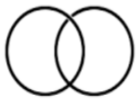
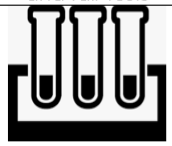
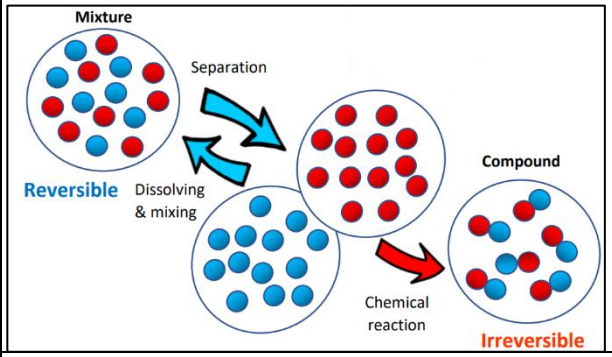
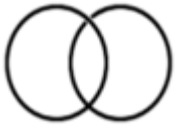
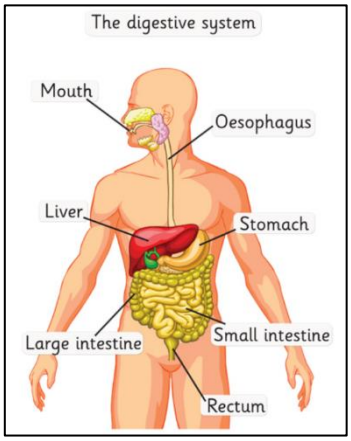
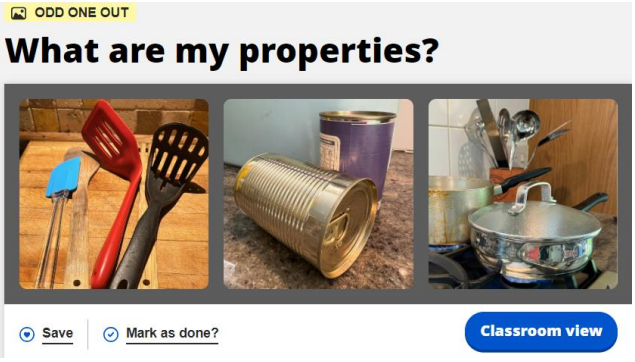
Science Unit Plan – Year 5

Materials – Chemistry

Observe Changes over time	Group and classify	Research Using Secondary Sources	Carrying out comparative and fair tests	Seeking patterns	Asking questions	Reason and explain
						

Science coverage NC	• Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets. • Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution. • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. • Demonstrate that dissolving, mixing and changes of state are reversible changes. • Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.
Working scientifically skills	• planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • using test results to make predictions to set up further comparative and fair tests • reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
Links to previous learning	Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials) Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials) Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet and identify some magnetic materials. (Y3 - Forces and magnets) Compare and group materials together, according to whether they are solids, liquids or gases. (Y4 - States of matter) Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C). (Y4 - States of matter) Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. (Y4 - States of matter)
Links to future learning	Chemical reactions as the rearrangement of atoms. (KS3) Representing chemical reactions using formulae and using equations. (KS3) Combustion, thermal decomposition, oxidation and displacement reactions. (KS3) Defining acids and alkalis in terms of neutralisation reactions. (KS3) The pH scale for measuring acidity/alkalinity; and indicators. (KS3)
Misconceptions	Some people think that all metals are magnetic but only iron, steel, nickel and cobalt are magnetic. Some people think that when a solid dissolves it has disappeared but it is still there, you just can't see it! Some people think that melting and dissolving are the same thing but melting needs heat and only needs one material whereas dissolving involves more than one substance.

	Some people think that thermal insulators only keep things warm, but they actually keep hot things hot and cold things cold as the heat doesn't pass through materials very well.
Key vocabulary	**material –** what something is made from. **mixture –** 2 or more particles in a mix. **sieving –** separates solid components by size. **filtering –** separates an insoluble solid from a liquid. **evaporation –** separates a soluble solid from a liquid in a solution. **dissolve –** when a solid dissolves in a liquid and it can't be seen. **solution –** what is made when a solid dissolves into a liquid. **soluble**- will dissolve in water. **insoluble** – will not dissolve in water. **irreversible change -** when a new compound is formed by chemical reaction and the change is not reversible. **reversible change –** these are physical changes which can be undone or reversed. **melting** – When a solid turns to a liquid. **freezing** - When a liquid turns to a solid. **thermal conductor –** lets heat pass through easily **thermal insulator** - does not let heat pass through easy
Key knowledge	Thermal insulators keep hot things hot and cold things cold. Mixtures can be separated by sieving, filtering or magnetism. The speed of evaporation increases with heat. Solutions can be separated by evaporation.
Key images	
What are the main properties of materials?  **Material –** what something is made from Some people think that all metals are magnetic but only iron, steel, nickel and cobalt are magnetic.	**Retrieval task:** Add the labels  **Activate task** Complete the 'Odd one out' as an oracy task in pairs or groups to assess current knowledge and vocabulary and identity any misconceptions. https://explorify.uk/en/activities/odd-one-out/what-are-my-properties  1. Show the three images above and ask everyone to come up with as many similarities and differences as they can. If they get stuck, prompt them to think about: • appearance

- what they do
- where they might be found

2. Then, everyone needs to decide which one is the odd one out and why. Encourage a reason for every answer and there is no wrong answer!

Background information

Different materials have different properties which make them useful for different purposes.

Most cans of food are made from tin plated steel. Steel is a metal that is both strong and hard (it won't easily change shape). Steel can corrode (rust) so a thin inner coating of tin is added to stop this happening. It is used for food cans because it is more durable (hardwearing) than aluminium. Aluminium is cheaper and can be used for drinks cans as they have a shorter life span.

The saucepans are made of the metal aluminium. They are strong which means they won't crack or break easily. All metals are good thermal and electrical conductors. Steel is magnetic but aluminium is not. Aluminium also has the advantage that it can easily be recycled time and time again.

Glass is transparent allowing the cook to see what is happening in the pan. Whilst the pans conducts heat, the glass is a thermal insulator. Thick glass is strong but thin glass is brittle and so breaks easily when dropped.

Plastic is strong, light and waterproof. It can be easily moulded into different shapes making it a suitable material for a wide variety of objects, including kitchen utensils. Plastic can be flexible or rigid. It is a good insulator and doesn't conduct heat or electricity. Plastic is not magnetic. It can be transparent or opaque. Plastic does not biodegrade and cannot be recycled more than once or twice.

Wood is also a good insulator and doesn't conduct heat. It is strong and wooden utensils don't scratch pans when stirring.

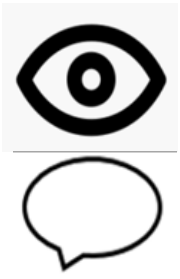
Main lesson

- Play 'Ping-pong' where children need to work in pairs and say a type of material. **Material –** what something is made from. Keep going back and forth until there are no more answers left… (example learnt in Year 1: wood, plastic, brick, paper, card, metal, rock)

- Display the following vocabulary on the board: transparent, translucent, opaque, flexible, rigid, rough, smooth, waterproof, absorbent, magnetic. Children to write a word on a post it notes and add to something in the classroom. Give 5-10 minutes and then have a look together and discuss the vocabulary and explain that materials have a range of properties.
- Children may have labelled something as magnetic….How do they know this is true? Can they test with magnets? Address the misconception: Some people think that all metals are magnetic but only iron, steel, nickel and cobalt are magnetic.

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

What material is the best thermal insulator?



Some people think that thermal insulators only keep things warm,

Retrieval task:

Match up task:

light- A form of energy that travels in a wave.

light source – something that produces its own light.

reflection – when light bounces off an object.

transparent – lets light through

translucent – lets some light through

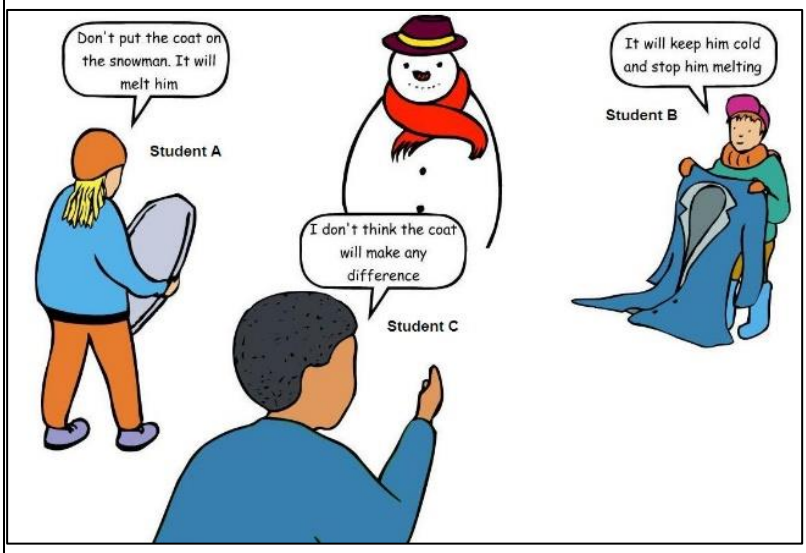
opaque – doesn't let light through

but they actually keep hot things hot and cold things cold as the heat doesn't pass through materials very well.

Thermal insulators keep hot things hot and cold things cold.

thermal insulator - does not let heat pass through easy

Activate task: Display the concept cartoon. Each child to record their thoughts in their books and they will revisit this at the end of the lesson. Don't discuss answers as a class but the children could share their thoughts.



Main lesson:

Children discuss the following

Laura and Jun both have a cup of hot chocolate.

They left their warm drinks on the table during breaktime, before coming inside to drink them.
Both drinks came from the same big jug of hot chocolate so why has Jun's gone cold?

Explain this…

Jun and Laura are using different types of cup.

Laura's cup is made of plastic. Jun's cup is made of ceramic.

Why would that affect the temperature of their drinks?

Different **materials** have different **physical properties**. One property is how well materials allow heat to pass through them.

A **material** that does not allow electricity to pass through it easily is called …

an electrical insulator.

Jun

A material that does not allow sound to pass through it easily is called …

a sound insulator.

Laura

We use a similar term to talk about heat. Do you know the name of this **physical property**?

Explain the key word: **thermal insulator** - does not let heat pass through easy.

"Thermal" is an adjective that means "related to heat".

Have you ever worn clothes like this, as underlayers?

These are called thermals or thermal base layers.

Thermal clothing is designed to work as a thermal insulator and prevent you from getting cold!

thermal base layer

Laura

My hot chocolate is still too warm to drink.

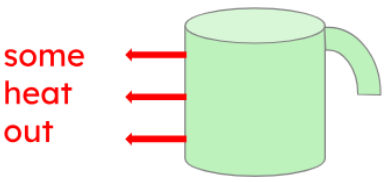
Mine has gone cold.

Jun

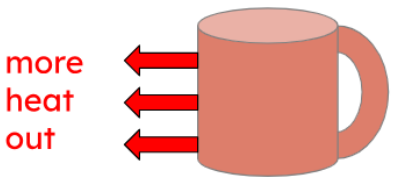
The children's hot chocolate drinks are different temperatures because one of the cups allows heat to pass through it more easily than the other.

Whose cup is a better **thermal insulator**? How do you know?

Laura's cup is a better **thermal insulator** because it allowed less heat to pass from the hot chocolate through the cup to the cooler surrounding air.



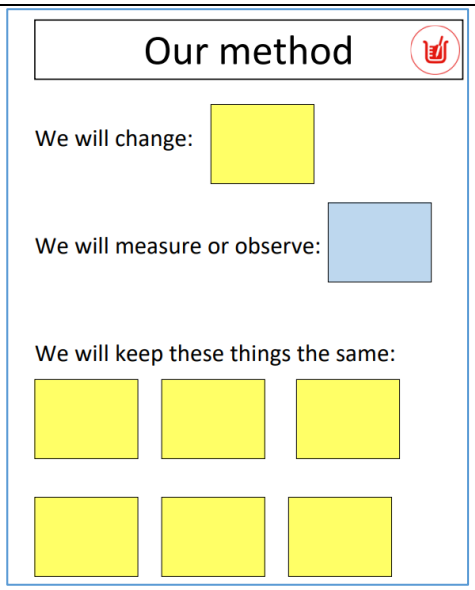
Laura's plastic cup



Jun's ceramic cup

Explain that today children need to work in groups to plan a comparative test using different cups to answer the following question: Which cup is the most suitable for keeping the water warm?

(SAFETY – Never use water hotter than 50 degrees in a classroom!)



The variable we will change is: the type of cup.
The variable we will measure is: the temperature change over time.

The variables we will control are:
- *the amount of warm water*
- *the starting temperature of the water*
- *the temperature of the room*
- *how long we carry out the experiment for*

Children to discuss the method and share with the class (UKS2 WS - Children decide for themselves how to gather evidence to answer a scientific question.)
Think about:
- How many different cups?
- Which materials?
- How much water?
- When are you taking readings?
- How many readings?
- How will you record the results?
- How will you present the results?

An example:

1. *Pour 100 ml of warm water into 3 different types of cup.*
2. *As soon as the water is in each cup, measure the temperature of the water using a thermometer. Record this as the temperature at 0 minutes.*
3. *Time 10 minutes using a timer then measure and record the temperature of water in each cup again.*

(UKS2 WS - The children decide how to record and present evidence)
Children to carry out the enquiry and collect and present evidence.

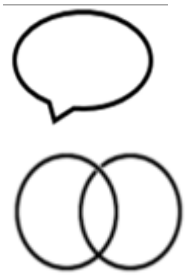
<u>Complete an evaluation as a group:</u>
How fair was your investigation? (Which variables were hard to keep the same?)
How accurate were your results? (What was hard to measure/observe?)
How could you improve your investigation?

Children to have another go at the concept cartoon – have they changed their minds?

Share responses and clarify that student B is correct as the coat will act as an insulator and keep the snowman cold.

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

How can you separate mixtures?

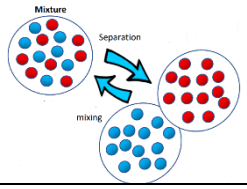


mixture – 2 or more particles in a mix

sieving – separates solid components by size.

filtering – separates an insoluble solid from a liquid.

Mixtures can be separated by sieving, filtering or magnetism.



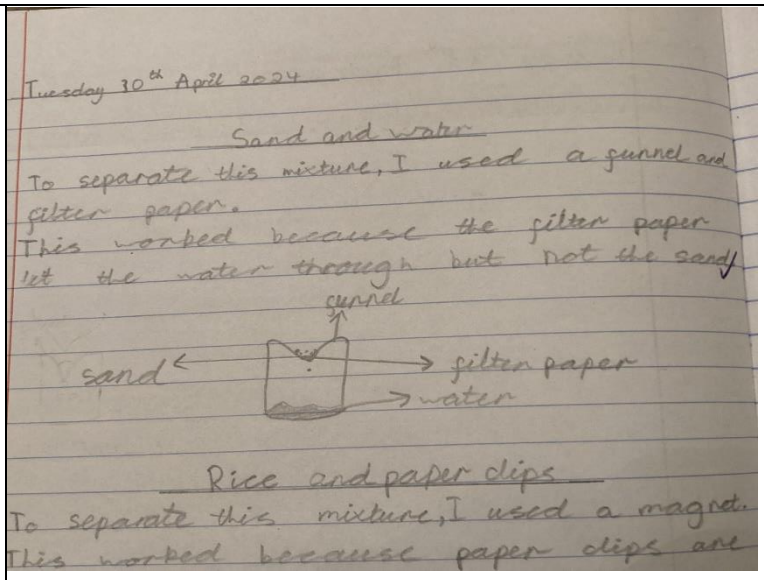
Retrieval task:
Match up the key word to its definition:
Carnivore - Animals that eat meat and other animals.
Herbivore - Animals that only eat plants.
Omnivore - Animals that eat both plants and meat or other animals.

Activate task:
Show the children filter paper, sieves and magnets. Talk about these and what they notice. Have they seen or used any of these before?

Main lesson
Explain - **mixture – 2 or more particles in a mix**
Children to be given 3 different mixtures to separate.
Sand and water (filter)
Rice and paper clips (magnet)
Flour and counters (sieving)

Children to create a pic collage/draw in books to show how they separated the mixtures with an explanation of why this option worked but the others might not have worked.
sieving – separates solid components by size.
filtering – separates an insoluble solid from a liquid.

See example below:



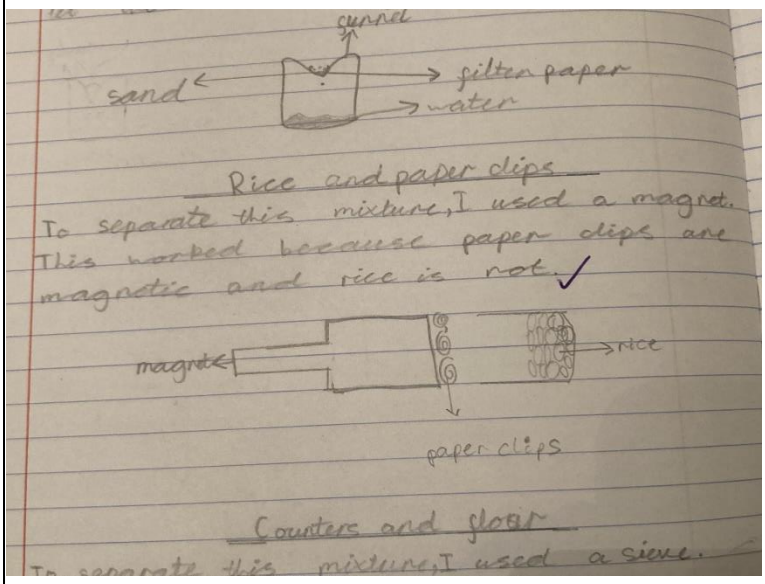
Tuesday 30th April 2024

Sand and water

To separate this mixture, I used a funnel and filter paper.
This worked because the filter paper let the water through but not the sand ✓

Rice and paper clips

To separate this mixture, I used a magnet.
This worked because paper clips are

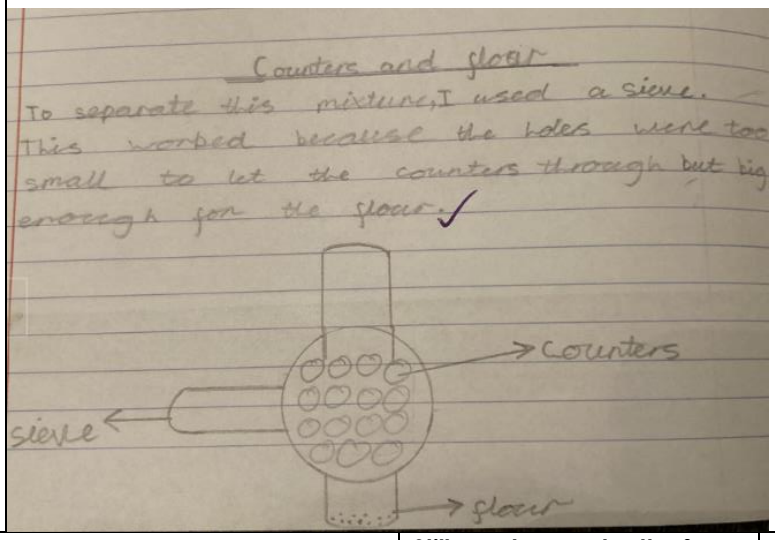


Rice and paper clips

To separate this mixture, I used a magnet.
This worked because paper clips are magnetic and rice is not. ✓

Counters and flour

To separate this mixture, I used a sieve.



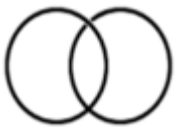
Counters and flour

To separate this mixture, I used a sieve.
This worked because the holes were too small to let the counters through but big enough for the flour. ✓

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

How can you separate a solution?	**Retrieval task:** Add the 4 labels to the diagram: canine, molars, premolars and incisors





soluble- will dissolve in water

insoluble – will not dissolve in water.

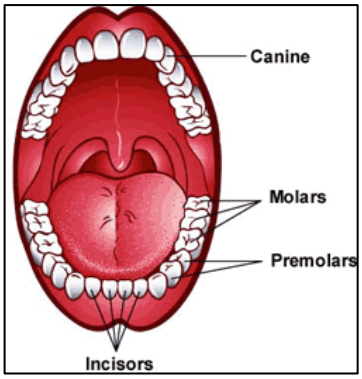
solution – what is made when a solid dissolves into a liquid.

dissolve – when a solid dissolves in a liquid and it can't be seen.

evaporation – separates a soluble solid from a liquid in a solution.

Solutions can be separated by evaporation.

Some people think that when a solid dissolves it has disappeared, but it is still there, you just can't see it!



Activate task:

Mix some salt with warm water in a glass so it dissolves. Ask the children where the salt has gone? (They will probably say it has disappeared!) Address this misconception by letting the children taste the water!

Explain that this salt has dissolved: **dissolve –** when a solid dissolves in a liquid and it can't be seen.

Some people think that when a solid dissolves it has disappeared, but it is still there, you just can't see it!

This has made a solution: **solution –** what is made when a solid dissolves into a liquid.

The salt is soluble - **soluble**- will dissolve in water.

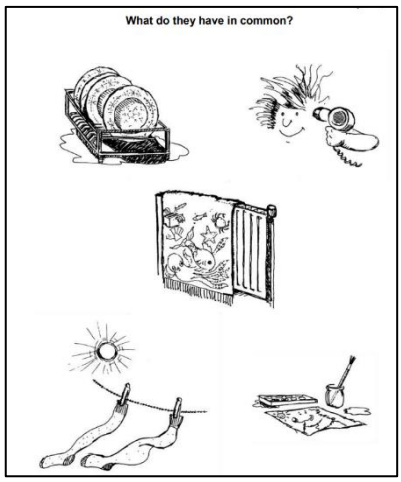
Now show rocks in water and explain that rocks are insoluble – **insoluble** – will not dissolve in water.

Main lesson:

- How can we separate the salt and water solution? Children to discuss ideas using the following questions and prompts.
  - Could we use a magnet? Why? Why not?
  - Could we use a sieve? Why? Why not?
  - Could we use filter paper? Why? Why not?

- To introduce the concept of evaporation, the children should be given the sheet below and asked what all the pictures have in common. The pictures show wet clothes on a washing-line, a hair-dryer being used to dry wet hair, paintings being left to dry, a draining rack of wet dishes and a towel on a radiator.

- Once children have established that each picture shows something drying, they are asked what happens to make wet things dry and where the water goes. The children should be introduced to the word 'evaporation', if it is not suggested as a reason for the water 'disappearing'.



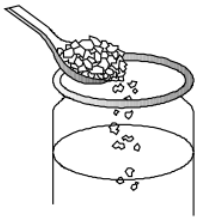
- Explain that to separate a solution you need to use evaporation: **evaporation –** separates a soluble solid from a liquid in a solution.
- Recap what this means from Year 4 science and the water cycle - This is when a liquid turns into a gas. Show the video:

https://www.youtube.com/watch?v=ppMdfnt80NE

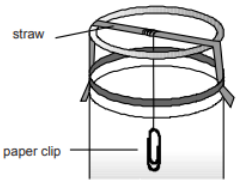
- Children to work in teams to create salt crystals. (You will set this up and leave until next weeks lesson as it takes about a week)

1. Fill a jar with warm water from a kettle.

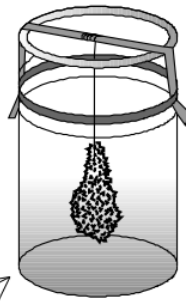
2. Add several teaspoons of salt to the water and stir until all the salt has dissolved.



3. Add several more teaspoons and stir. Repeat this until no more salt will dissolve.

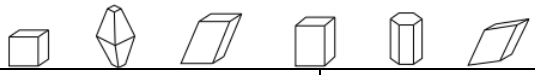


4. Tie a paper clip onto the end of a piece of cotton and wrap the cotton around a straw. Bend down the ends of the straw and secure over the jar with an elastic band as shown in the diagram.



5. Put your growing crystal solution to one side and look again in a week. You should see crystals growing around the paper clip.

6. After a week, observe your crystal using a magnifying glass. Can you see any of the shapes below?



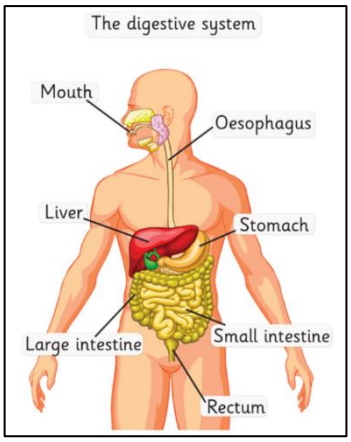
Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

What is the effect of temperature on the rate of evaporation?

The speed of evaporation increases with heat.

Retrieval task:

Label the digestive system with the words: mouth, oesophagus, stomach, liver, small intestine, rectum, large intestine and liver



Activate task:

https://explorify.uk/en/activities/have-you-ever/needed-to-dry-something-quickly

1. In pairs or groups ask the children to share their experiences.

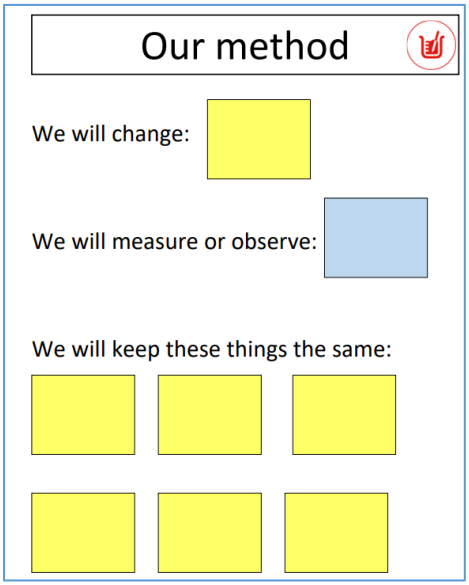
2. Once they have had a brief chance to chat give them some prompts to help their conversation:

- Which item of clothing did you need to dry?
- Why was it wet?
- Why did you need it to dry quickly?
- How did you speed up the drying?
- Can you think of any other ways to speed up drying?

Main lesson:

Explain that today we are going to investigate 'What is the effect of temperature on the rate of evaporation?'

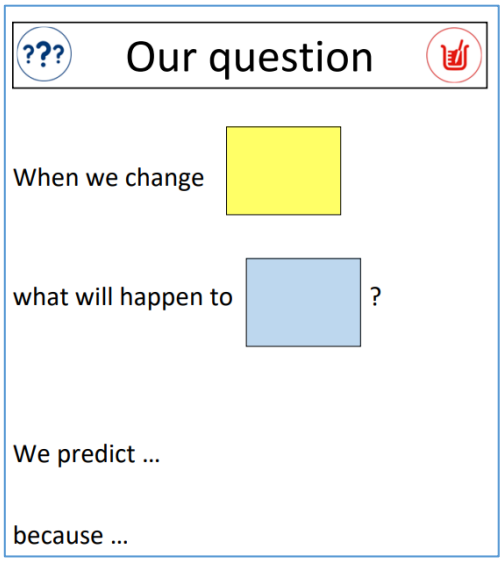
As a class, fill in this planning board and add to working wall – We know that we will change the temperature. We will measure the amount of water.



Explain that each group will have 3 containers of water with 3 different temperatures of water in. The amount of water will be observed and measured over time.

In pairs or small groups discuss which variables that we will have to keep the same. Share ideas and add to the working wall.

Make prediction verbally in groups and then record own ideas in books. (when we change the temperature what will happen to the amount of water?)



(SAFETY – Never use water hotter than 50 degrees in a classroom!)

Children need to select measuring equipment to give the most precise results. (KS2 WS)

The children decide how to record and present evidence.

Complete conclusion.

Conclusions

When we changed ____

we found that ____ ...

My evidence for this is...

My scientific explanation for this is...

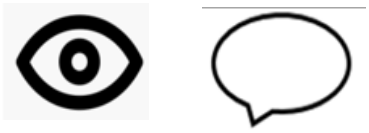
I think this because...

<u>Complete an evaluation as a group:</u>
How fair was your investigation? (Which variables were hard to keep the same?)
How accurate were your results? (What was hard to measure/observe?)
How could you improve your investigation?

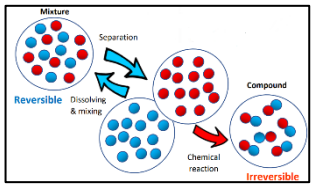
The conclusion should be: The speed of evaporation increases with heat.

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

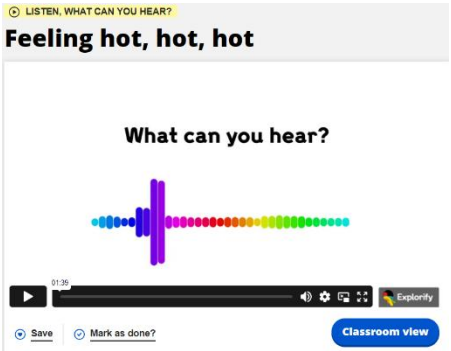
What is an irreversible change?



irreversible change - when a new compound is formed by chemical reaction and the change is not reversible.



Activate task: https://explorify.uk/en/activities/listen-what-can-you-hear/feeling-hot-hot-hot



1. You're going to listen to a short sound clip then 'reveal' a matching image. The aim isn't to find right answers, it's to explore ideas and find out what they know.

- Do they know what they are listening to?

2. After you've listened to the sound clip, lead a discussion with your class:

- Have they heard these sounds before? What was going on when they did?
- Do you ever hear sounds like these in school? Do you make them yourself?

3. Reveal the matching image – is it what they expected to see? Does it change their ideas?

Background information

You have been listening to materials undergoing irreversible changes: an egg frying, bacon frying and wood burning.

Main lesson:
Watch the video – https://www.bbc.co.uk/bitesize/articles/z9brcwx

Explain what an irreversible change is: **irreversible change -** when a new compound is formed by chemical reaction and the change is not reversible.

Main lesson:

Let's see chemical reactions…Children take part in the following 2 activities. Use observational skills and discuss what is happening.

Fizz Balloons

You will need:

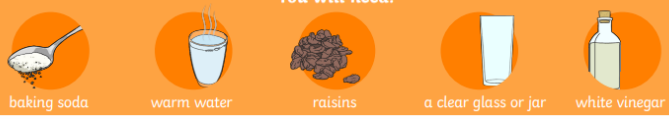
Method:
1. Pour 3 to 5cm of vinegar into a plastic bottle.
2. Use a funnel and add about 2 tablespoons of baking soda to the vinegar.
3. Quickly place the neck of the balloon over the end of the bottle.
4. Watch what happens!

Why this happens:
Baking soda is a substance called a base. Vinegar is a substance called an acid. When bases and acids combine they create new substances. In this experiment carbon dioxide is created. Carbon dioxide is a gas; the gas leaves the bottle and blows up the balloon.

What next?
What happens if you add more or less vinegar?
What happens when you add more or less baking soda?
What if you use a bigger or smaller balloon?
What happens if you use a bigger or smaller bottle.

Bouncing Raisins

You will need:



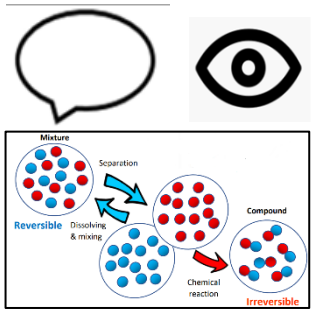
Method:
1. Half fill the jar with warm water.
2. Add 2 teaspoons of baking soda.
3. Add 5 raisins to the jar.
4. Fill the rest of the jar with vinegar.
5. Watch what happens!
6. Clean up your experiment area by washing out the jar and safely disposing of the mixture inside.

Why this happens:
Baking soda is a substance called a base. Vinegar is a substance called an acid. When bases and acids combine they create new substances. In this experiment carbon dioxide is created. Carbon dioxide is a gas; the gas makes bubbles which stick to the raisins and float them up to the surface. When the raisins reach the surface the bubbles pop and the raisins fall back down.

What next?
What happens if you add more or less vinegar?
What happens when you add more or less baking soda?
What happens if you add more or less hot water?
What happens if you add more or fewer raisins?

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

What is a reversible change?



reversible change – these are physical changes which can be undone or reversed.

melting – When a solid turns to a liquid.

freezing - When a liquid turns to a solid.

Retrieval task:

Match up task:

fossil - the impression of an animal or plant in a rock.

permeable – absorbs water

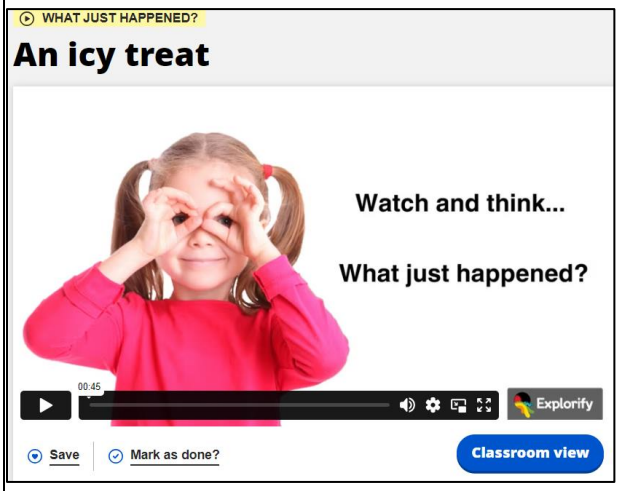
impermeable - does not absorb water

geologist – a scientist who studies rocks

palaeontologist - a scientist who studies fossils

Activate task:

https://explorify.uk/en/activities/what-just-happened/an-icy-treat



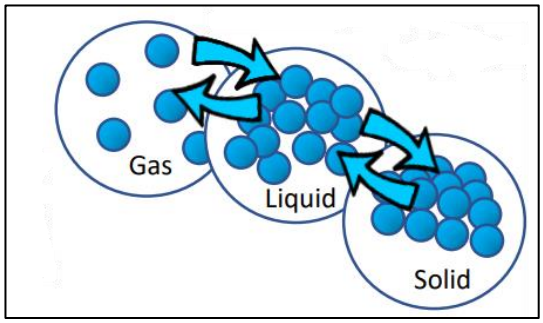
Ask the children what just happened in these pictures.

Background information

Ice lollies are made by freezing liquids. This frozen lolly is a solid made from orange juice. When it is taken out of the freezer it warms up and melts to become a liquid again.

Main lesson:

This diagram shows the states of matter (the state at which a substance exists)



Explain that changes of state are reversible changes. Explain what reversible change is:
reversible change – these are physical changes which can be undone or reversed.

Watch the video – https://www.bbc.co.uk/bitesize/articles/z9brcwx

How would you change a liquid into a solid? Freeze it. **freezing** - When a liquid turns to a solid.
How would you change a solid into a liquid? Melt it. **melting** – When a solid turns to a liquid.

Children could make some chocolates or some ice lollies and describe the changes in state and represent using particle model.

Children to sort some pictures into the correct groups.
After they have sorted them. Go through the answers.

Children to look at the similarities for the irreversible changes. Try to get out of the children that when a new material is formed then this is an irreversible change.

Teacher assessment	**Still need more depth of learning**	**Shows strong understanding**

Common strengths	Common weaknesses	Notes for subject leader	Pupils who still need more depth of learning	Shows strong understanding