Pioneer Federation
Medium term plan
UKS2 cycle 1, Term 1
Science

Subject: Science

Key Concept/ Theme: Properties and changes of materials

- Prior Learning links:
  KS1: Name, compare and identify properties of everyday materials thinking about their suitability for the purpose.

  Year 3: compare and group rocks based on appearance and physical properties. Learn how fossils are formed. How soils and rocks are made from organic matter.
- Year 4: Compare and group materials together, according to whether they are solids, liquids or gases
- 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) Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Vocabulary:

Thermal conductivity – thermal conductor, thermal insulator

Electrical conductivity – electrical conductor, electrical insulator

Dissolving – Solvent, solution, solute, soluble, insoluble, solid, liquid, particles, suspensions

Separating materials – Sieve, filter, evaporate, condense

soluble - *a substance that will dissolve in water*
insoluble - *a substance that will not dissolve in water*
saturation - *the point at which no more solute can be dissolved*
solution - *a soluble solid is dissolved in liquid to form a solution*
filtration - *the collection of larger particles in a mixture*
boiling - *the process by which molecules of a liquid change to vapour (much faster change than evaporation)*
condensing - *the change of vapour into a liquid*
evaporation - *change from a liquid to a vapour*
freezing - *the change of a liquid to a solid*
melting point - *the point at which a solid substance liquefies*
chemical change - *one where the molecular structures of the combined substances are broken down and recombined to make a new substance*
physical change - *where the molecular structures of the combined substance stay separate, allowing separation to occur*

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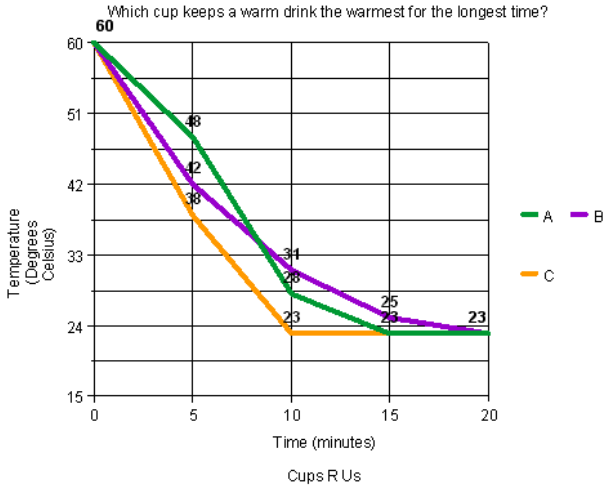
reversible change *- a physical change that we can undo* ***irreversible change*** *- a physical change that we cannot undo*	
1.	**Deeper learning question for the term:** How do materials change? **Prior learning reconnection (year group, cycle & term):** Year 4 cycle year 3 cycle **Enquiry skill:** fair test, record results, graphs **LO:** Let's investigate the thermal insulation of different materials. **Activity:** Complete pre-assessment cartoon concept. Which materials make the best thermal insulators? Set up context for the session: Letter from teachers to class asking them to find out and design the best travel mug for teachers to use to keep their tea warm. Share with the children the terms thermal conductor and thermal insulator and share examples on the board. https://www.bbc.co.uk/programmes/p0118n4j Ask the children to use the graph to work out which cup kept the water the warmest for the longest time. Ask them to explain which type of material they think each of the cups was made from. They can then be asked to design their own investigation in order to find their own set of results  Children could fill beakers with same amount of warm 'tea', wrap each with a different material and then measure the temperature every 5 minutes or take a final reading only after 20 minutes. See Kent planning for further information on the session (page 10-11)

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	Future learning links after topic: The children will be taught about reversible and irreversible changes in term 6. In ks3 the children will learn the nature of matter, atoms, elements and compounds. They will learn about pure and impure substances are, including simple techniques for separating materials. They will learn about chemical reactions and represent them using formulae and equations.
2.	**Deeper learning question:** Which material is best at conducting heat? **Reconnection:** What is a thermal insulator? **LO:** Let's learn to compare which materials are best for conducting heat. **Enquiry skill:** take measurements, record results **Activity:** Continue with the idea of designing a new travel mug. Explain that a teacher enjoys having soup in their mug and therefore needs a spoon, which could sit in the soup and be used throughout. Comparative test – Which material is best at conducting heat? 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 to 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: create table. 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– 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
3	**Deeper learning question:** Is all data reliable? Should you repeat results? **Reconnection:** What is the difference between thermal insulators and conductors? **LO:** Let's learn how some materials will dissolve in liquid to form a solution, and how to recover a substance from a solution. **Enquiry skill:** method and equipment, safely using equipment, take measurements, **Activity:** Hook: Teachers are wanting to quickly dissolve their sugar in their tea and it is taking too long. Introduce the children to dissolving. To ensure that children do not think that sugar disappears in water, allow them to mix sugar in a clean cup of water. Even though they can no longer see the sugar, they should be able to taste it. You could allow the children to carefully observe different sugars using a digital microscope. Are there any clues about how long they might take to dissolve? This is a good opportunity to develop the children's understanding of why they take repeated measurements/observations.

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Show the children the table of results below. You could reveal each column of results one at a time. Each time, ask the children to explain what the results are showing. Do their explanations change as more data is revealed? Can they spot any dodgy data?

How does the temperature of the water affect the time it takes for the sugar cube to dissolve?

Temperature of water (degrees Celsius)	1st try Time to dissolve (seconds)	1st try Time to dissolve (seconds)	1st try Time to dissolve (seconds)	1st try Time to dissolve (seconds)	Average time to dissolve (seconds)
15	30	31	20	31	
25	27	29	29	28	
35	24	27	25	25	
45	21	27	23	24	

The children can then create their own fair-test to find out how a particular factor affects the rate at which sugar will dissolve. The children could use fair-test post-its and posters to help scaffold their planning. Encourage the children to think about the reliability of their findings; i.e. are they repeating their investigations? The children should record the variables: that are staying the same, the one being changed, and the one being measured/observed. The children could record their results in a table.

In order to develop their explanation, allow the children to first act out being the water and the sugar. This way they think carefully about what they have done to the sugar or the water to make it easier for the sugar to dissolve in the water. Now ask them to record some key words that will feature in their explanations. Finally, use this thinking and the key words to record a sentence or two. The children could use this as an opportunity to evaluate their investigation: FAR (Fairness, Accuracy and Reliability). Fair – have they kept all the variables the same apart from the one being changed? Accuracy – how accurate were their measurements? Reliability – were the repeated measurements very similar? Then suggest improvements for their investigation.

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Deeper learning question: What is a thermal insulator?
Reconnection: What is a solution?
LO: Let's compare and group together everyday materials based on evidence about the conductivity of heat.
Enquiry skill: Scientific questioning, make predictions
Activity:
The adults again need some help. They are getting cold outside because they are not running around and need help with a coat, can you help them?
Simple test – What affect will a coat have on a person and an ice man?

https://www.bbc.co.uk/programmes/p0118t8z

The video above clearly shows how wetsuits and dry suits work.

Discuss what children think will happen to the heat from the person and the heat from outside of the snowman when they are each covered in a layer of material (i.e. a coat).

Ask children for ideas for what they could use to represent the iceman and the man. They could make an ice balloon (water frozen in a balloon) for the iceman and beaker containing warm water (up to 60 degrees Celsius) for the person.

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	Allow small groups of children to investigate what happened to the 'iceman' and 'person' when they are wrapped with an identical piece of fabric. They could further extend this investigation to find out which material makes the best insulator for the ice man (i.e. the material that will be best at slowing down the rate at which it melts). The children could draw the iceman and person dressed in the fabric. They could use labels and arrows to show where the heat is moving from and which direction it is travelling. Encourage them to use the term 'thermal insulator'.
5	Deeper learning question: How can mixed materials be separated? Reconnection: What is a thermal insulator? LO: Let's learn how to use different process to separate mixtures. Enquiry skill: make predictions, take measurements Activity: Context: Unfortunately the food delivered to the school kitchen was dropped and there has been a mix up with some of the foods- can you help? A bag of salt has mixed split open and mixed with water. (a solution- a solid dissolved in a liquid) Evaporation Raisins and flour have mixed. (mixture of two solids) Sieving Rice split over the paper work and mixed up with a pot of paper clips. (mixture of two solids) Magnetic Attraction A bottle of water was mixed with some a sand bag delivered at the same time. (a suspension- a mixture of a liquid and a solid and particles that will not dissolve) Filtration How will the children separate the mixtures? Provide 4 explanations where the children have to try to work out which one would be best. Children to then start to separate the mixtures- leave the evaporation one to next week.
6	Deeper learning question: Why is it important to know about changes in state? solid, liquid, gas, add heat, reduce heat (cool), melt, evaporate, condense and solidify Reconnection: Recap on filtration, sieving and magnetic attraction. When would we use this in real life? LO: Let's learn how to use different process to separate mixtures focussing on evaporation. Enquiry skill: method and equipment, record results Activity: In small groups the children could use drama to demonstrate their understanding of changing states. Provide them with following vocabulary: 'solid, liquid, gas, add heat, reduce heat (cool), melt, evaporate, condense and solidify.' (They should have learnt much about changes of state in Lower Key Stage 2). Ask the children to think about how their understanding changing states could assist them when trying to work out how to separate water from salt. The children could try heating a mixture of salt and water in a small metal tray on a night light holder. They can try to condense some of the water vapour onto a mirror. The salt can be views under the digital microscope. Problem-solving – How could you separate water from salt if your only heat source was the Sun? The children could try modelling their ideas by: • Placing a few centimetres of salty water in a mixing bowl. • Place a small beaker in the centre of the beaker. • Stretch some Clingfilm over the opening of the bowl and place a weight in the middle of the Clingfilm (thus making it dip above the small beaker). • They could then either try heating the mixture with a lamp or they could leave this equipment outside on a sunny day.

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	• The water should evaporate, and then condense on the Clingfilm, before dripping into the small beaker below the Clingfilm. The children could draw how they set up their equipment. They can use words and arrows to explain what happened over time.
7	Deeper learning question: Which materials allow electricity to pass through them? Reconnection: What is evaporation, condensing and water vapour? Where would you see this in the world around you? LO: Let's investigate the conductivity of electricity with different materials. Enquiry skill: Scientific questioning, make predictions Activity: To understand which materials allow electricity to pass through them. Children can devise their own investigation to find out which materials conduct electricity. They will probably choose first to make a working simple series circuit in which they will place a gap to test the different materials. Simple test 2 - Which metals are the best conductors of electricity? Children can use strips of different metals or objects made from different metals to find out which are the best at conducting electricity. The children could record their results in a chart. The children could explain their results using the terms 'electrical conductor' and 'electrical insulator'. Quiz

End points:

To understand the conductivity of electricity.
To ask scientific questions when investigating and then make predictions.
To understand and identify different processes needed for separating mixtures.
To compare and group together everyday materials based on evidence about the conductivity of heat.
To understand the thermal insulation of different materials.
To understand that some materials will dissolve in liquid to form a solution, and how to recover a substance from a solution.
To compare which materials are best for conducting heat.
To identify the variables for a fair test and explain if the outcome was expected. To explain how it is a fair test using the terms independent and dependent variables.
To take measurements, record results and graphs, interpreting results and finding patterns.
To safely use equipment.