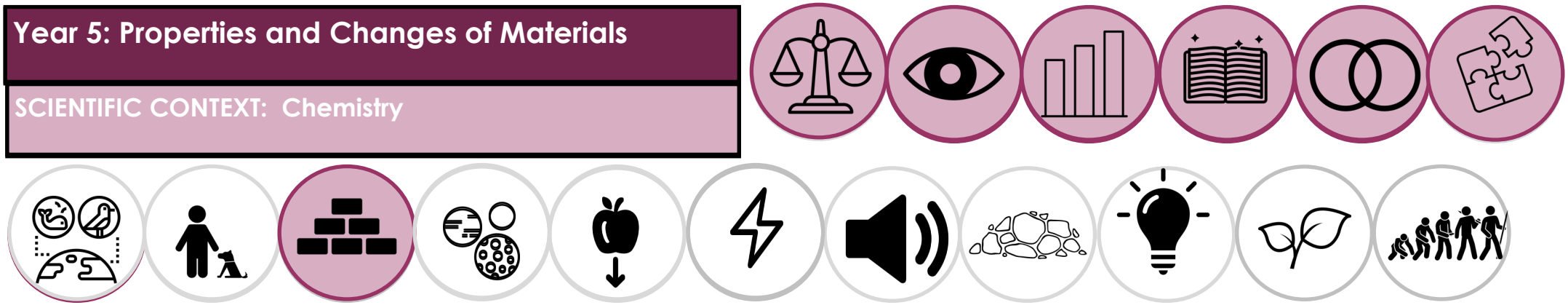
Year 5: Properties and Changes of Materials

SCIENTIFIC CONTEXT: Chemistry



As scientists, we will...

- 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:

- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs,
- Plan a scientific enquiry to answer a question recognising & controlling variables,
- Use test results to make predictions to set up further comparative and fair tests.

Notable Scientist: Ruth Benerito

Key questions

Key Questions:

1) How can we group everyday materials based on their properties?
2) What can happen to some materials when mixed with liquid?
3) How can we recover a substance from a solution?
4) How can mixtures be separated, including through filtering, sieving and evaporating?
5) What are the particular uses of everyday materials, including metals, wood and plastic?
6) What changes of state are irreversible?
7) What changes are irreversible? Do some of these changes result in the formation of new materials?

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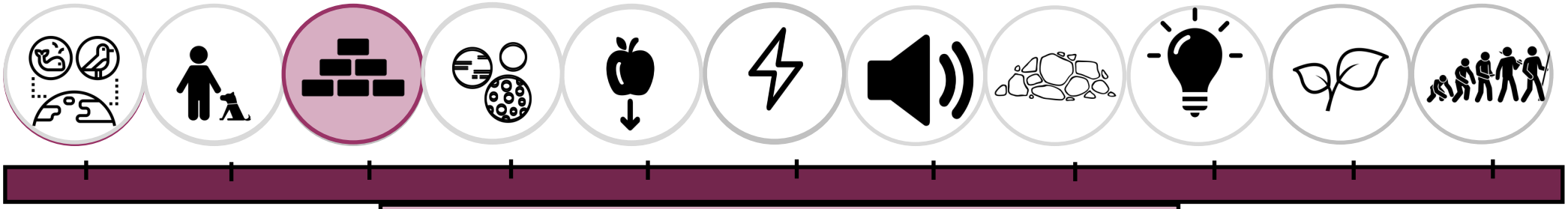

KEY VOCABULARY:

Thermal/electrical conductor	A material that allows heat/electricity to pass through easily
Thermal/electrical insulator	A material that does not allows heat/electricity to pass through easily
Change of state	The process of one state of matter (solid, liquid or gas) changing to another.
Mixture	A substance in which two or more substances are mixed but not chemically joined together
Dissolve	The process that occurs when a material is added
Solution	A mixture of two or more substances that stays evenly mixed.
Soluble	A substance that can dissolve in liquid.
Insoluble	A substance that can't dissolve in liquid.
Reversible change	When materials can be changed back to how
Irreversible change	When materials can 't be changed back to how

Filter	A device used to remove unwanted parts from a mixture.
Sieve	A device that is able to separate particles of different sizes.
Burning	*A chemical reaction that produces heat and light*.
Rusting	Rusting is an chemical reaction. The iron reacts with water and oxygen to form rust.
New material	Formation of a new material after two substances
Magnetic	Materials attracted to magnets.
Evaporation	If water (liquid) is heated, it changes to water va-
Condensation	If gaseous water vapor cools down enough, it will turn back into a liquid - that's called condensa-

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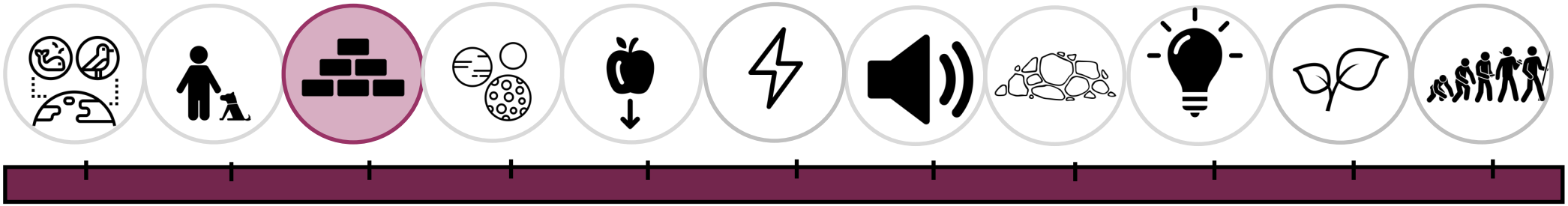

What I need to know:

Materials have different uses depending on their properties and state (liquid, solid, gas). Properties include hardness, transparency, electrical and thermal conductivity and attraction to magnets. Some materials will dissolve in a liquid and form a solution while others are insoluble and form sediment. Mixtures can be separated by filtering, sieving and evaporation. Some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda result in the formation of new materials and these are not reversible.

Opportunities for science capital

Part of science capital includes scientific media consumption- documentaries, reports etc. Here are links that provide daily science news for children. Checking in on these every now and then would be beneficial to help children see science in the wider world.

https://www.sciencenewsforstudents.org/

https://www.sciencejournalforkids.org/

Assessment:

By the end of this topic, pupils will be able to group properties based on their properties,; know that some materials dissolve in liquid to form a solution, and can describe how to recover materials; explain how mixtures might be separated, including through filtering, sieving and evaporating; list reversible and irreversible changes and explain that sometimes changes lead to the formation of new materials and explain the uses of everyday materials.

When working scientifically, pupils will be beginning to record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs; plan a scientific enquiry to answer a question recognising & controlling variables; and use test results to make predictions to set up further comparative and fair tests.

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Theme 1: Grouping and comparing materials

Starter

- Recap Y4 states of matter knowledge
- KWL grid
- Key vocabulary activity, children match key vocab of properties to their definition:

* Magnetic
* Reflective
* Absorbent
* Permeable
* Soluble/ insoluble
* Translucent/transparent/opaque
* Insulator
* Conductor (electric al & thermal)
* Flexible
* Hard
* Flammable

Main

Disciplinary knowledge

Working scientifically objective: Recording data in a table

Provide children with a rang e of different materials (e.g. flour, coffee, sugar, plastic, aluminium, copper, steel, felt and rock). Also provide children with a range of equip-ment to test the materials: response to magnets, solubility, hardness (could be a scratch test), transparency, electrical conductivity and permeability.

Now children have an understanding of the scientific vocabulary, ask them how will they test if the materials are: magnetic, soluble, hard, transparent, electrical conductors and permeable? Record their answers in books.

Model drawing a results table with columns responding yes or no to whether or not the materials are magnetic, soluble, transparent, electrical conductors and permeable; and a scale of 1-5 for their hardness. Children draw tables in their books.

Plenary / assessment

Children test the materials and their properties, recording their results in their tables as they go.

Using their knowledge of properties, ask children to now explain the uses of different items drawing on what they've seen in the wider world. Pre-sent pupils with a range of pictures– such as saucepans, radiators, glass for windows etc– and ask them to write a short sentence explaining why that object has been made out of a par-ticular material (e.g. metal saucepan because metal is a good thermal conductor).

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Theme 2: Dissolving and recovering materials

Starter

Recap– vocabulary kahoots quiz

Main

Disciplinary knowledge

Comparative/fair test

Working scientifically objective: Plan a scientific enquiry to answer a question recognising & controlling variables

Today we are going to be chemists.

Ask children to think of everyday examples of dissolving solids in water (e.g. sugar in tea, salt in cooking water).

Ask: how could we make salt dissolve quicker in water? Using year 5 planning boards, children independently plan different independent variables they could change. If needed prompt with ideas such as: what would happen if we stirred it more? What if we changed the temperature of the water, size of salt grains, volume of water? Etc. The dependent variable will be the same for each group: time taken for salt to dissolve, so this part of the planning board can be missed.

In groups, to make the investigation more manageable, choose one independent variable to investigate as a group and make a group prediction ensuring reasoning for the prediction is given.

Independently, children plan what variables they need to control to make it a fair test. For example, if the temperature of water is being changed, then the volume of water, size of grains etc. needs to be kept the same.

Plenary / assessment

Carry out investigation and record results as a group. Write a brief explanantion of results . Save the solutions that have been made!

Disciplinary knowledge

Observation over time

Pour a small amount of the salt water solutions into a an uncovered petri dish and leave somewhere warm. Over the coming lessons, observe salt being left in the dish as the water evaporates. Use magnifying glasses, children may comment on the different size and shapes of salt crystals. Record using observational notes, drawings and or photographs. Note that this is a reversible change as the materials have been separated.

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Theme 3: Separating mixtures

Starter

Recap: Dissolving (slide 2)

Using the link below, read out introduction to problem solving challenge. Give each group a mixture of items to represent dirty sea water, such as salt, sand, stones, grass and plastic, which can be prepared in advance, or in front of the class.

Pose the question: Can we turn dirty, salty water into something that animals can drink?

Give children a range of filtering equipment, such as coffee filters and sieves.

Give children time in groups to discuss how they are going to get this water clean. What order will they use the filters in? How will they remove the salt?

https://www.stem.org.uk/system/files/elibrary-resources/2017/02/How%20can%20we%20clean%20our%20dirty%20water.pdf

Main

Disciplinary knowledge

Problem solving

Groups fill out results table (sheet available from link) with the filer name, order they'll use it in and predictions about what material the filter will remove.

Filter name	Which order for filters?	Prediction I predict this filter will remove . . .	Results What substances has this filter removed?

Once predictions have been made, groups now work on trying to separate the mixture as best as possible.

Teacher demonstration for evaporation

Once the students have filtered out what materials they can, you could then evaporate and collect the water, to show the salt and any other dissolved materials left behind. It is recommended that this is done as a teacher demonstration as a heat source is required to evaporate the water. Could be done with foil cases and tealight candles.

Plenary / assessment

Children complete the results table demonstrating what material each filter removed.

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Theme 4: Thermal insulators

Starter

Recap: Draw/explain how to separate salt, sand & water

Properties of a fire fighter's suit discussion starter: https://www.tigtagworld.co.uk/mindmap/#/lessons/CLASS00262/activities/starter

Main

Substantive knowledge:

Work through the activities on: https://www.tigtagworld.co.uk/mindmap/#/lessons/CLASS00262/activities/main

Ask: what is thermal conductor? Can you name some insulating materials? Can you describe how a thermos flask works? How do marine mammals stay warm? Many insulators have small pockets of what?

Plenary / assessment

Disciplinary knowledge:

Comparative/fair test

Working scientifically objective: Use test results to make predictions to set up further comparative and fair tests

Today we are going to be packaging technologists.

You want to see which cup will keep your tea warm for longest. Give children results from a test on different cups, investigating which cup kept the tea warm for the longest (theme 4 results table worksheet). Ask children to study the results and make a prediction about what makes a good insulator e.g. I(e.g. a good insulator has more layers / traps air / made of….) . Use predictions to then set up further comparative tests. For example, if they predicted a good insulator has more layers, then they can change the amount of layers on a cup and measure the temperature after different intervals of time.

In groups, briefly plan the comparative test on the planning sheet, carry out the experiment and record results as a group. What did they find?

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Theme 5: Irreversible changes and formation of new materials

Starter

Recap: Snowman's coat concept cartoon

Substantive knowledge:

Work through powerpoint (follow link below) from slides 3-5, briefly touch upon information about vinegar and bicarbonate, but we will come back to this later in an experiment.

https://onedrive.live.com/view.aspx?resid=54CF08BDFC25132B!24322&ithint=file%2cpptx&authkey=!AN7So9-0MfgKb_Y

Main

Disciplinary knowledge

Comparative/fair test

Working scientifically objective: record data and results of increasing complexity using tables and bar graphs.

Follow the investigation, choose as a class how you'll develop this into a comparative (e.g. by changing the amount of bicarbonate of soda, or vinegar) and how you'll measure the reaction (e.g. time taking for bag to burst, ranking bags from most inflated to least): https://www.tigtagworld.co.uk/mindmap/#/lessons/CLASS00263/activities/practical/ACTVTY00373

Again, as a class, carry out the experiment. Use one HA child to record results in a table.

Once the experiment is complete, present the table to the class. Model how to present data on a bar graph. Pupils then independently draw a bar graph in their books.

Plenary / assessment

Complete grouping activity on slide 6. HA can add examples of their own to the table.

https://onedrive.live.com/view.aspx?resid=54CF08BDFC25132B!24322&ithint=file%2cpptx&authkey=!AN7So9-0MfgKb_Y

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Theme 6: Ruth Benerito

Starter

Recap: learning from the whole topic, could be a kahoots quiz, or paper quiz from twinkl.

Main

Disciplinary knowledge:

Research

Working scientifically objective: Report and present findings from enquiries in written forms.

Carry out research on Ruth Benerito and present findings in an infographic style.

Questions to research:

1) Who is Ruth Benerito?
2) Her career in science.
3) Her legacy.

Plenary / assessment

Complete KWL grid.