

S1 Science - Matter



Matter

Changes of State

Solubility



Education Scotland Experiences, and Outcomes

- **SCN 3-05a:** By contributing to experiments and investigations, I can develop my understanding of models of matter and can apply this to changes of state and the energy involved as they occur in nature.
- **SCN 3-16b:** I have taken part in practical investigations into solubility using different solvents and can apply what I have learned to solve everyday practical problems.

States of Matter

24/09/2024

Page 4

Starter:

What's the difference between the objects below?

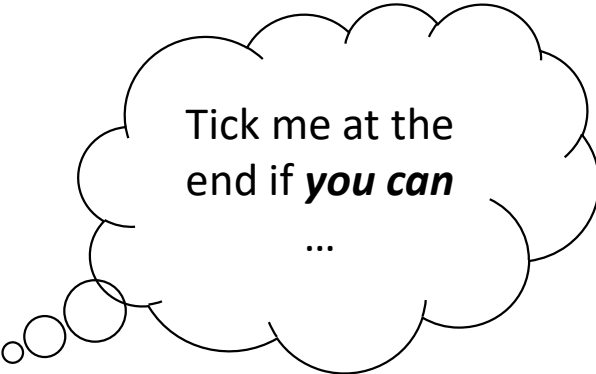


Learning Intentions:

- To identify solids and liquids by their properties and give everyday examples of each.
- To describe the particles in a solid, liquid and gas.

Success Criteria

- I can identify solids and liquids by their properties and give everyday examples of each.
- I can describe the particles in a solid, liquid and gas.



Tick me at the end if ***you can***

...

States of Matter

Matter is anything which has a mass and occupies a space.

There are three main states of matter:

- **solid**
- **liquid**
- **gas**

States of Matter

Activity:

Classify items as solids, liquids and gases.

Solid	Liquid	Gas

Extension:

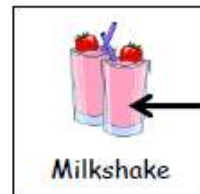
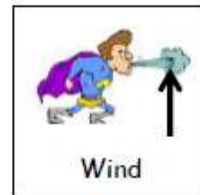
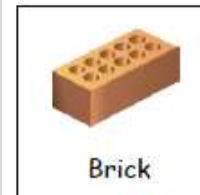
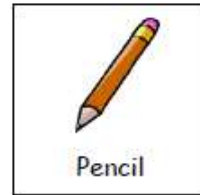
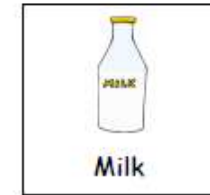
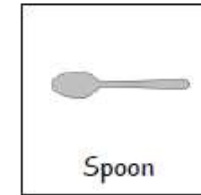
Think of some examples of your own and add them to your table.

Date

Classify items as solids, liquids and gases

Draw a table in your book with 3 columns with headings of solid, liquid and gas, like the one below:

Solid	Liquid	Gas



Extension: Think of some examples of your own and add them.

States of Matter

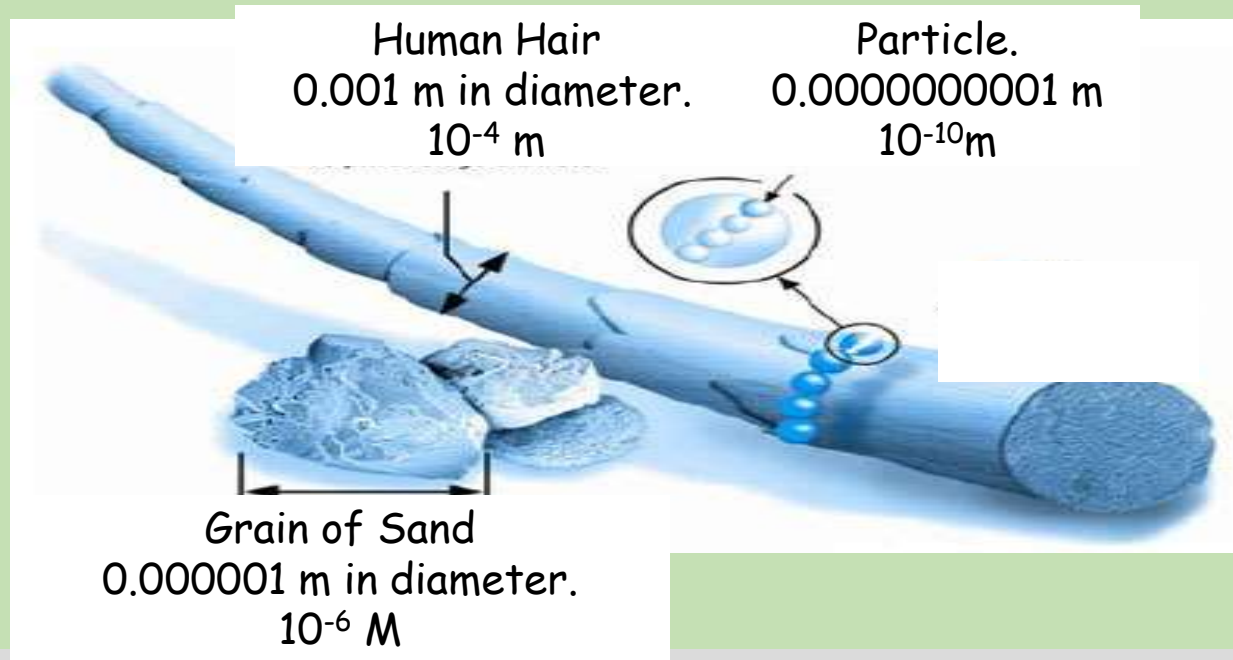


States of matter song:

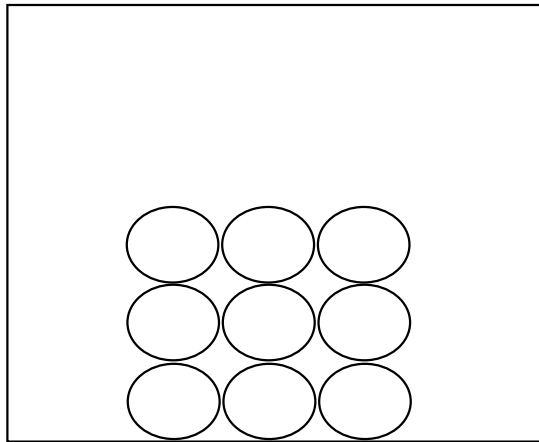
Matter Chatter (song for kids about solids, liquids, and gases) 3:14 mins

Particles

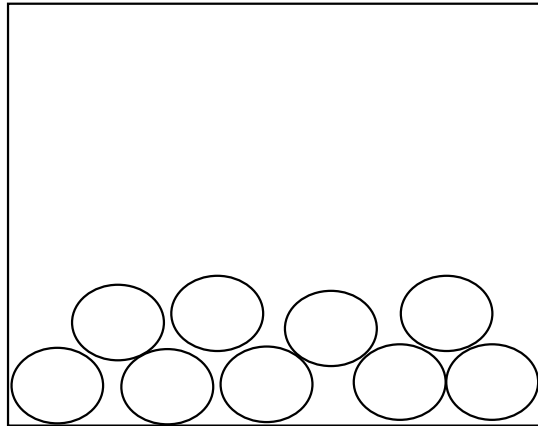
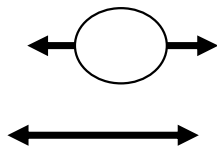
All matter is made from tiny particles called atoms.
Particles are always moving.



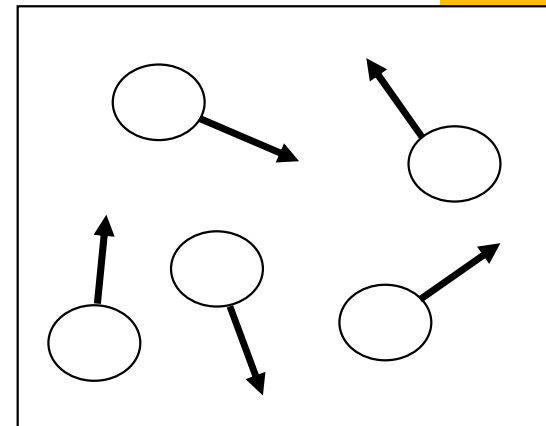
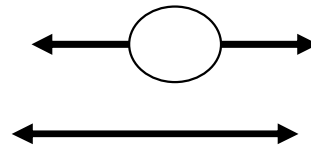
Solid, liquid or gas



SOLID



LIQUID



GAS



[Video link](#)

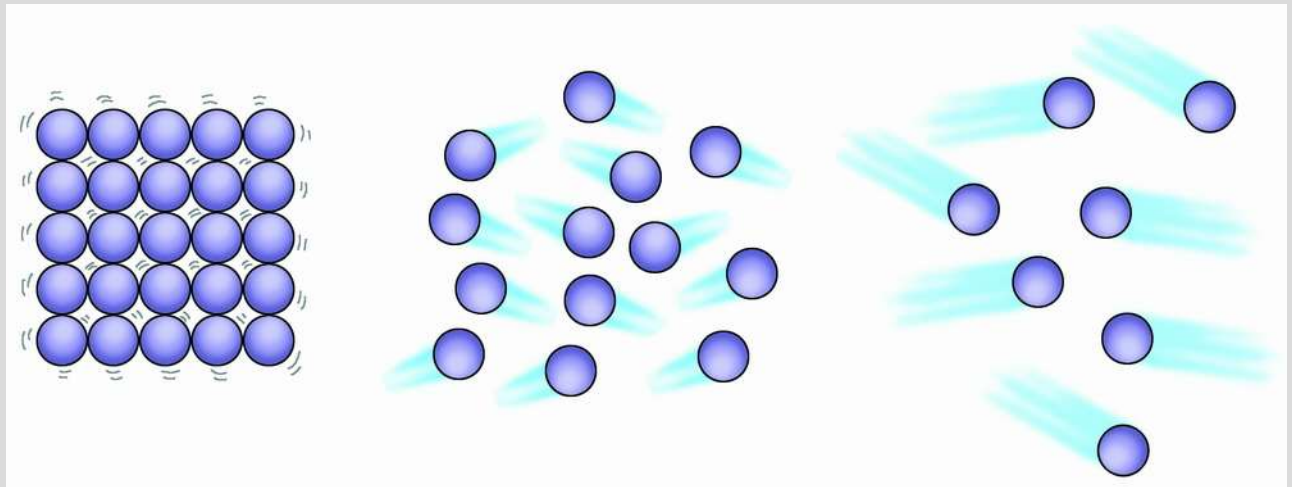


[How can a penguin "huddle" be compared to a solid, liquid and gas?](#)



Solid, liquid or gas

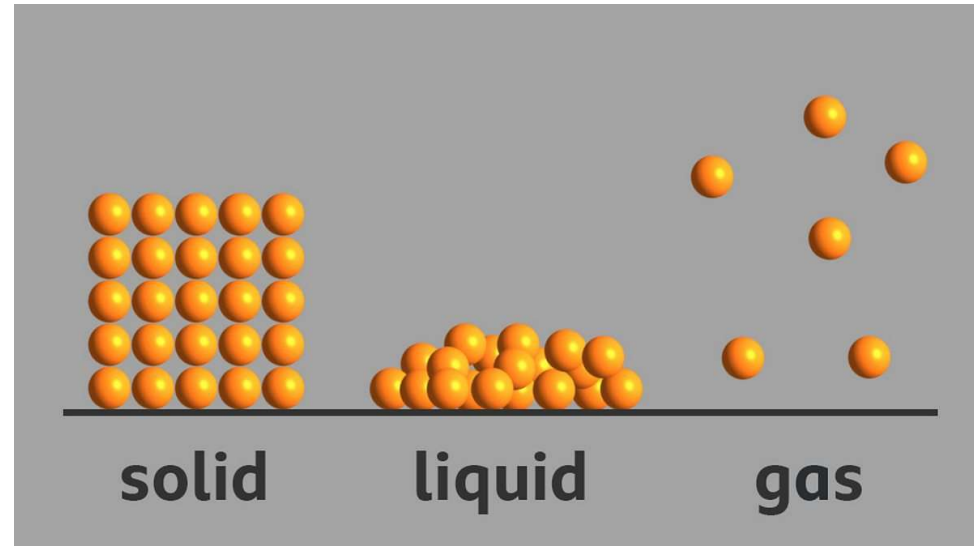
Activity: Act it out and move around like a solid, liquid and gas.



Plenary:

Describe how the particles **move** in a:

- Solid
- Liquid
- Gas



Success Criteria

- I can identify solids and liquids by their properties and give everyday examples of each.
- I can describe the particles in a solid, liquid and gas

Tick me at the
end if ***you can***

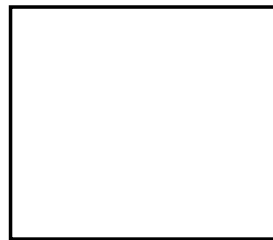
...

Starter:

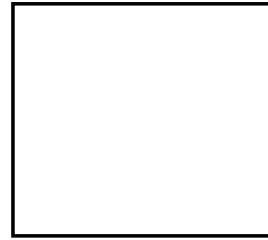
1. Draw the particle arrangement of a solid, liquid and gas.



Solid



Liquid



Gas

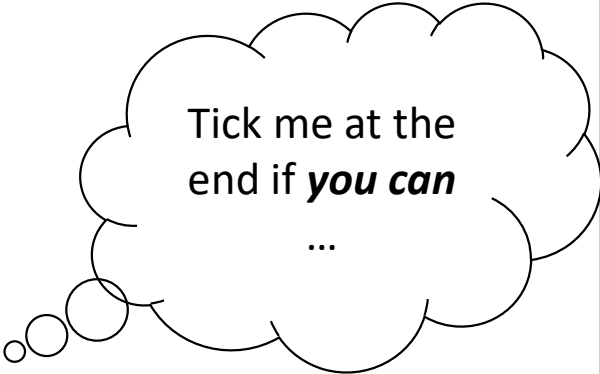
2. Describe how the particles in a solid, liquid and gas move.

Learning Intentions:

- To describe the properties of solids, liquids and gases.

Success Criteria

I can describe the properties of solids, liquids and gases.



Tick me at the
end if ***you can***

...

Properties of solids liquids and gases

Aim: To investigate the properties of solids, liquids and gases.

	Change Volume? (be compressed)	Change shape?	Flow?
Solid			
Liquid			
Gas			

We will complete three different activities to investigate if solids, liquids and gases can:

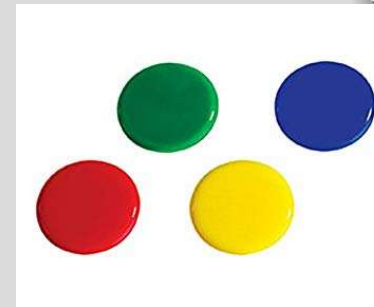
- change volume?
- change shape?
- flow?

Properties of solids liquids and gases

Activity 1

Look at the different solids in the tub on your table and decide the following:

1. Does the shape of a solid change?
2. Has it changed volume?
3. Can it flow?



Properties of solids liquids and gases

Aim: To investigate the properties of solids, liquids and gases.

Page 8

	Change Volume? (be compressed)	Change shape?	Flow?
Solid	No	No	No
Liquid			
Gas			

Properties of liquids

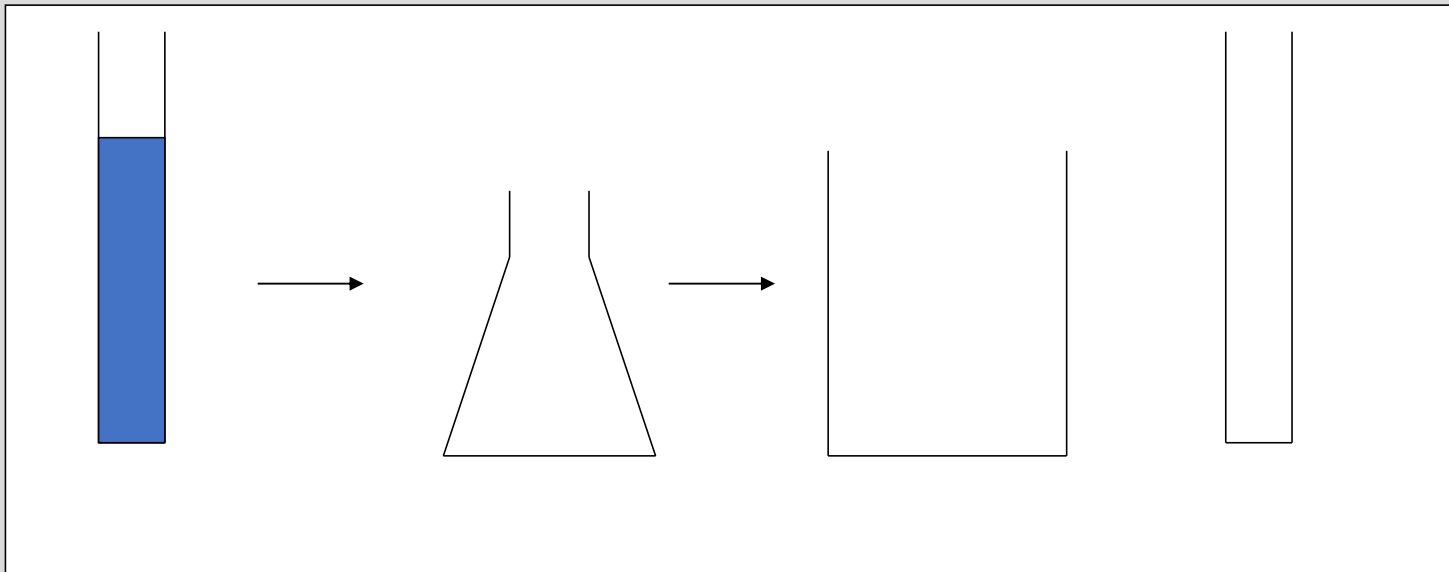
Activity 2:

- Measure 50ml of water in a measuring cylinder and add ONE drop of food colouring.
 - Transfer this to a beaker.
 - Transfer this to a conical flask
 - Transfer this to the original measuring cylinder.
1. What shape does the coloured water have in each of the containers?
 2. Has it changed volume?
 3. Can it flow?



Properties of liquids

1. Does the water change shape?
2. Does the water keep its volume ?
3. Does the water flow?



Properties of solids liquids and gases

Aim: To investigate the properties of solids, liquids and gases.

Page 8

	Change Volume? (be compressed)	Change shape?	Flow?
Solid	No	No	No
Liquid	No	Yes	Yes
Gas			

Properties of gases

Activity 3

- Can you pour a gas?
- Watch the demonstration with a candle and carbon dioxide.....
- Do gases **flow**? Can you “pour” a gas?



Properties of solids liquids and gases

Aim: To investigate the properties of solids, liquids and gases.

Page 8

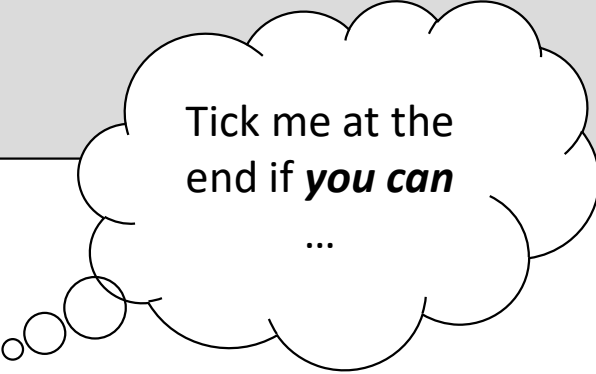
	Change Volume? (be compressed)	Change shape?	Flow?
Solid	No	No	No
Liquid	No	Yes	Yes
Gas	Yes	Yes	Yes

Plenary

1. Describe how solids and gases are **different**.
2. Describe how liquids and gases are the **same**.

Success Criteria

- I can describe the properties of solids, liquids and gases.



Tick me at the end if *you can*

...

Solid or Liquid?

24/09/2024

Page 9

Starter:

1. Are these substances solid, liquid or gas? Explain your thinking.



Paint



Jelly



Custard

Solid or Liquid?

24/09/2024

Learning Intentions:

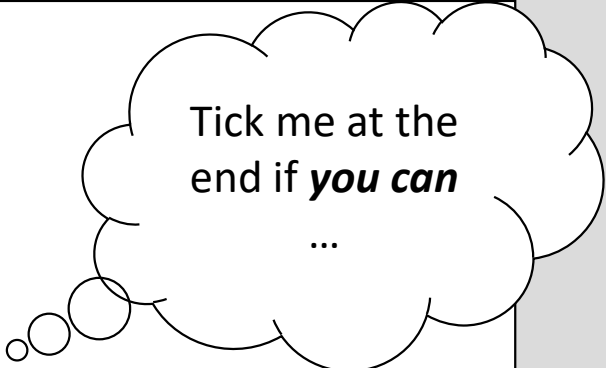
- To describe the properties of a non-Newtonian fluid.

Solid or Liquid?

24/09/2024

Success Criteria

I can describe the properties of a non-Newtonian fluid.



Tick me at the
end if *you can*

...

What about if something behaves like a solid and a liquid?



[Jon Tickle WALKS on Custard! | Brainiac \(3.45\)](#)

Making Slime - Cornflour and Water

Aim: To investigate the properties of a non-Newtonian fluid.

Method: Your teacher will give you specific instructions on how to carry out this activity.

- Add cornflour to a cup or beaker.
- Add a **small** amount of water to the cornflour and mix with a spatula.
- Keep adding water until you make a paste – don't add too much water at once or it will be too runny!



Making Slime - Cornflour and Water

Page 10

Aim: To investigate the properties of a non-Newtonian fluid.

Method: *(What did you do?)*



Making Slime - Cornflour and Water

Page 10

Results?: *(What did you observe?)*

Conclusion: *(What did you find out?)*

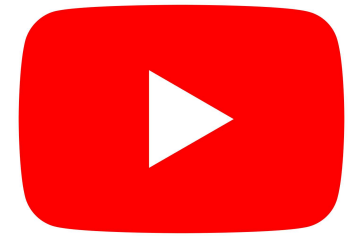


A Non-Newtonian Fluid

[Non-Newtonian Fluid in Slow Motion - The Slow Mo Guys \(4:15\)](#)

[What Kind of Liquid Lets You Run Across Its Surface? | Street Science \(2.28\)](#)

[CBBC: Blue Peter - Radzi walks on custard! \(4.12\)](#)



Solid or Liquid?

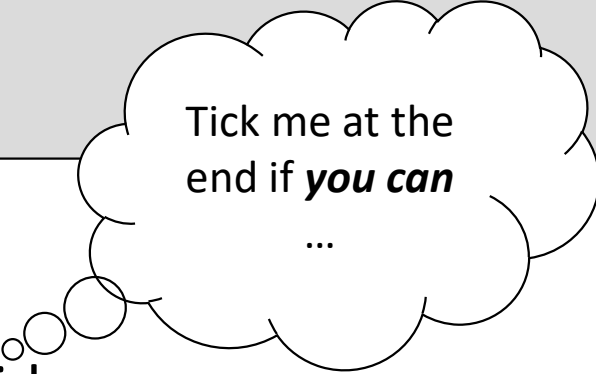
24/09/2024

Plenary

Explain how it is possible to walk on custard.

Success Criteria

I can describe the properties of a non-Newtonian fluid.



Tick me at the
end if *you can*

...

Starter:

The three states of matter are solid, liquid and gas.

1. Name a solid
2. Name a liquid
3. Name a gas
4. Describe how solids, liquids and gases are different.
5. Name something that behaves like a solid and a liquid.

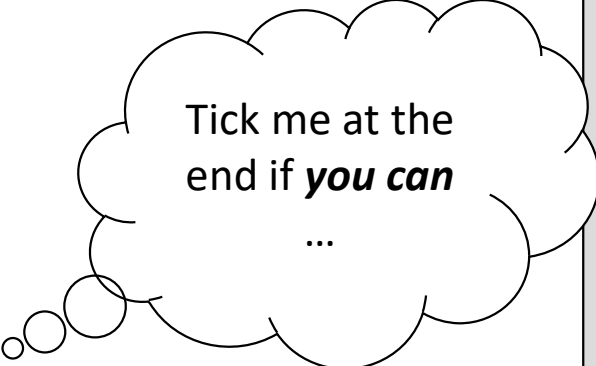


Learning Intentions:

- To explain changes of state.

Success Criteria

I can explain changes of state.

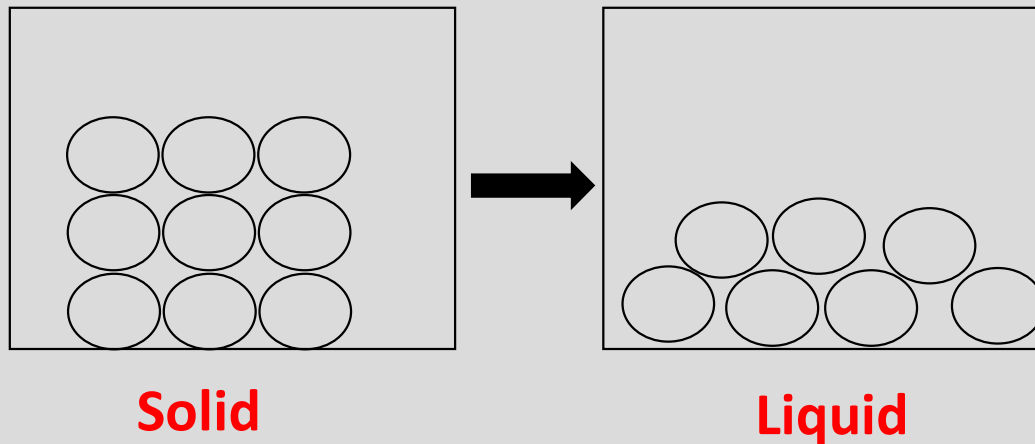


Tick me at the
end if *you can*

...

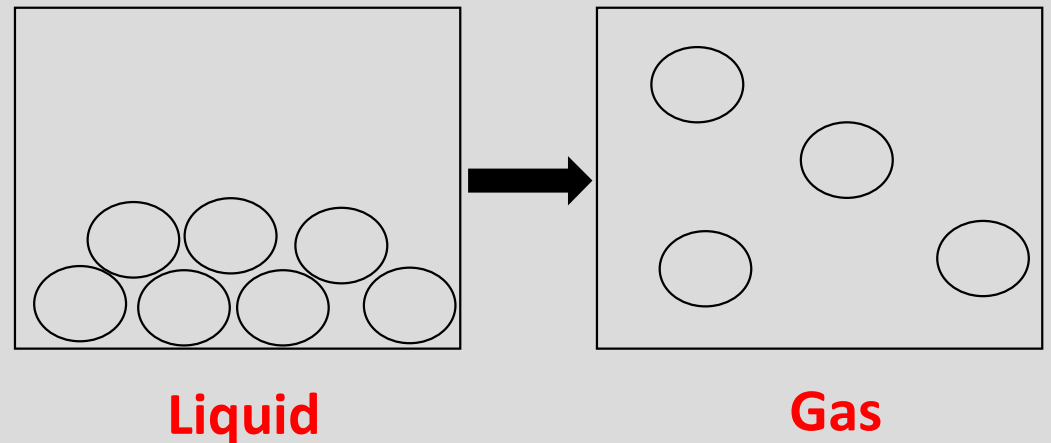
Changing States

When a **solid** is heated the particles start to vibrate as they gain energy and it **melts** to become a **liquid**.



Changing States

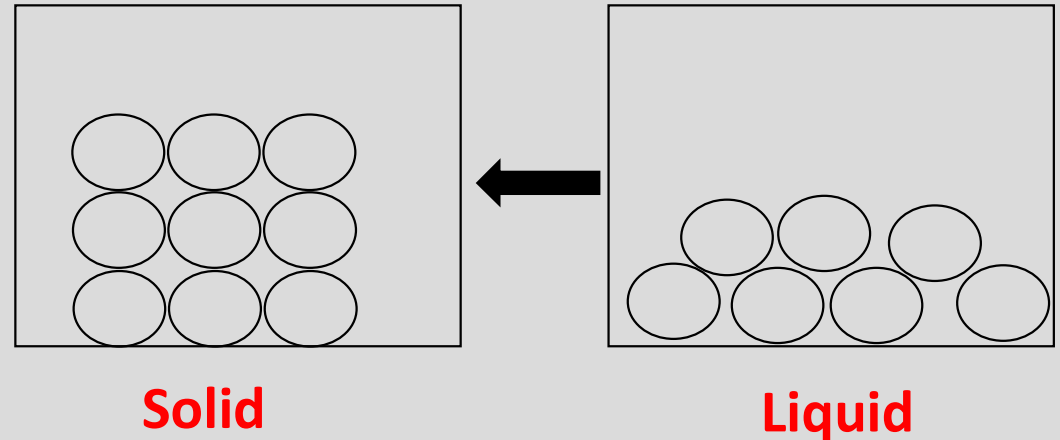
When a **liquid** is heated it **boils** and becomes a **gas** i.e. **Boiling**.



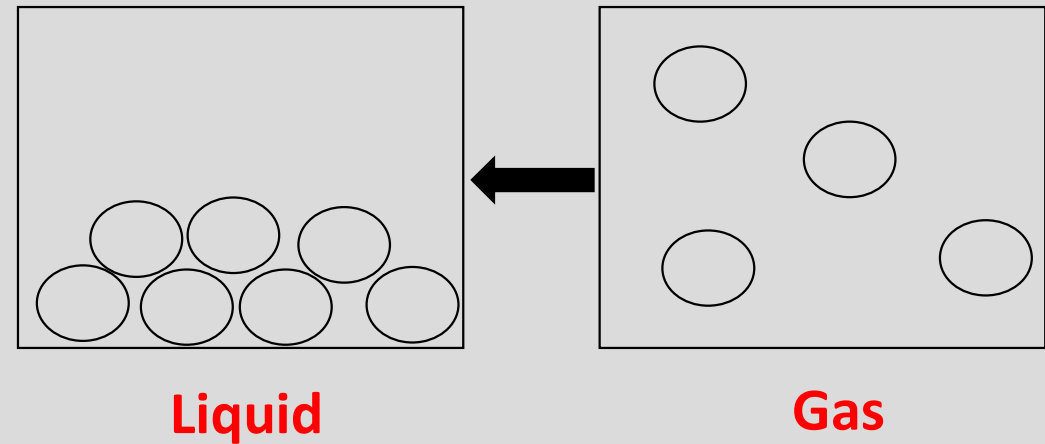
If a liquid becomes a gas without bubbling we call it **evaporation**.

Changing States

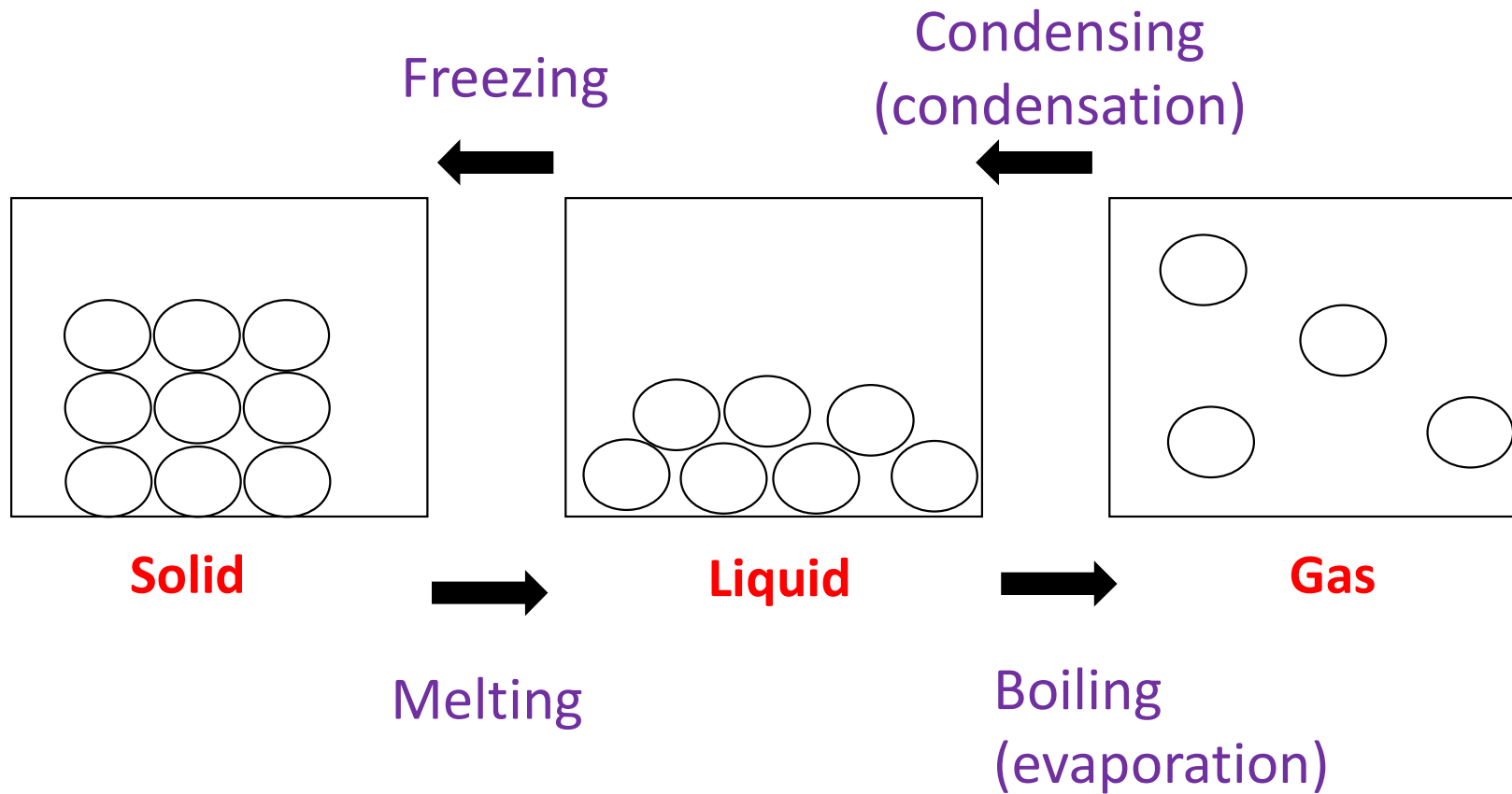
When a **liquid** is cooled until it becomes a **solid** we say it **freezes**.



When a **gas** is cooled till it becomes a **liquid** we say it **condenses**.



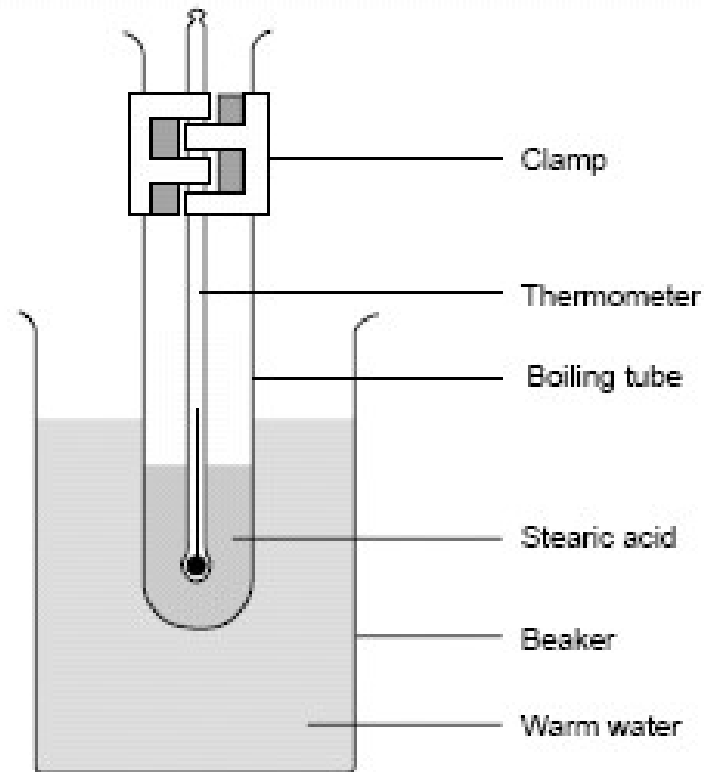
Changing States



Stearic acid experiment

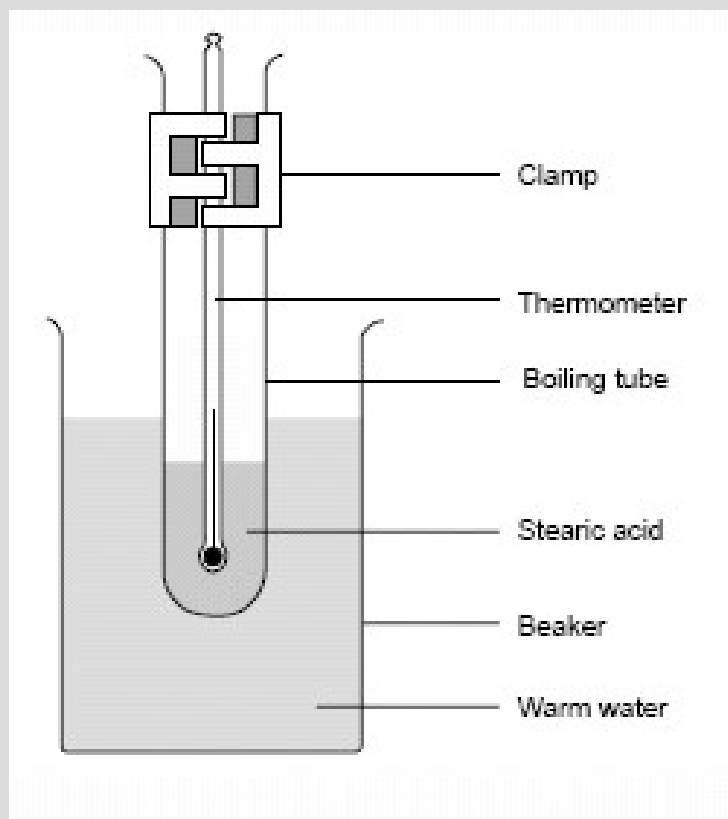
Aim: To investigate changes of state using stearic acid.

Method: (*Label the diagram*)



Stearic acid experiment

Method

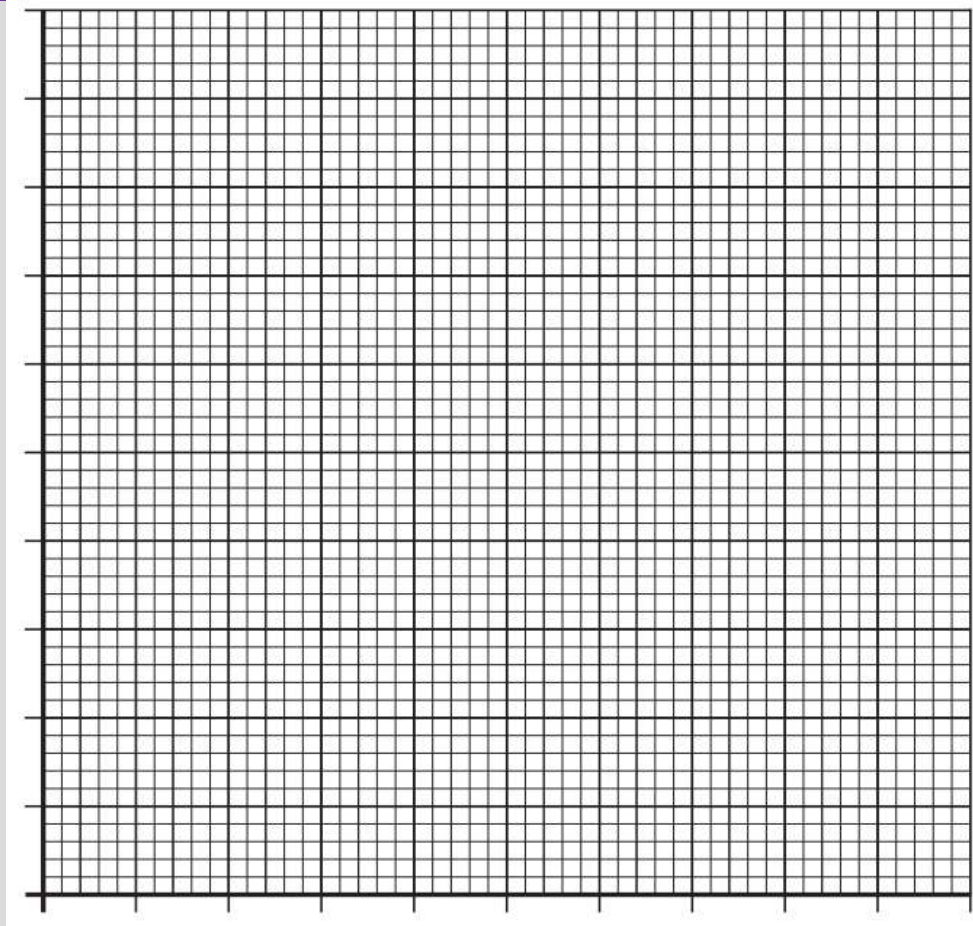


1. Put about 150 cm³ water into the beaker.
2. Set up the apparatus as shown in the diagram. Heat it on a tripod until the water reaches about 70 °C (until it melts)
3. Note on your results table the point at which you see the solid start to **melt then start the timer.**
4. Use the clamp stand to lift the tube from the hot water. Record the temperature every minute as the stearic acid cools down until it reaches about 50°C. Note on your results table the temperature at which you see the stearic acid begin to **solidify.**

Stearic acid experiment

Graph:

Temperature (°C)



Time (minutes)

Stearic acid experiment

Aim: To investigate changes of state using stearic acid.

Conclusion:

The stearic acid changed from a _____ to a _____ at _____.

Evaluation: *(how can we improve our experiment?)*

Changing States

24/09/2024

Plenary

1. When a solid changes state to a liquid we call this melting
2. When a liquid changes to a solid, this is called freezing
3. Boiling is when a liquid changes state to a gas
4. When a gas becomes a liquid this is called condensing

Success Criteria

I can explain changes of state.

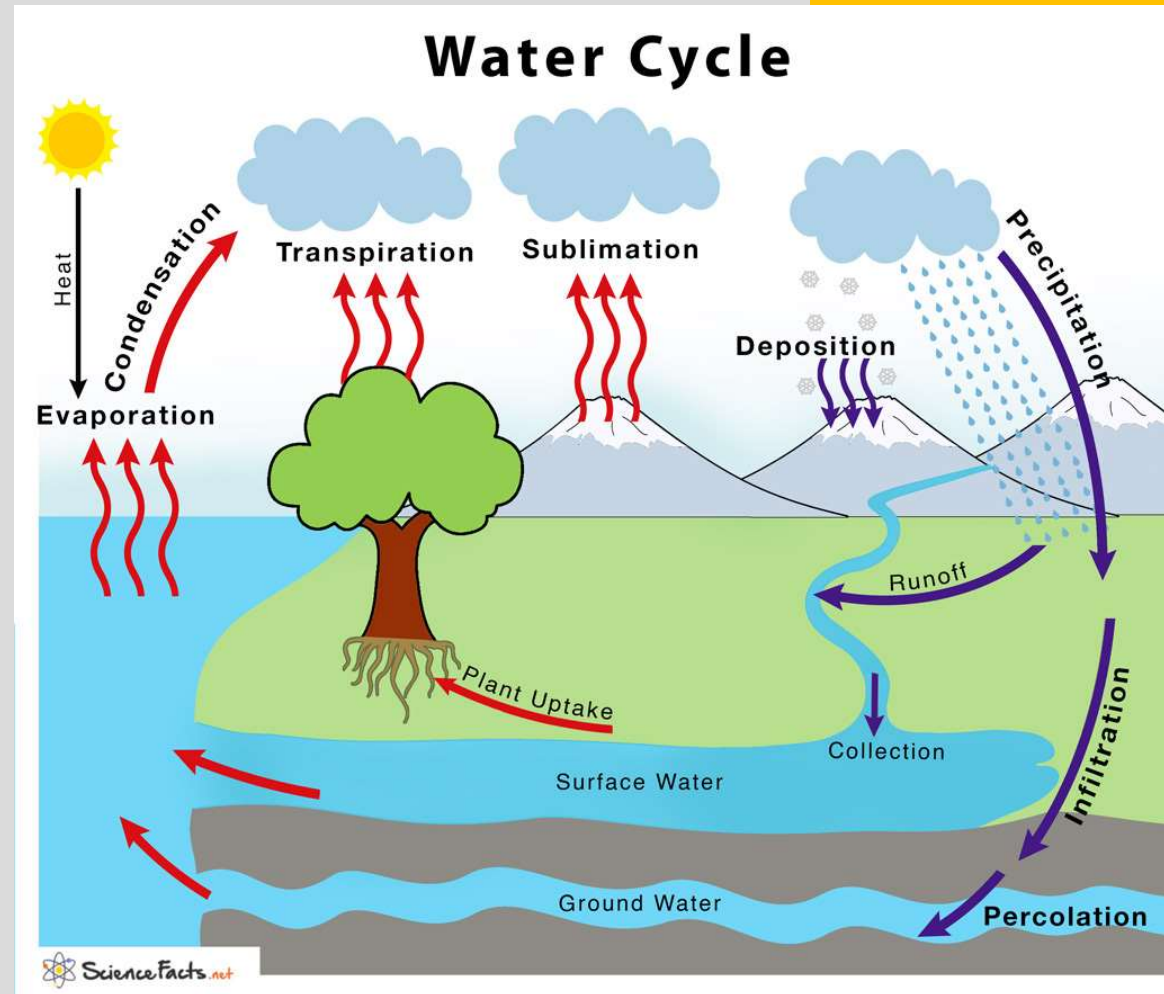
Tick me at the
end if *you can*

...



Starter:

1. What temperature does ice melt?
2. What temperature does water boil?
3. What can you remember about the water cycle from primary school?

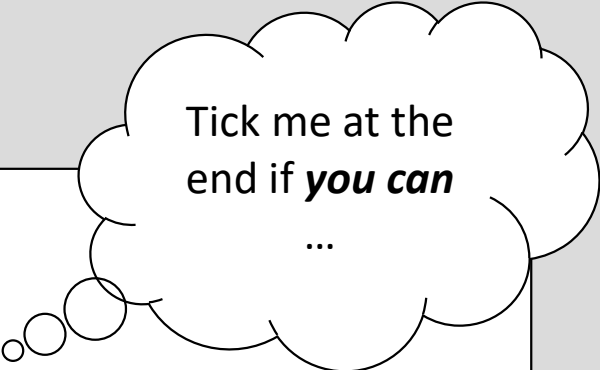


Learning Intentions:

- To explain the water cycle using my knowledge of changes of states.

Success Criteria

- I can explain the water cycle using my knowledge of changes of states.

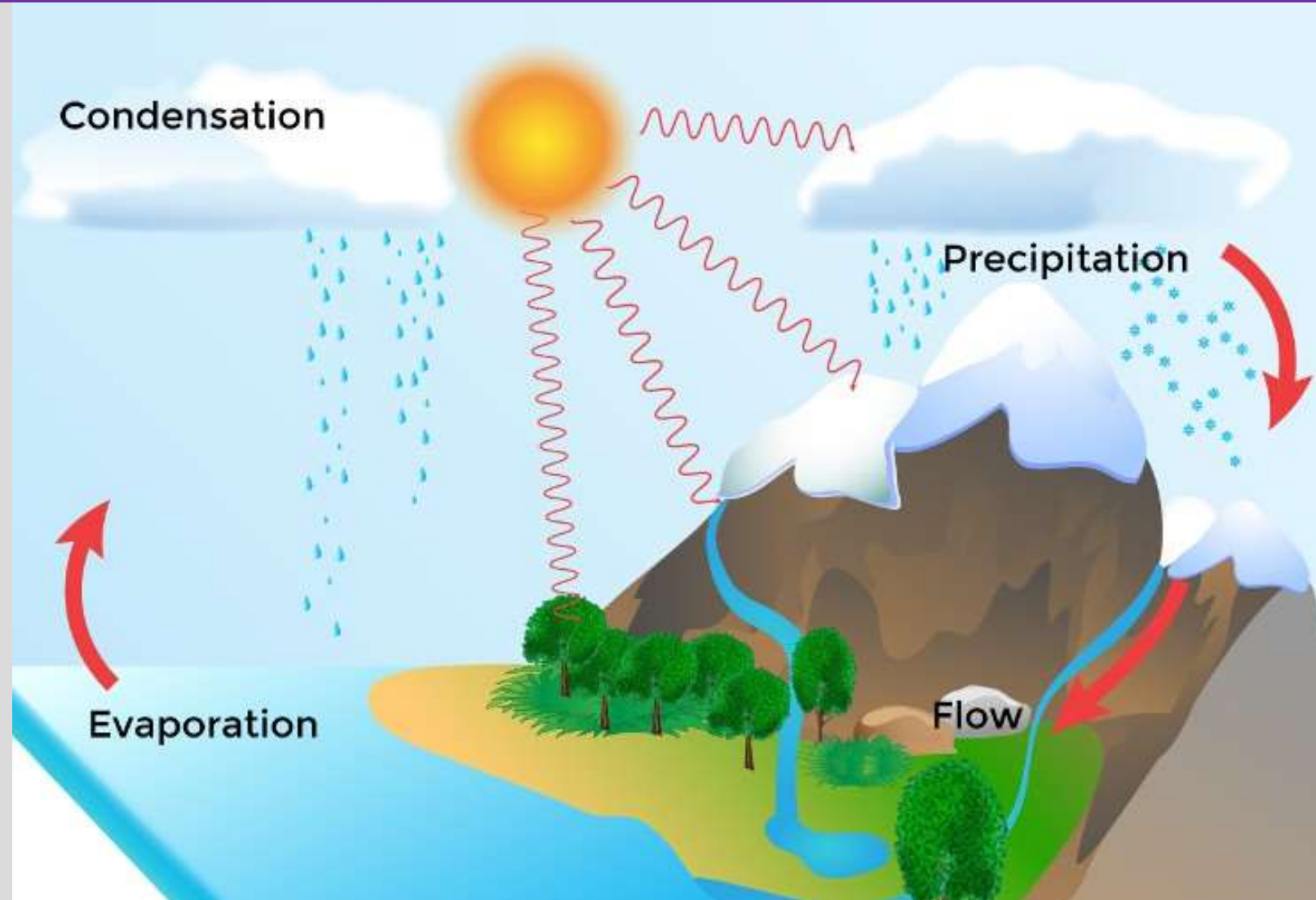


Tick me at the end if *you can*

...

The Water Cycle

The water cycle

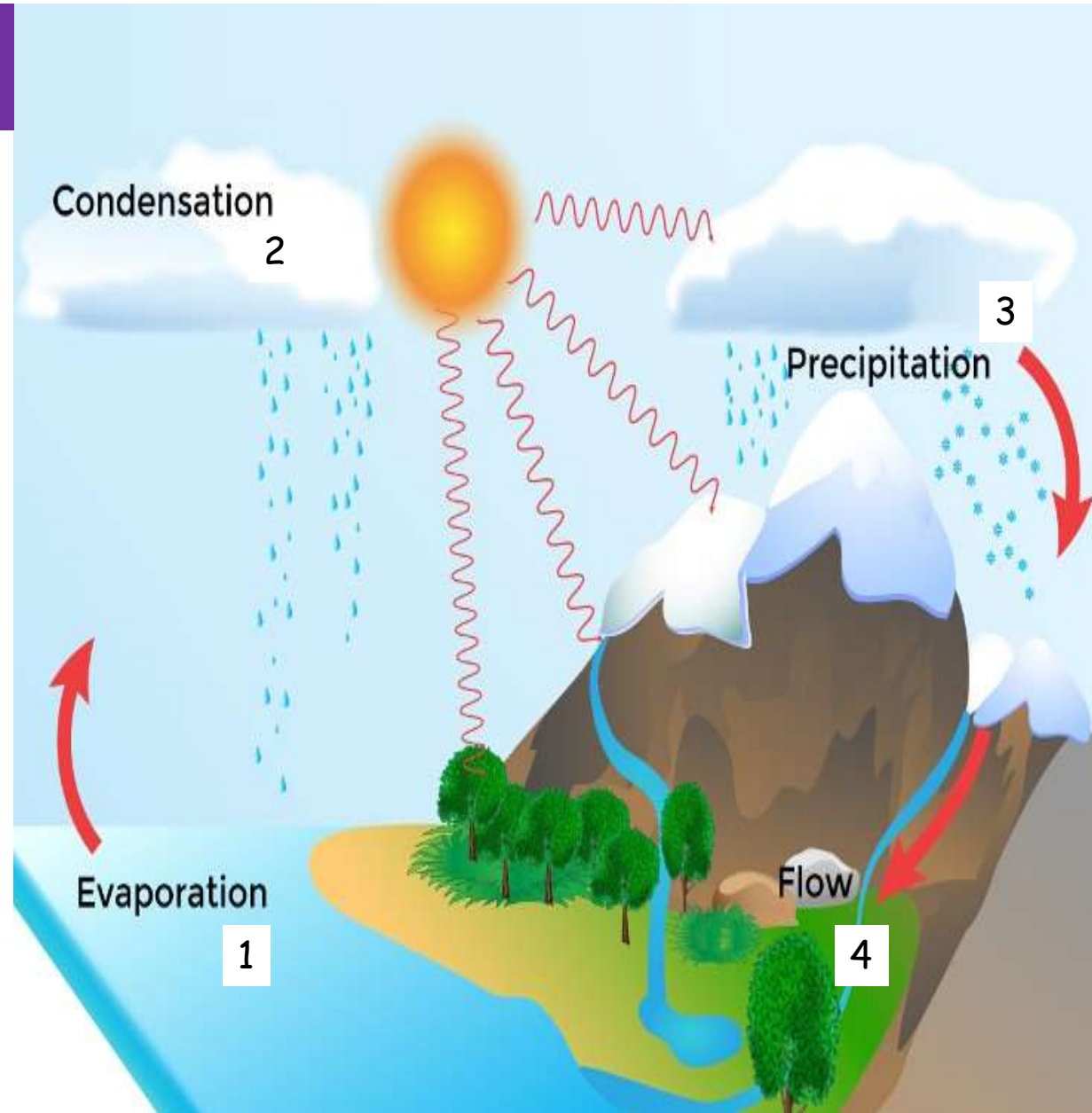


Water cycle link



The Water Cycle

1. Water **evaporates** into the air – *the sun heats up water on land, in rivers, lakes and seas and turns it into water vapour which rises into the air*
2. Water vapour **condenses** into clouds – *water vapour in the air cools down and changes back into tiny drops of liquid water, forming clouds*
3. Water falls as **precipitation** – *the clouds get heavy and water falls back to the ground in the form of rain or snow*
4. Water **runs off** into the sea – *rain water runs over the land and collects in lakes or rivers, which take it back to the sea and the cycle starts all over again*



The Water Cycle

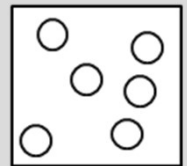
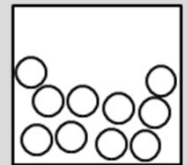
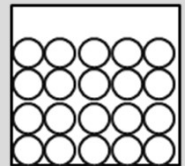
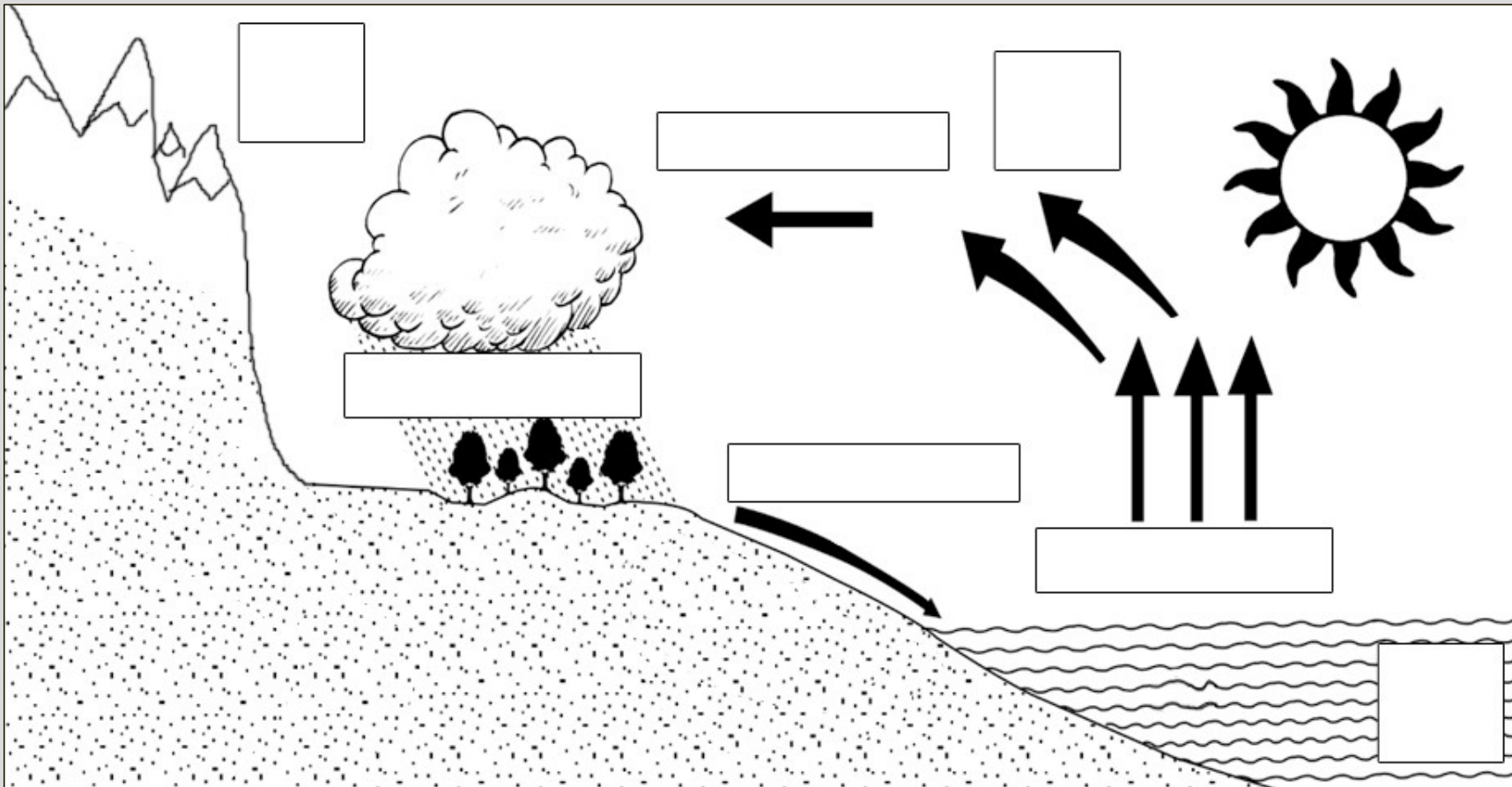
Runoff

Precipitation

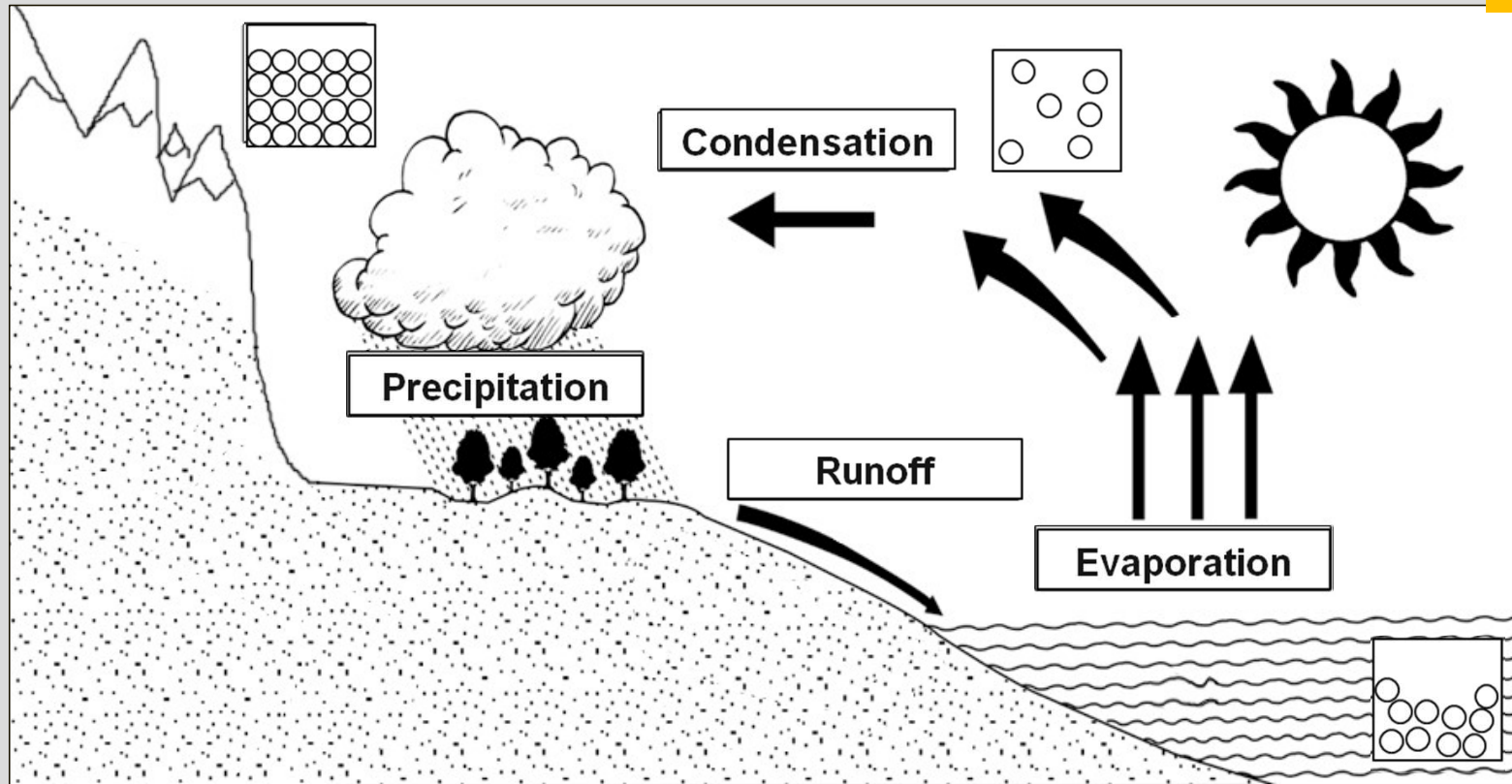
Evaporation

Condensation

Page 15

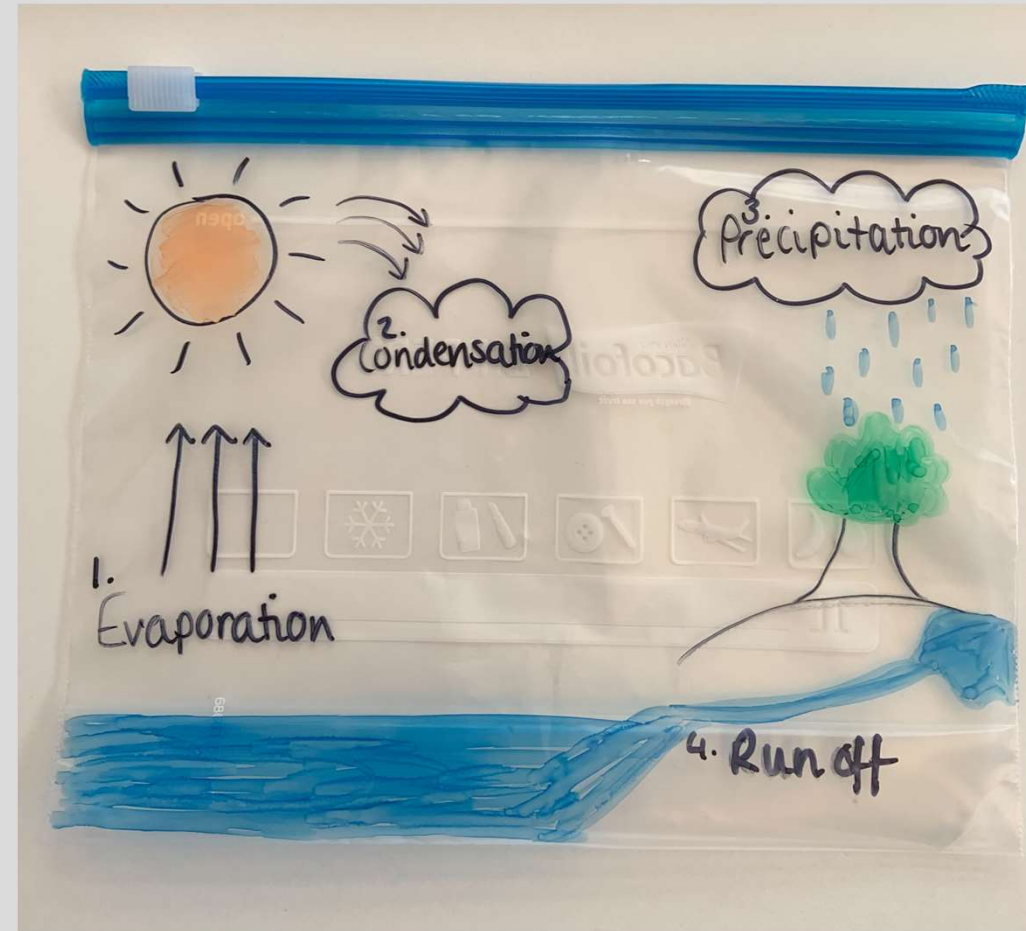


The Water Cycle



The Water Cycle – In a bag!

1. Collect a zip lock bag and pens
2. Draw the water cycle on the bag, labelling each of the **four stages**
3. Fill the bag $\frac{1}{4}$ full with **warm water** and seal the bag
4. Tape your water cycle to the window, make sure it is taped in a sunny place (*remember, heat is needed for the water to evaporate*)
5. Leave your water cycle to observe next lesson



Plenary - complete one of the sentences below

I was successful when I

A question I have about today's lesson is

Today I learnt

The part of the lesson I enjoyed the most was.....

The skills I used in today's lesson were.....

One thing I need to remember from today's lesson is.....

Success Criteria

I can explain the water cycle using my knowledge of changes of states.

Starter:

1. What is meant by the term “**soluble**”?
2. How do we know if a substance is soluble?

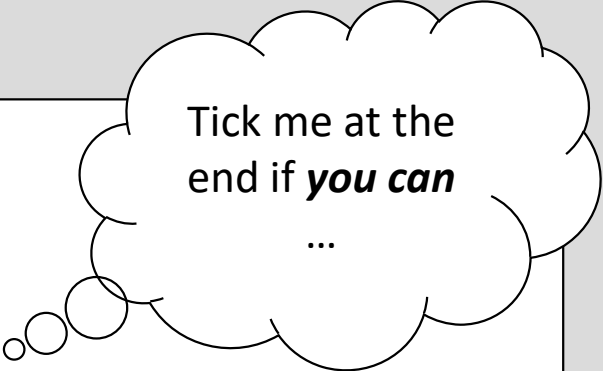


Learning Intentions:

- To explain the terms soluble and insoluble.

Success Criteria

I can explain the terms soluble and insoluble.



Tick me at the
end if *you can*

...

Solubility – key words

dissolves

soluble

insoluble

solution



Solubility



coffee granules + hot water → cup of coffee

solute + **solvent** → **solution**

The liquid you use when making a solution is called the **solvent**.

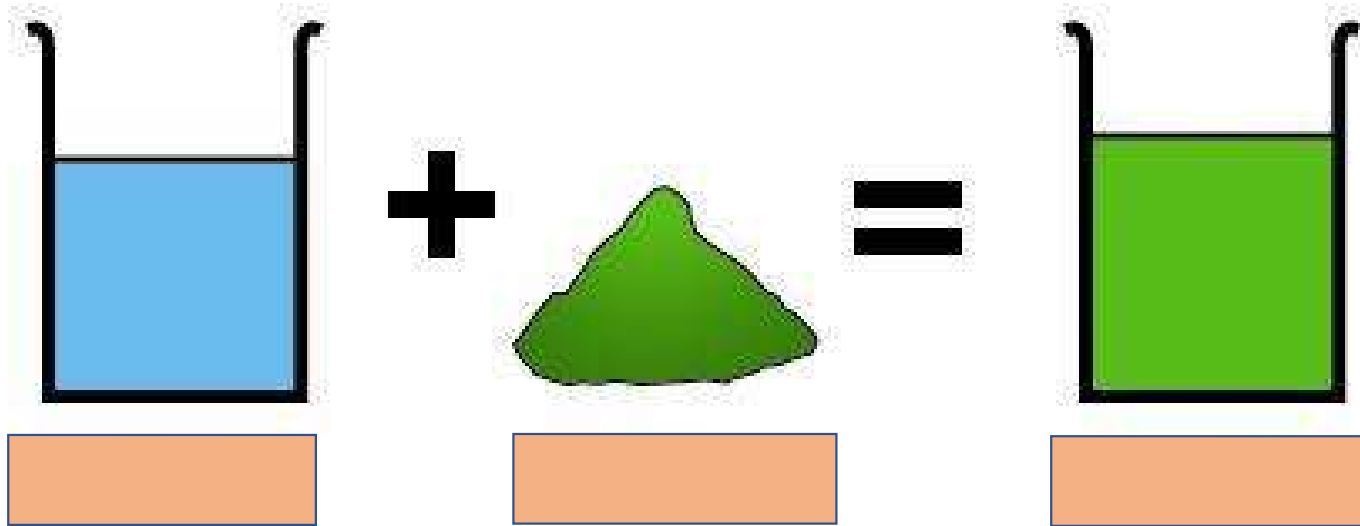
The substance which is actually dissolved is called the **solute**.

The product formed is called a **solution**.

Solubility

Fill in the blanks:

Page 16



Example:

hot water + coffee granules → cup of coffee

Solubility

Match the statements with the words below:

Page 17

solute

solution

solvent

soluble

The liquid in which a solute dissolves:

The substance that dissolves in a liquid to form a solution:

The product formed when a solute has dissolved in a solvent:

Describes a substance which can dissolve in a solvent:

Solubility

Sea water is “salty” ... how do you know?

The water and the dissolved salts produce “sea water”.

In this case, what is the **solute**?

what is the **solvent**?

what is the **solution**?

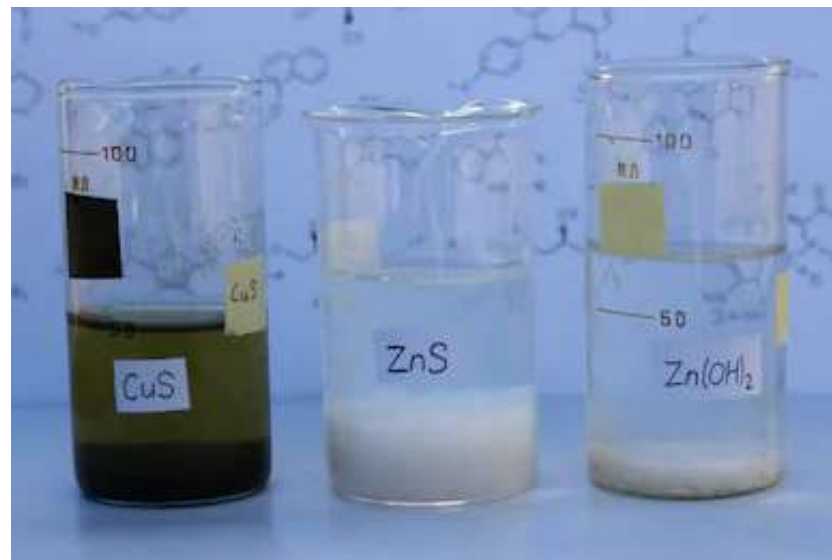


Solubility

Not all substances are soluble. A substance which cannot dissolve in a solvent is insoluble.

Example:

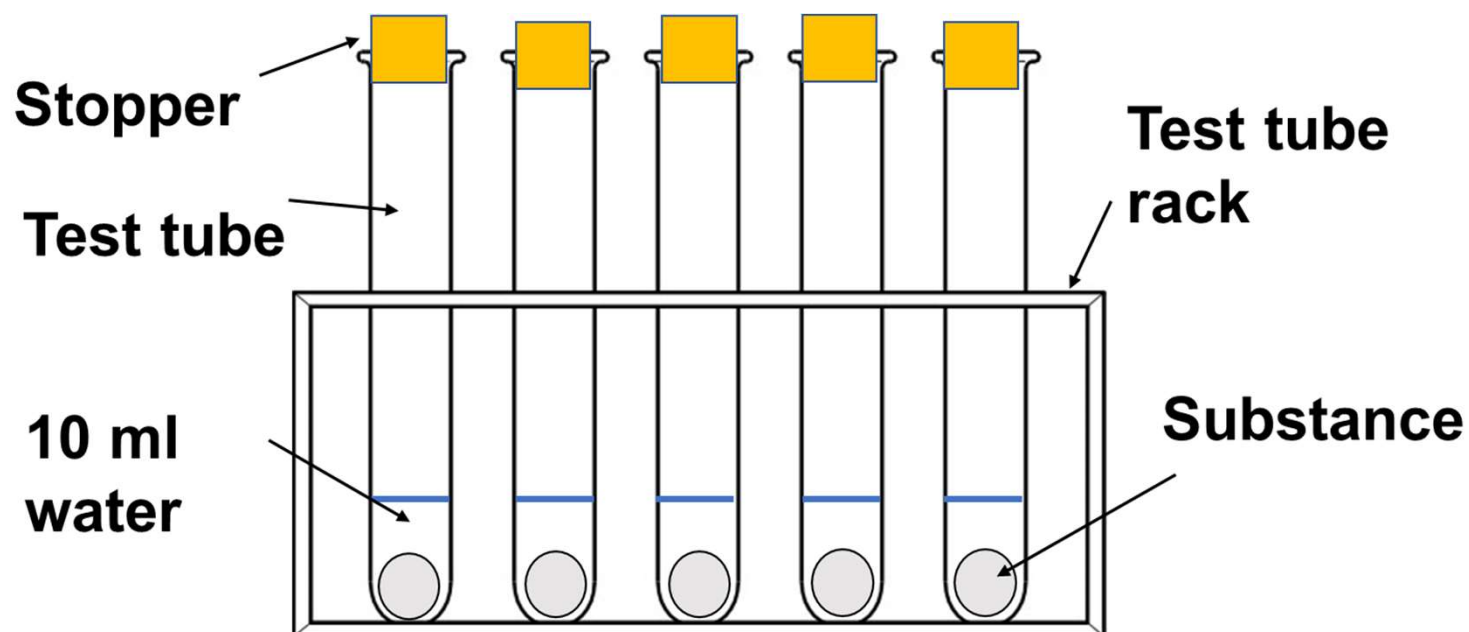
Sand is insoluble in water.



Solubility Experiment

Aim: To test the solubility of different substances in water.

Method:



Solubility Experiment

1. Put 4 tubes with stoppers in a test tube rack
2. Pour 10 ml of water into each test tube
3. Add a spatula of the substance to a test tube
4. Shake gently and look to see if a solution is formed
5. Complete the table of results

Solubility Experiment

Results:

Substance	What did you see?	Soluble in Water?
sodium carbonate		
sodium chloride		
sucrose		
flour		
calcium carbonate		
copper chloride		

Solubility Experiment

Results:

Substance	What did you see?	Soluble in Water?
sodium carbonate		soluble
sodium chloride		soluble
sucrose		soluble
flour		insoluble
calcium carbonate		insoluble
copper chloride		soluble

Solubility Experiment

Conclusion: *Answer your aim. Which substances are soluble? Which substances are insoluble?*

Evaluation: *What went well? How could you improve your experiment?*

Solubility

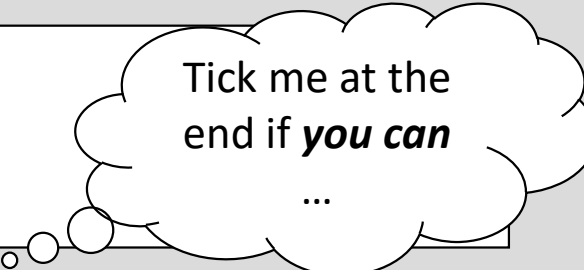
24/09/2024

Plenary:

1. Name a substance which is soluble.
2. Name a substance which is insoluble.

Success Criteria

I can explain the terms soluble and insoluble.



Tick me at the end if *you can*

...

Starter:

1. What do these words mean?
 - a. Soluble
 - b. Insoluble
2. Name a substance which is soluble.
3. Name a substance which is insoluble



Learning Intentions:

- To learn how to separate dirt from water.

Success Criteria

I can separate dirt from water.

Tick me at the
end if *you can*

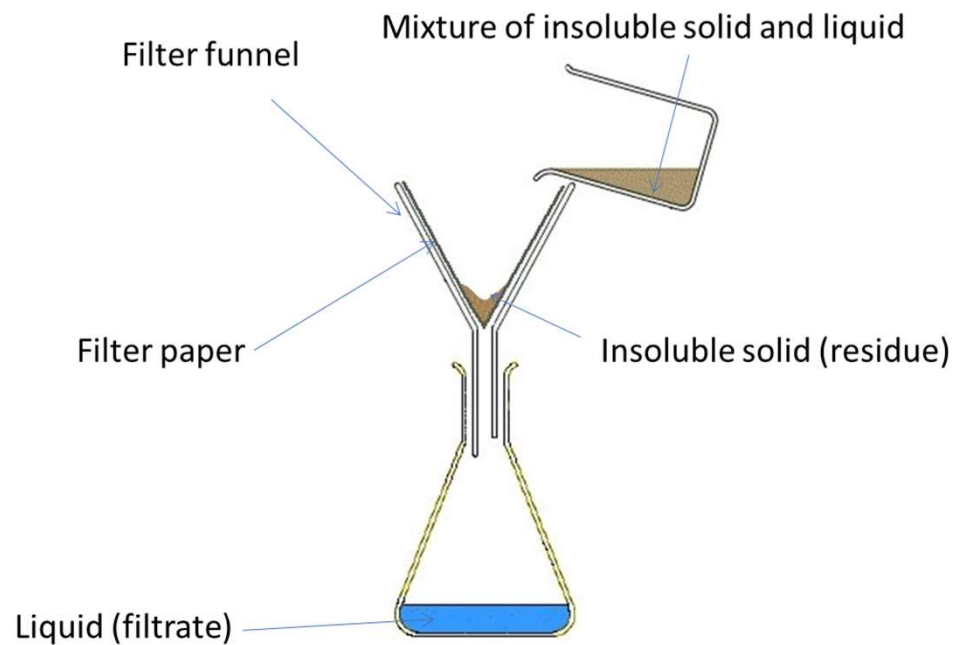
...



Separating Dirty Water

Aim: To investigate how to separate dirt from water.

Method:



Separating Dirty Water

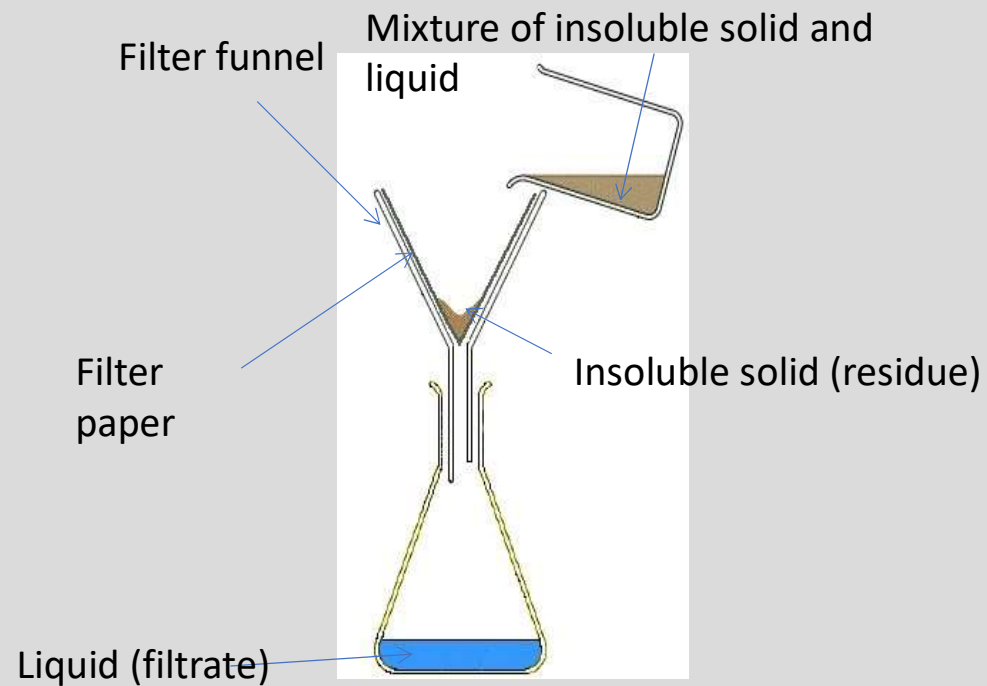
Results: *What did you see?*

Conclusion: *How can you separate dirt from water (use the word soluble or insoluble)? What is this technique called?*

Filtration

We use filtration to separate an insoluble solid from a liquid.

Dirt is collected in the filter paper and the water is collected in the flask.

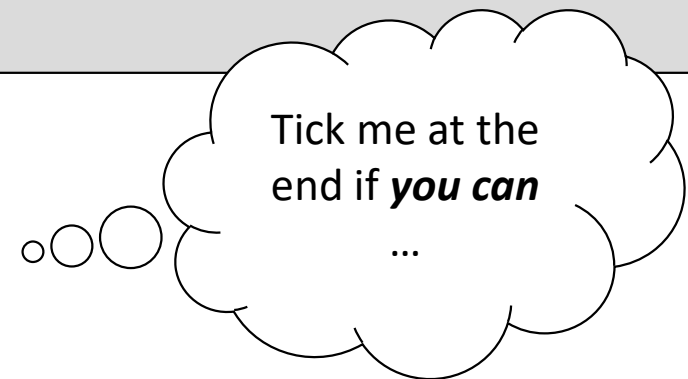


Plenary:

1. What other substances could be separated using filtration?

Success Criteria

- I can separate dirt from water.



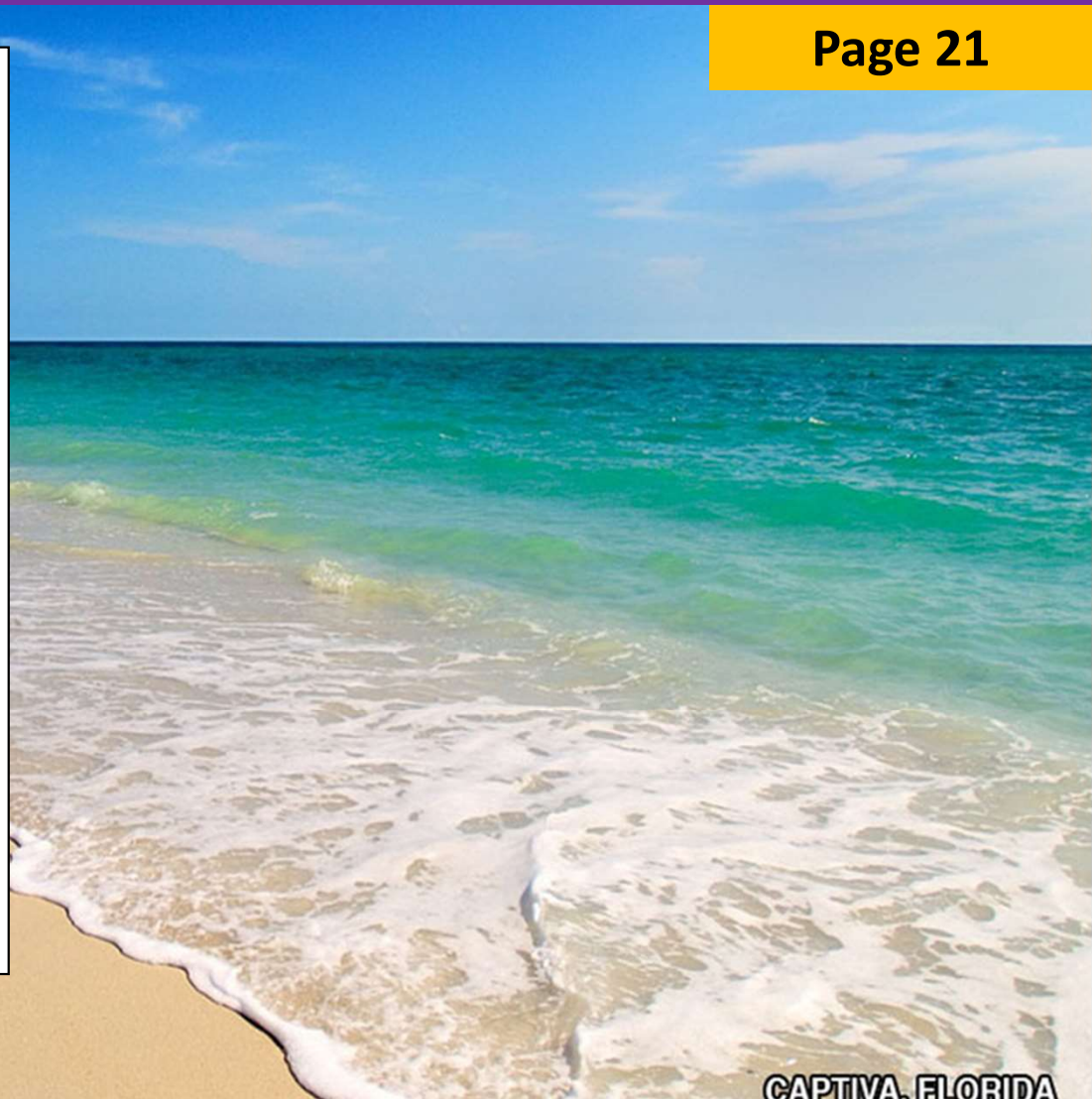
Starter:

1. How would you separate **sand** from **sea water**?
2. How would you separate **salt** from **sea water**?

Think about the words:

SOLUBLE

INSOLUBLE

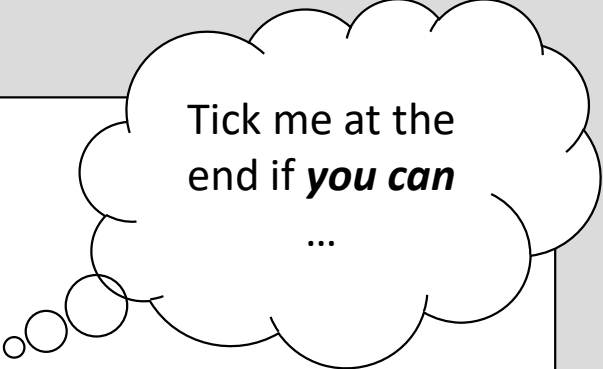


Learning Intentions:

- To learn how to separate salt from water.

Success Criteria

I can separate salt from water.



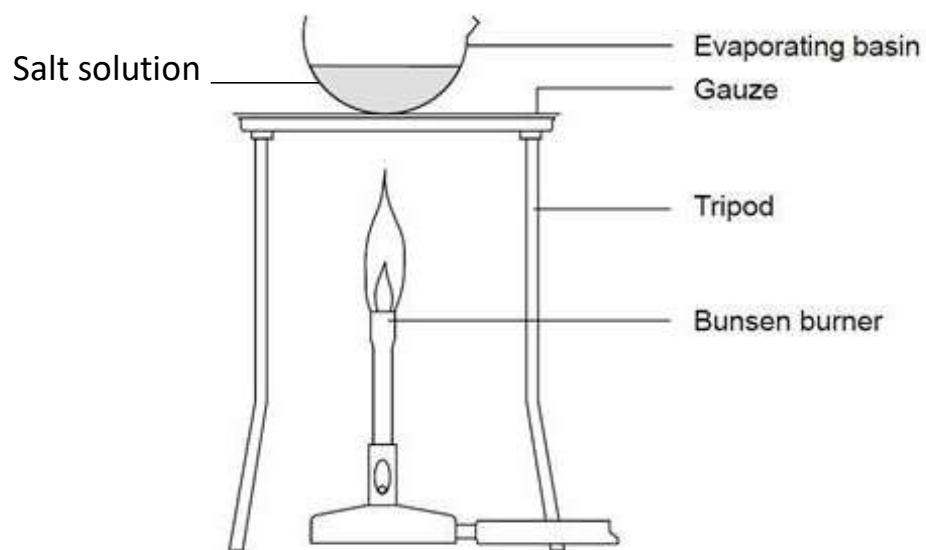
Tick me at the
end if *you can*

...

Evaporation

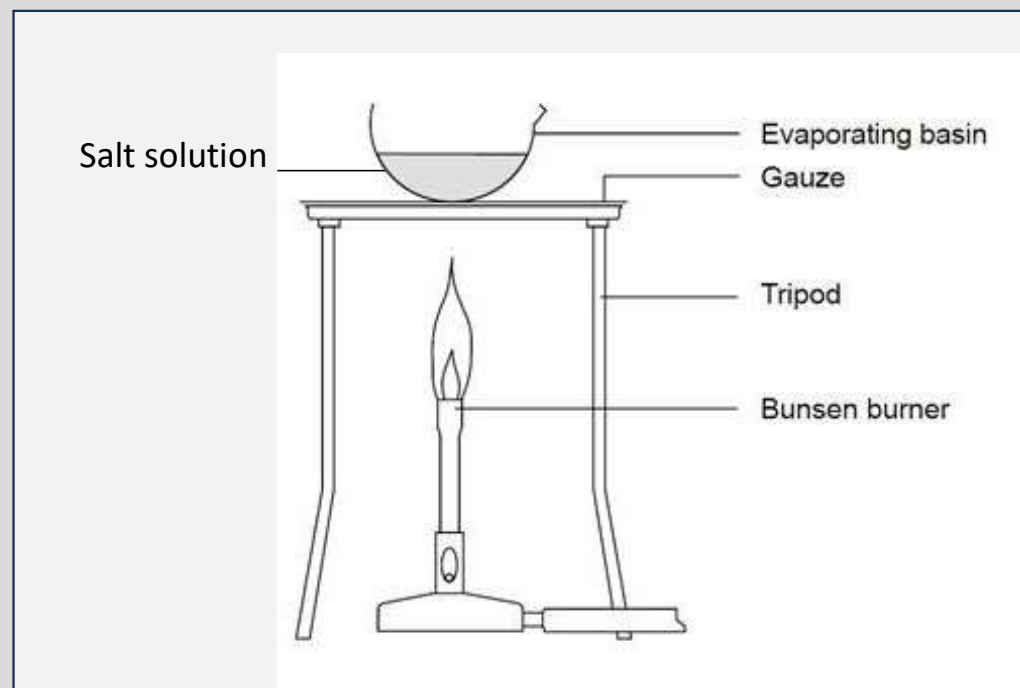
Aim: To investigate how to separate salt from water.

Method:



Evaporation

1. Set up the equipment as shown in the diagram and by your teacher
2. Add 20 mL of salt water to an evaporating dish
3. Heat on a blue flame, moving the heat source if it starts to boil too much
4. Wear safety specs and tie hair back



Evaporation

Results: *What did you see?*

Conclusion: *How can you separate salt from water (use the word soluble or insoluble) ? What is this technique called?*

Evaporation in Use



Salt "pans"

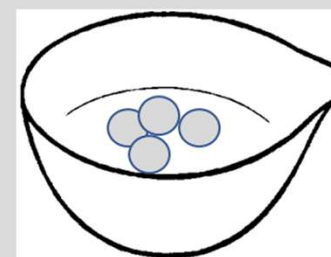
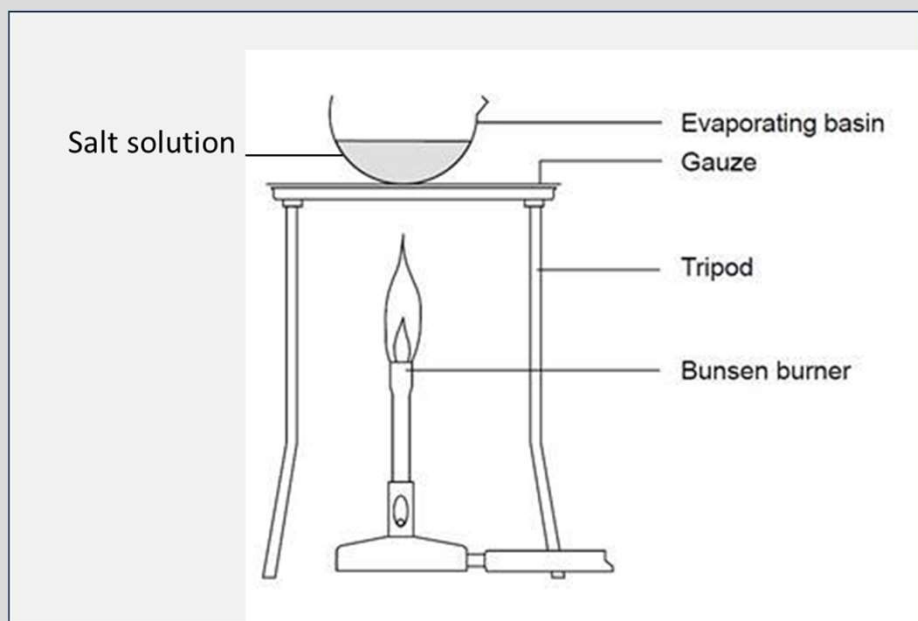


St Monans windmill
(no longer used)

Evaporation

We use evaporation to separate soluble solids from solutions.

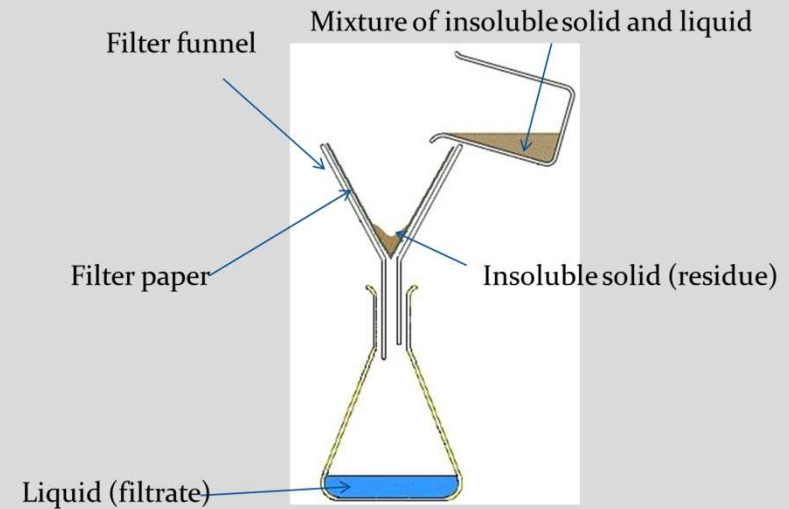
Water evaporates and leaves behind the solid salt in the evaporating dish.



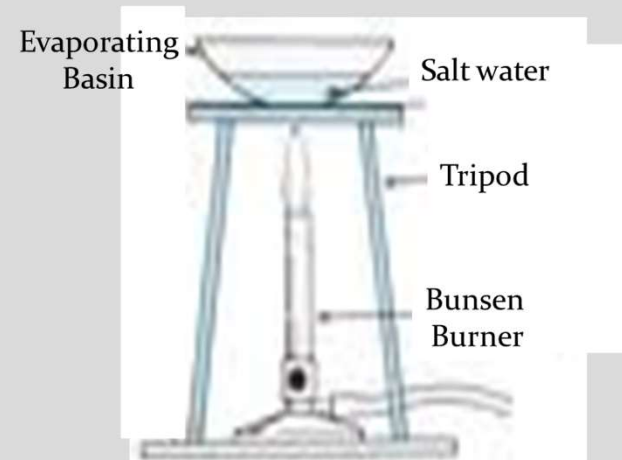
Salt separated from water

Separation Techniques

Filtration is used to separate sand from water.
Sand is insoluble in water.



Evaporation is used to separate salt from water.
Salt is soluble in water.

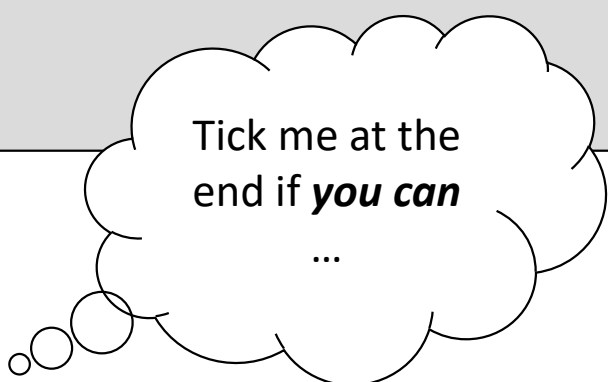


Plenary:

1. What other substances could be separated using evaporation?

Success Criteria

- I can separate salt from water.



Tick me at the
end if *you can*

...

Starter

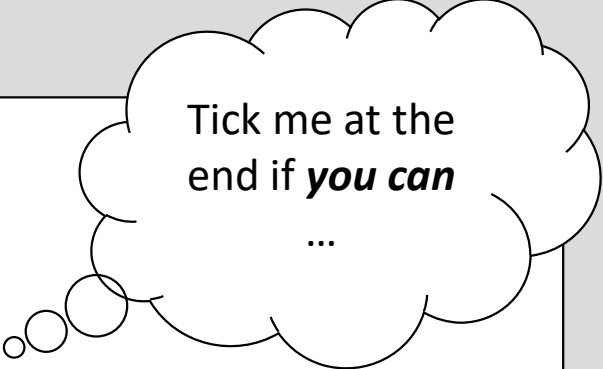
1. Name the two separation techniques we have used.
2. Choose one of these techniques and explain how it works.

Learning Intentions:

- To learn how to separate coloured dyes.

Success Criteria

I can separate coloured dyes.



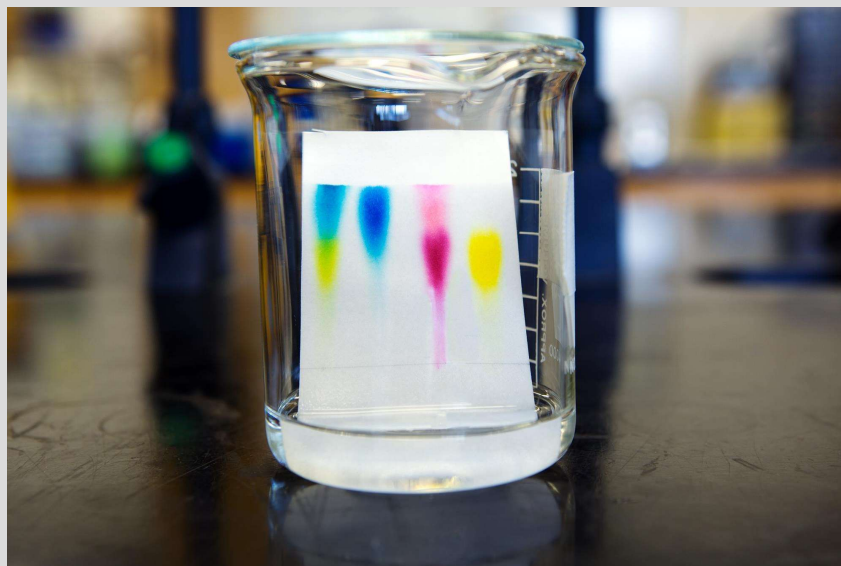
Tick me at the
end if *you can*

...

Chromatography

Chromatography means colour writing!

It is used to separate a mixture of coloured or non-coloured substances that are soluble in the same solvent.



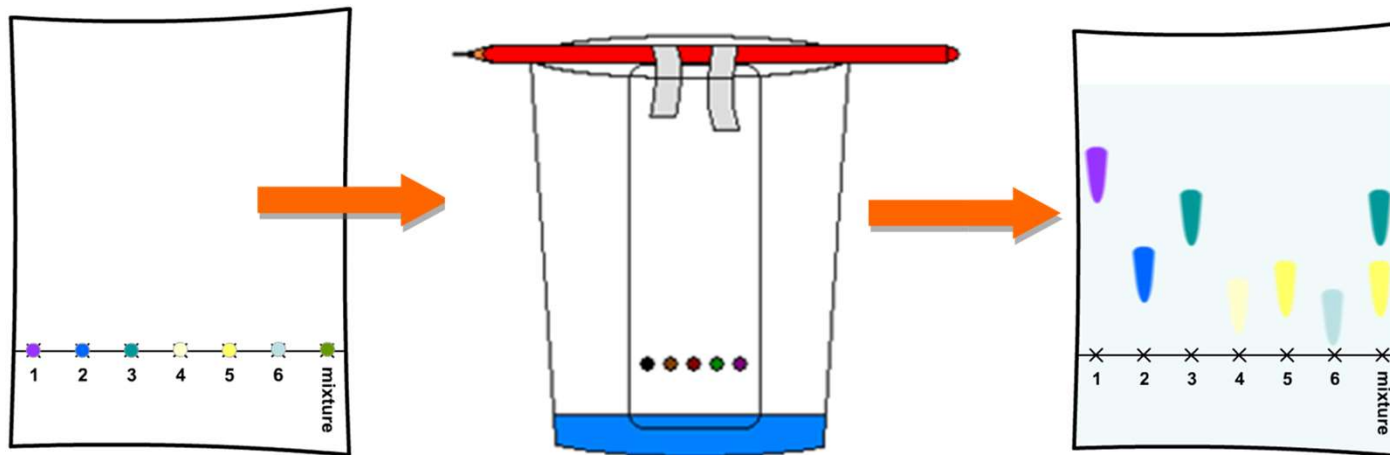
Chromatography

Experiment 1

Aim: To identify the mixture of dye in pens.

Which pen contains the most dyes?

Method:



Chromatography

Results: When dry, glue in your chromatography paper here – or describe what you saw.

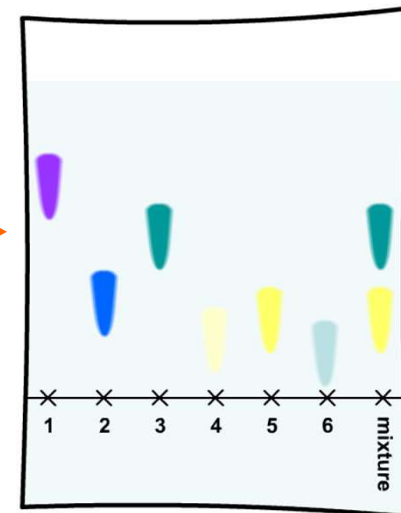
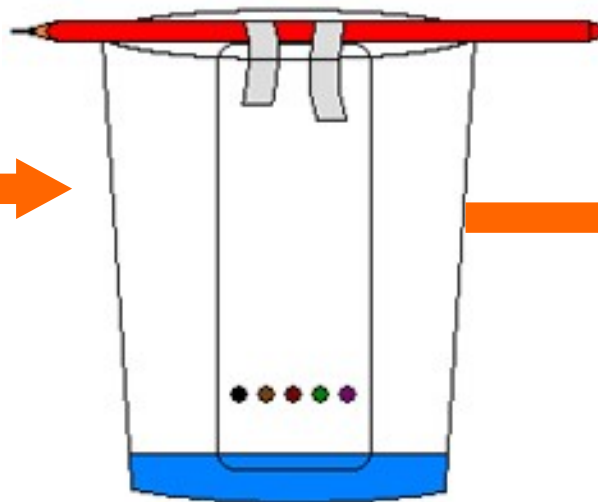
Conclusion: *What did you find out? Answer your aim.*

Chromatography

Experiment 2.

Aim: To identify the mixture of dyes which make up different M&Ms and smarties.

Method:



Chromatography

Results: *What did you see?*

Conclusion: *What did you find out? Answer your aim.*

Paper Chromatography

How does it work?

- In **chromatography**, there is a **mobile phase** and a **stationary phase**.
- For example, **water** is the mobile phase and **paper** is the stationary phase.
- The solution's components ideally move at different speeds as they travel through the stationary phase so that they can be **separated**.
- In paper chromatography different **pigments** can be separated based on their **solubility**, or their ability to **dissolve** in water.
- The more **soluble** a pigment is, the more readily it will dissolve in the mobile phase and the farther it will usually travel as it is carried by the water being **absorbed** into the paper.

Plenary - complete one of the sentences below

I was successful when I

A question I have about today's lesson is

Today I learnt

The part of the lesson I enjoyed the most was.....

The skills I used in today's lesson were.....

One thing I need to remember from today's lesson is.....

Success Criteria

I can separate coloured dyes.