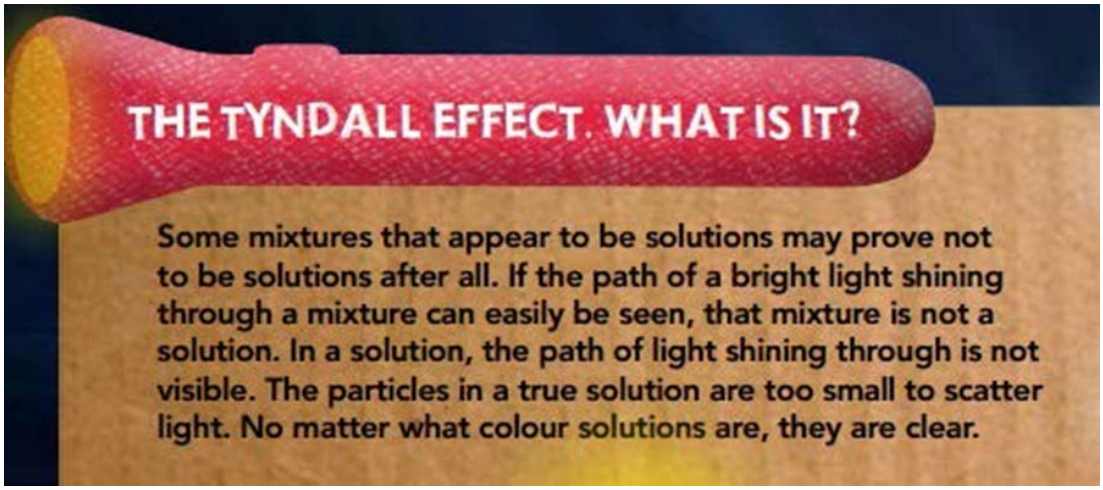
Think about the meaning of the following terms which are all associated with mixtures.

**colloid, dissolve, suspension, solute, solution, non-solution, solvent**

Write your ideas about what each word means in the second column of the table below.

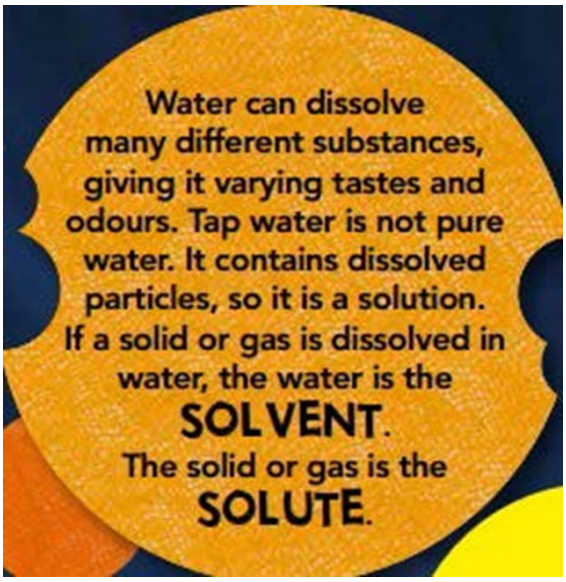
| Word or term | My meaning | Scientific meaning | ✓ or ✗ | What's the difference between my meaning and the scientific meaning? |
|---|---|---|---|---|
| mixture | | | | |
| solution | | | | |
| non-solution | | | | |
| colloid | | | | |
| suspension | | | | |
| dissovle | | | | |
| solute | | | | |
| solvent | | | | |

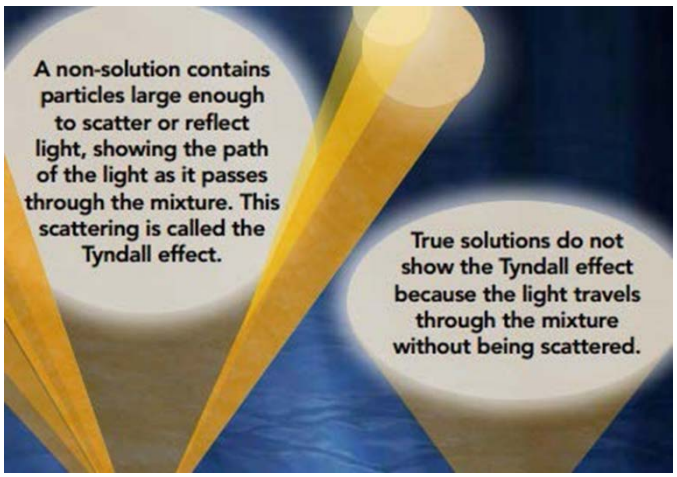
By reading the following information you will find the scientific meanings of the words in the above table.

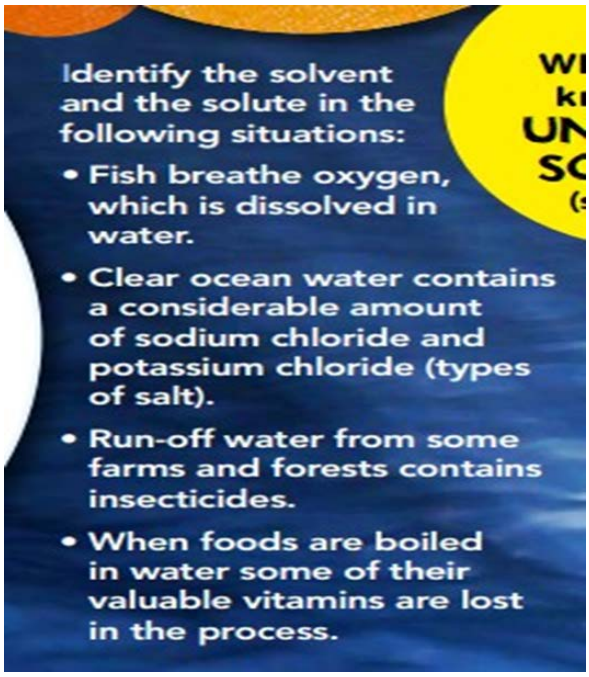



More substances will dissolve in water than in any other liquid, so water is known as the universal solvent. Not all substances, though, can dissolve in water. Some solid particles may sink to the bottom. A suspension is a mixture that contains visible, insoluble particles in a liquid. Muddy water is an example of a mixture that is a suspension. The visible dirt particles that don't dissolve form a layer of sediment on the bottom.

Sometimes the particles of dirt and clay in the water don't settle and the water looks murky brown. This mixture is a colloid. It is not clear like a solution and the particles in it don't settle as in a suspension.






Write the scientific meaning of each word in column 3 in the table above. If your meaning matches the scientific meaning place a tick in column 4. If it is different place a cross.

For those words with a cross write how the two meanings are different in column 5.

Go back and look again at the observations you made in Activity 6.

In the space below list any of the mixtures you think are solutions.

_____

_____

_____

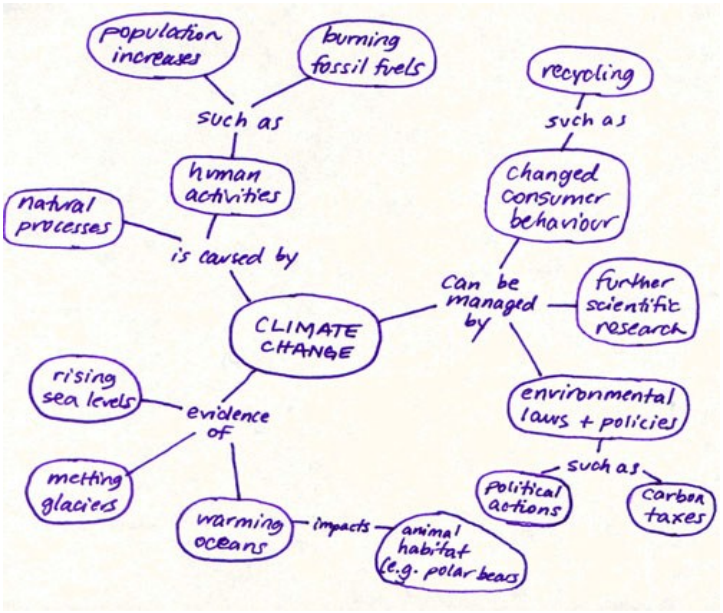
## Activity 8 – What's your learning?

At the end of this activity you will be able to:

- share what you have learned so far about water

In this activity you will complete a Concept Map as a formative assessment task. It provides the opportunity to organise your understanding so far. This will give your teacher a clear idea of the progress you are making.

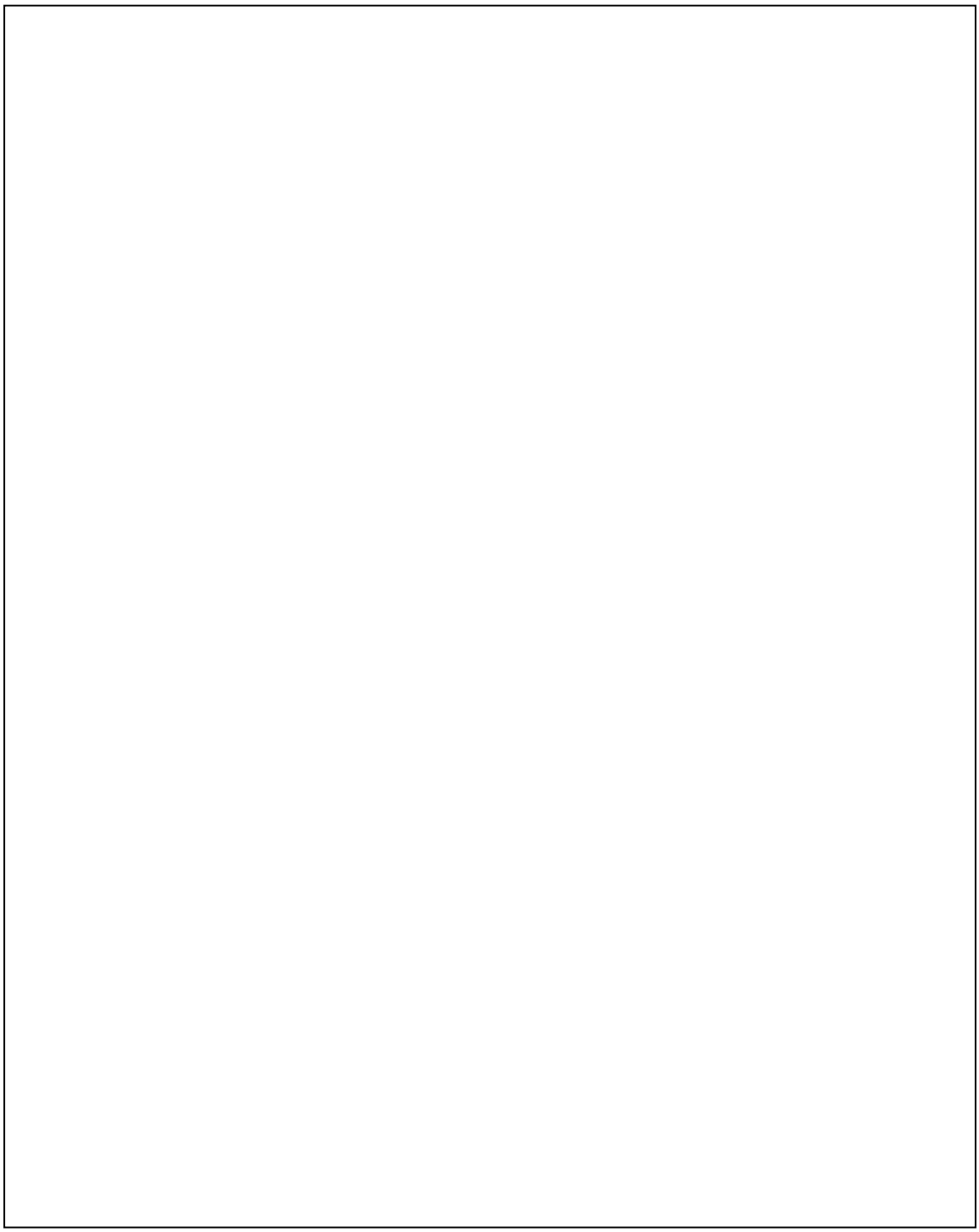
The following is an example of a concept map. This map links ideas about climate change.




Words to use in your concept map.

**Adhesion, Water molecule, Cohesion, Polar charge, Solvent, Hydrogen bonding, Mixture, Solution, Colloid**

You can include extra terms, as well as connecting words, to show your understanding so far. It doesn't matter how many links you use or how many times you link a word to other words. Draw your concept map below.



Now complete the Student Reflection on the next page which is your opportunity to think about what you learnt in this set of activities and to think about what you could improve next time.

# Student Reflection

# How Did I Go?


The three best things about my work are:

_____

_____

_____

The most important thing/s I learned was/were:

_____

_____

One thing that surprised me:

_____

_____

My work could have been better if:

_____

_____