Mendell Primary School

Aspire Challenge Achieve

Medium Term Plan Science

Year Group: 5	Term: Autumn 2 – Spring 1	Teacher: Miss Keenan	Subject lead: Sarah Bride

Common Misconceptions:

Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed.

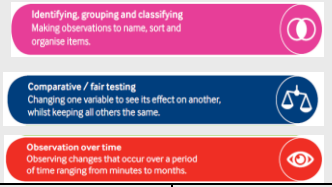
Some children may think:
- thermal insulators keep cold in or out
- thermal insulators warm things up
- solids dissolved in liquids have vanished and so you cannot get them back
- lit candles only melt, which is a reversible change.

Unit key Vocabulary:

Thermal/electrical insulator/conductor, change of state, mixture, dissolve, solution, soluble, insoluble, filter, sieve, reversible/non-reversible change, burning, rusting, new material

Overview: Properties and changes of materials.

- 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.



Key End Points: By the end of this unit children will be able to:

- Explain what thermal conductivity is and which materials provide insulation
- Describe what a solution is
- Describe what a mixture is
- Explain the difference between soluble and insoluble.
- Explain what dissolving means and give examples
- Explain what filtering and sieving are and give examples
- Explain how materials can be recovered from solutions or mixtures through evaporation, filtering and sieving.
- Describe reversible and non-reversible changes

Links to other learning:

DT, Circuits.

Prior 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)**

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

High Quality Text:

Kensuke's Kingdom – This book is the perfect setting for exploring survival scenarios and is full of opportunities for:
Exploring solids, liquids and gases. Investigating how mixtures might be separated, including through filtering, sieving and evaporating the particular uses of everyday materials, including metals, wood and plastic. Investigating dissolving, mixing and changes of state.

Risk Assessment/Healthy and safety

Take care with warm water, using saws and hammers to look at materials.

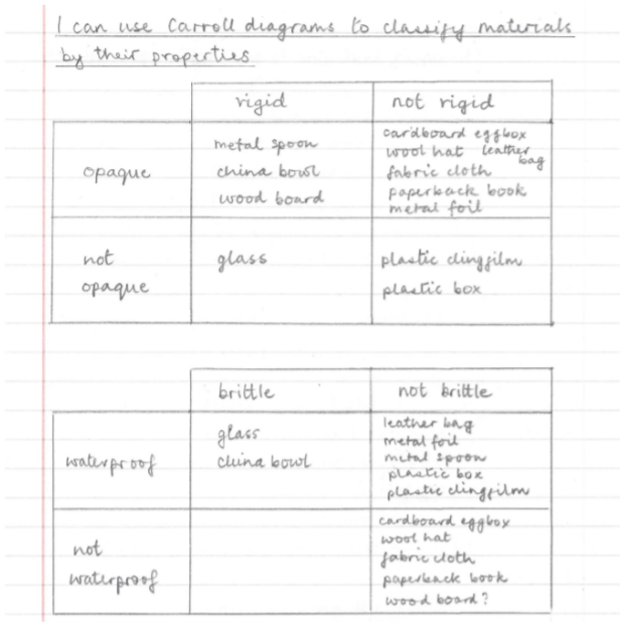
Teacher CPD:

PLAN ASE Diogjena Unit of work.

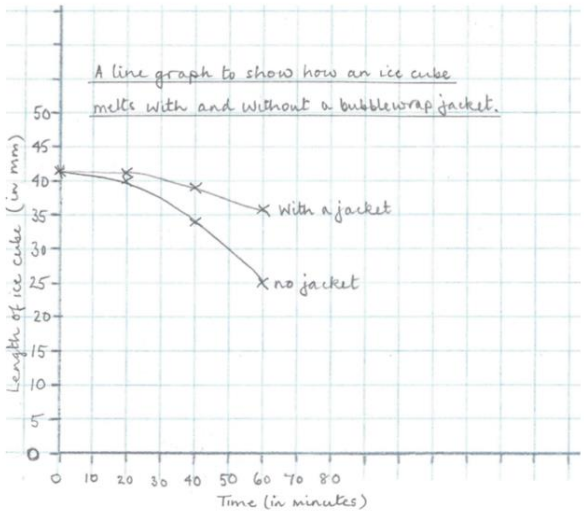
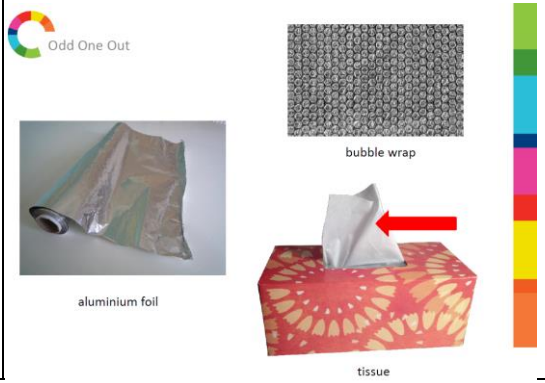
Reach Out CPD - https://www.reachoutcpd.com/

	• 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)**	terms of neutralisation reactions. **(KS3)** • The pH scale for measuring acidity/alkalinity; and indicators. **(KS3)**	**Scientist to study:** **Antoine Lavoisier (1743 - 1794)** **Dmitri Mendeleyev (1834 - 1907)** **Sir Humphry Davy (1778 - 1829)** **John Dalton (1766 - 1844)** **Marie Curie (1967-1934)**	Remind children that while using liquids in small battery operated circuits is fine, water and mains electricity **DO NOT** mix and would cause an electrical fire/electrocutions.	sign up for free.

	Learning Intention	Lesson Outline (Key Questions in colour)	Resources	Vocabulary	Lowest 20% Adaptations
1	L.I. I can use Carroll diagrams to classify materials by their properties.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is making observations and asking questions.** **Big Question: What do you already know about the properties of materials?** Review what the children recall about the properties of materials from previous years – key vocab - Names of materials – wood, metal, plastic, glass, brick, rock, paper, cardboard. Properties of materials – opaque, transparent and translucent, reflective, non-reflective, flexible, rigid shape, push/pushing, pull/pulling, twist/twisting, squash/squashing, bend/bending, stretch/stretching, solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle Complete vocab colour coding sheet pre assessment. Share the word bank slide of the PowerPoint. Ask the children to discuss the key vocabulary and discuss if they have heard of this word and can give a definition, discuss any words children are unsure of. Encourage children to use this vocab when completing the odd on out activity – three glass one made of metal, one glass, one plastic. For example, children may have considered transparency to choose the odd one out. The **properties** of materials help us to decide which materials are suitable to make a particular object. Which important properties do all three cups need to have? Watch this clip to help you decide: https://www.bbc.co.uk/bitesize/topics/z4339j6/articles/zx8hhv4 Provide groups of children with 10-12 materials – ideas on PowerPoint - ask the children to sort them according to properties – again use word bank to support if needed. Encourage children to explore multiple ways of sorting – one example on PowerPoint. **Activity:** Classify household items using two different Carroll diagrams. Lower ability may like to use the example on PowerPoint for first one. Children to use what they have learnt and the word bank to help them. **Recording example;**	ASE PLAN PowerPoint A range of materials for sorting.	**Properties** **Absorbent** **Brittle** **Electrical conductor** **Electrical insulator** **Flexible** **Material** **Opaque** **Property** **Reflective** **Rigid** **Thermal conductor** **Thermal insulator** **Translucent** **Transparent**	

		There are many possible outcomes for this activity. Try to use the name of the material and the object, for example 'metal spoon'. You may find there is a Carroll diagram quadrant with no objects. For example, here there are no objects which are both 'brittle' and 'not waterproof'. **Possible learning outcome for reviewing your work:**  I can use Carroll diagrams to classify materials by their properties **rigid / not rigid** opaque: metal spoon, china bowl, wood board / cardboard eggbox, wool hat, leather bag, fabric cloth, paperback book, metal foil not opaque: glass / plastic clingfilm, plastic box **brittle / not brittle** waterproof: glass, china bowl / leather bag, metal foil, metal spoon, plastic box, plastic clingfilm not waterproof: cardboard eggbox, wool hat, fabric cloth, paperback book, wood board? It may be difficult to classify some objects. For example, a cardboard egg box needs to be fairly rigid but it has a flexible hinge so the lid can open easily. These Carroll diagrams only have two options. If the property selected in the first column is 'rigid', the second column should be labelled 'not rigid'. 9			
2	L.I. I Can compare and group together everyday materials on the basis of their properties.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is asking questions, setting up tests and recording data.** Set out 'The Wrong Materials' images and related materials (see resource) around the room. Play the Bestival highlights video, and get children (in groups) to create a list of the materials they can see (wood, glass, etc.), then list what they think might be classified as 'properties' of these materials (*use this as part of a pre-block assessment*). Explain they have been selected to form an advisory 'materials committee' for the festival organisers. Children need to explore and investigate (using a fair testing and comparative approach – *check understanding from previous blocks*) a range of materials and their properties in order to recommend which materials are up to the job for the festival's needs. Children explore 'wrong materials' and make as many suggestions as they can as to why they are not suited for purpose (*you should also use this as a pre-block assessment to note the scientific language children are using and their current knowledge of the properties of materials – do they recall Yr2 knowledge of properties*). Share suggestions, then show children the set of materials (see suggested list) and get them to suggest a minimum of two different ways to group them by property (e.g. flexibility, weight, transparency, expected absorbency). Explain that their challenge is to investigate food prep surfaces (for catering vans and temporary cafes). All food prep areas at the festival need to meet health and safety standards and be made from the best (and hardest) materials around. Show children the guidelines and (in gps) get children to identify properties that recommendable materials will need to have, based on these guidelines (*hard, easy to clean, smooth, corrosion resistant and non-toxic* – they will not be testing these last two, but worth noting).	https://www.youtube.com/watch?v=Zu7bJ1qGCnM resources saved on Google Drive Plastics (plastic bags, polystyrene, bottles,) • Metals (aluminium foil, stainless steel cutlery, iron hammers/saws)	**Comparative test** **Variable** **Hardness** **Flexibility** **Weight** **Transparency** **Absorbency**	

		Activities: Introduce children to the sticky-note approach to investigations (see resource). In groups, get children to identify their overarching enquiry question (*Which material is best to use for food prep surfaces?). S*upport them as they break this down further (*as in previous blocks*) to identify what they are investigating (**Which material is the hardest, non-porous, smoothest and easiest to clean? Leading to: Which material resists being scratched the most? Which material doesn't soak water up? Which material feels smooth to touch? Which material can be cleaned easily with soap and water?).** This may seem like a lot to investigate but you need to get the children to prioritise in order to eliminate materials as they investigate. Get children to order the enquiry questions by importance - as long as they can justify this, there is no 'right' answer. Recap on what 'variables' are and encourage children to identify what will change and how they will ensure their testing is fair and accurate (see example). Get children to carry out their investigations, noting any issues encountered along the way and possible solutions. Get children to record their findings in the table provided. Explore any issues the children had in their investigations and highlight possible solutions. Then look at the materials that have been recommended. Note that wood is an interesting one as it is often used for chopping boards, despite not necessarily scoring 'highest' on the tests. If you can, take the children into the school kitchens to look at the food prep areas to look at the materials have been used. Where they on the right lines?	• Woods (if possible a hard wearing maple or walnut chopping board, and a less robust pine or oak chopping board) • Stone (chalk, granite) • Fabric (woven material, knitted wool, cotton) • Glass • Rubber • Cork • Viny		
3	L.I. I can investigate how to stop a snowman melting using a comparative test.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is asking questions and observing** **.** **Big Question; How could you stop a snowman from melting?** Share the concept cartoon and discuss: Imagine you have just made a snowman. **How could you stop it from melting?** **Which of these children do you agree with?** **Do you have a different idea?** **Might the type of jacket make a difference?** Talk or think about how you might investigate this question. **Word of the week: Thermal insulator -** A thermal insulator does not allow heat to pass through it easily. Thermal insulators help to keep hot things hot and cold things cold. Discuss the vocabulary Comparative test. Do the children know what it means? - A **comparative test** explores the relationship between variables. One variable which can have two or more '*types*' or '*categories*' is selected to be changed, for example 'the material of a jacket'. One variable is selected to be measured, for example 'the length of the ice cube'. All other variables are kept the same, for example 'the start size of the ice cubes' and 'the place where the ice cubes are left'. Children to complete the investigation following the instructions on the PowerPoint - ***Investigating how quickly an ice cube melts with or without a 'jacket' on.-*** discuss the importance of accurate measuring. Use your results to plot a line graph. Plot two lines on the graph, one for each ice cube, showing the length at 0, 20, 40 and 60 minutes. Label your lines 'no jacket' and 'with a jacket'. **What have you found out?** Try to explain your results. *Use the word bank to help you.* **Which variables did you need to keep the same?** **Recording example;**	ASE PLAN PowerPoint Two ice cubes of the same size. A piece of flexible material such as bubble wrap or a cleaning cloth. Scissors and a ruler. Use squared paper	**Comparative test** **Variable** **Melting** **Thermal insulator/conductor**	

		Results Time in minutes / Length of ice cube in mm: without a jacket / with a jacket 0 — 42 — 42 20 — 40 — 42 40 — 34 — 39 60 — 25 — 36 I found out that the ice cube without a bubblewrap jacket melted faster than the ice cube with a jacket. This is because the bubblewrap is a good thermal insulator so it stops the heat from the surroundings reaching the ice cube. The bubblewrap is made of plastic with air pockets which help to insulate the ice cube and keep it frozen.  This is a comparative test as you are comparing ice cubes with and without a 'jacket'. The **variable** you **change** is jacket/no jacket. The **variables** you **keep the same** include the size of ice cube at the start and the place where the cubes are left. The **variable** you **measure** is the size (length) of the ice cube every 20 minutes. The line graph here shows that both ice cubes melted very slowly in the first 20 minutes. After 60 minutes the ice cube with no jacket had melted much more than the one with a jacket.	**Exit pass;** Discuss the taking if further slide.			
4	L.I. I can use a comparative test to observe thermal conductors	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is asking questions and setting up tests.** **Odd One Out:** possible responses – electrical conductor or insulator, thermal conductor or insulator, metal non-metal. 	Spoons made of different materials. Warm water in bowls/cups. Butter	**Thermal conductor** **Material** **Purpose**		

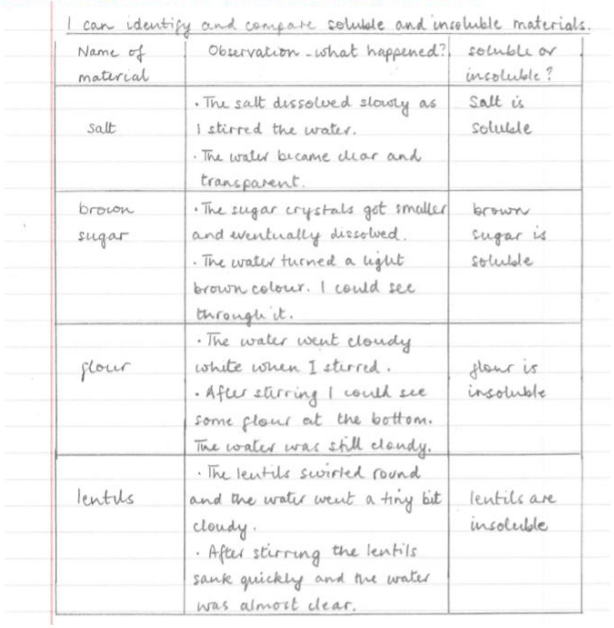
		Big Question - Which material is best at conducting heat? **Word of the week - thermal conductor** Show children the spoons all made from different materials. Ask them to figure out how they could use these spoons to work out which material is best at conducting heat. Warm water can be placed in a bowl. Cut holes in a card lid for the bowl large enough for the handles of spoons to poke through. Place spoons made from different materials through each of the holes in the lid and place on the bowl. Place a blob of butter on the end of each of the spoons. The children could time how long it takes the lump of butter to reach the lid. **Recording** The children can draw the spoons in the bowl and label each spoon with an explanation about what happened. Encourage them to use the words 'thermal conductor'. **Deep thinking time – Why are these objects made from particular materials?** Can children relate their findings to the materials that some of the following objects are made from: saucepans, radiators, roof insulation, double gazing, coffee cup holders, hot water bottles, chip paper, etc			
5	L.I. I can explore a range of materials and test their electrical conductivity.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is asking questions and setting up tests** **Word of the week: electric conductor/insulator.** **Big Question: Which materials allow electricity to pass through them?** Have a circuit set up on each table with a switch and a 'thing' that may or may not conduct electricity (see resources for partially completed table, which provides a list of suggested materials to include in circuits). Get the children to look round the room and decide if any of the lightbulbs will light up when they switch the circuit on – encourage children to draw upon prior knowledge with circuits from year 4. Then get children to turn them on and note that they all conduct electricity apart from the metallic looking plastic! Ask children if they can explain why the salty water conducts electricity – it contains electrically charged ions that help conduct the electricity (children don't need to know this, but may find it interesting). Remind children of sessions when you spoke about 'thermal conductivity' – is this the same as electrical conductivity? Explain that we need to find materials that will conduct electricity as well as those that will not (and that are waterproof) for temporary wiring repairs. Ask children whether the salt water would be useful for conducting electricity– no! It would be exceptionally dangerous. Remind children that while using liquids in small battery	Electricity kits Suggested materials form the resource sheet.	**Electric conductor** **Electric insulator** **Circuit** **Material** **Metal** **Conductivity**	

		operated circuits is fine, water and mains electricity **DO NOT** mix and would cause an electrical fire/electrocutions. **Make it clear to children that only qualified electricians should ever work with mains electricity and wiring – what chn are doing today is simply to make recommendations.** Remind children that they need an enquiry question and a plan for their investigation. Get children to set up an electrical circuit for testing out their materials for electrical conductivity (**how well have children remembered their previous work on electric circuits?).** Ensure they have the glass and tin as well as a range of metals and non-metals (see table). Ask children to suggest a way to measure 'good' vs 'poor' conductor (have more cells to enable a very bright, 'normal', or dim bulb). Support and challenge children (depending on what you noted from the previous session) as they investigate, using the sticky-note method. Children record their findings in the table then to select a graph form to present this information effectively and to help make recommendations through their final video presentation (they can now combine and edit all videos from the block to create a video 'report' to be sent with their work in the final session to the festival organisers). **Can children recommend a good conductor, and appropriate insulator that is also waterproof, using their graphs?** (Emphasise how visual graphs can help us 'see' the results without needing to know the actual figures.) Ask children to classify materials into three categories: weak, medium, good conductor. Now look at weak, medium and good thermal conductors and make comparisons. **What do children think would happen if they touched a live electrical wire? (Potential heart attack/suffocate/won't be able to let go – note that electrical fences mustn't be touched either, but they have a pulsating electrical current – so that animals can release themselves).** Exit pass: Play the simple conductivity game online			
6	L.I. I can identify and compare soluble and insoluble materials.	**This is a Science lesson. In Science, we study nature and the behaviour of natural things. The skill we will be using this lesson is making predictions and observing.** **Explorify: Hot drinks for cold days** - https://explorify.uk/en/activities/odd-one-out/hot-drinks-for-cold-days **Word of the week: soluble** **Big Question: What happens when you add sugar to a warm drink?** Some people like to add sugar to their tea or coffee. **What happens to the sugar?** Get the children to half fill a clear plastic cup or glass with lukewarm water. Add ½ teaspoon of white sugar. Stir slowly and watch what happens. Talk about what they see. Take feedback on what they children observe. Sugar seems to 'disappear' when you stir it into water but it is still there! The sugar has **dissolved** in the water to form a transparent, clear **solution**. Sugar is a **soluble** material. **Which other soluble substances can you find in the kitchen?** Watch this clip: https://www.bbc.co.uk/bitesize/topics/zcvv4wx/articles/zpbdpbk Discuss soluble and insoluble substances using the PowerPoint. Let's compare soluble and insoluble materials we use in the kitchen. Ask the children to follow the instructions on the PowerPoint to test a range of kitchen substances such as brown/white sugar, salt, lentils, rice, flour. Children make predictions before being the investigation. **Recording**; children draw a table to show what happened and weather each material is soluble or insoluble. Example:	ASE PLAN PowerPoint Household items to support learning: Clear plastic cups (or glass cups). Salt, white sugar, brown sugar, flour and rice (or other grain/pulse). Teaspoon and water	**Solution** **Soluble** **Insoluble** **Dissolve** **Transparent**	

Salt and white sugar both dissolve in water to form a clear, transparent solution.

Brown sugar dissolves in water to form a slightly brown coloured solution.
All solutions are clear so you can see through them.

Possible learning outcome for reviewing your work:



I can identify and compare soluble and insoluble materials.

Name of material	Observation - what happened?	soluble or insoluble?
salt	• The salt dissolved slowly as I stirred the water. • The water became clear and transparent.	Salt is soluble
brown sugar	• The sugar crystals got smaller and eventually dissolved. • The water turned a light brown colour. I could see through it.	brown sugar is soluble
flour	• The water went cloudy white when I stirred. • After stirring I could see some flour at the bottom. The water was still cloudy.	flour is insoluble
lentils	• The lentils swirled round and the water went a tiny bit cloudy. • After stirring the lentils sank quickly and the water was almost clear.	lentils are insoluble

Flour does not dissolve in water. Grains of flour are small, so some will stay suspended in the water, making the water cloudy. The flour grains are called a sediment.

Lentils do not dissolve in water. Lentil grains are quite large so they fall quickly to the bottom as a sediment. Dust from the lentils may make the water slightly cloudy.

Extension or homework task use the taking it further slide from the PowerPoint and think about **What is the difference between normal water and salty water?**