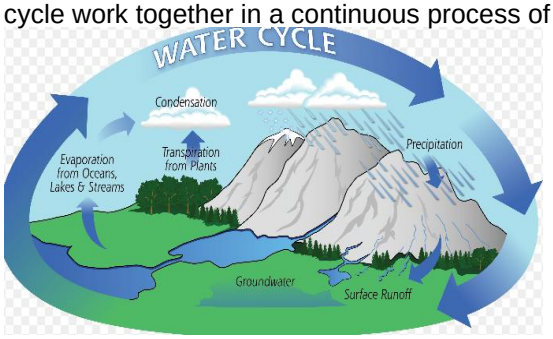
Science

States of Matter Year 4

Remember when
Some materials are used for certain purposes because of their properties. (Y2)

Sticky knowledge
Particles are what materials are made from. They are so small that we cannot see them with our eyes. The properties of a substance depend on what its particles are like, how they move and how they are arranged,
Particles behave differently in solids, liquids and gases.
In a solid state, the particles are packed closely together and in a pattern. A solid object holds it shape.
In a liquid state, the particles are close together but can move over each other. A liquid can be poured and will fill the shape of the container.
In a gas state, the particles are spread out and move in all directions. A gas would escape and fill a space.
The temperature at which water turns to ice is called the freezing point. This happens at 0oC.
The temperature at which water turns to steam is called the boiling point. This happens at 100oC.
The main stages of the water cycle are evaporation, condensation, precipitation and collection. The stages of the water cycle work together in a continuous process of recycling Earth's water supply.



Key vocabulary
Celsius
condensation
cooled
energy
evaporation
freeze
frozen
gas
liquid
matter
oxygen
particles
precipitation
properties
recycling
solid
state
structure
temperature
vibrating/ vibrate
water cycle
water vapour

National Curriculum
Explore a variety of everyday materials and develop simple descriptions of the states of matter
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

Common Misconceptions
• solid' is another word for hard or opaque
• solids are hard and cannot break or change shape easily and are often in one piece
• substances made of very small particles like sugar or sand cannot be solids
• particles in liquids are further apart than in solids and they take up more space
• when air is pumped into balloons, they become lighter
• water in different forms – steam, water, ice – are all different substances
• all liquids boil at the same temperature as water (100 degrees)
• melting, as a change of state, is the same as dissolving
• steam is visible water vapour (only the condensing water droplets can be seen)
• clouds are made of water vapour or steam
• the substance on windows etc. is condensation rather than water
• the changing states of water (illustrated by the water cycle) are irreversible
• evaporating or boiling water makes it vanish
• evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.

LO and Enquiry type	Knowledge and skills	Lesson outline
Lesson 1 **LO:** To know how particles are arranged in	**Sticky Knowledge:** Particles are what materials are made from. They are so small that we cannot see	What is a solid, liquid and a gas? Children to give examples and discuss what they already know. Move as a gas, liquid and solid.

solids, liquids and gases. **Enquiry type:** Research	them with our eyes. The properties of a substance depend on what its particles are like, how they move and how they are arranged, Particles behave differently in solids, liquids and gases. In a solid state, the particles are packed closely together and in a pattern. A solid object holds it shape. In a liquid state, the particles are close together but can move over each other. A liquid can be poured and will fill the shape of the container. In a gas state, the particles are spread out and move in all directions. A gas would escape and fill a space. **Skill:** Reporting on findings from enquiries, using relevant scientific language.	https://www.bbc.co.uk/bitesize/topics/z6p6qp3/articles/zsgwwxs (states of matter) STEM - solids, liquids and gases - Definition of solids, liquids and gases. What are the properties of solids, liquids and gases? 3 different balloons as a model. Balloon 1 with ice. Balloon 2 with water. Blow up balloon 3 – what is in there? How do you know there is something in it? Diagram to show the particles. LA/ARE- Definition of a solid, gas and liquid. Particles drawn alongside. GD- Definition of a solid, gas and liquid. Examples needed. Particles drawn alongside.
Lesson 2 **LO:** To group materials into solids, liquids and gases.. **Enquiry type:** Grouping and classifying	**Sticky Knowledge:** In a solid state, the particles are packed closely together and in a pattern. A solid object holds it shape. In a liquid state, the particles are close together but can move over each other. A liquid can be poured and will fill the shape of the container. In a gas state, the particles are spread out and move in all directions. A gas would escape and fill a space. **Skill:** Reporting on findings from enquiries, using relevant scientific language, including oral and written explanations, displays or presentations of results and conclusions.	Recap on properties of solids, liquids and gases. Various images as a class sort and group. Discuss reasoning behind it. Match statements for each one. Compare and group materials according to whether they are S/L/G. Sort into categories. Question if children are correct? Include shaving foam. What is this? Discuss that we have a solid container with a liquid and gas inside. Do any solids have properties of a liquid? (sugar can be poured) why does this happen? (addressing misconceptions) LA/ARE Sorting images and molecules and explaining why. GD – Identifying own examples for solids, gases and liquids. Answer questions- What solid also has a property of a liquid (for example)
Lesson 3 **LO:** To know that some materials change state when heated or cooled. **Enquiry type:** Comparative/fair test.	**Sticky Knowledge:** The temperature at which water turns to ice is called the freezing point. This happens at 0^{o}C. The temperature at which water turns to steam is called the boiling point. This happens at 100^{o}C.	Recap on examples we have found for solids, liquids and gases. STEM – What stuff does? Clips to be used are ice trail, melting moments and all change. https://www.stem.org.uk/resources/elibrary/resource/30642/what-stuff-does Children to predict first then adult to demonstrate what happens when solids are heated, liquids heated, liquids cooled and gases cooled.

	Skill: Taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.	https://www.stem.org.uk/resources/elibrary/resource/315591/what-temperature-does-chocolate-melt STEM experiment - At what temperature does chocolate melt? To be completed in mixed ability groupings. (Pizza box experiment – use silver foil inside a pizza box in the sun to melt chocolate. Chocolate may need to be thin pieces/small shavings; weather dependent) Children to predict. What will it make the investigation fair? As a class discuss the variables. What equipment will we need? Results to be collected at specific intervals to record during the lesson. Children to decide on times. _. All abilities - I predict ____ because _____ Results recorded on a table template. Use thermometers. Conclusion LA I found _____. I know because ____. ARE – What results have shown. Reasons given. GD - What results have shown, explanations.
Lesson 4 **LO:** To know that materials can change state at different temperatures **Enquiry type:** Comparative/fair test.	**Sticky Knowledge:** The temperature at which water turns to ice is called the freezing point. This happens at 0ºC. The temperature at which water turns to steam is called the boiling point. This happens at 100ºC. **Skill:** Taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.	Follow on from chocolate investigation. Will this temperature be the same for all materials? Discuss we are going to investigate temperatures for changing state. Solids – butter, cheese, jelly, ice, chocolate. Measure temperature of water in bowls (silicone cake cases containing butter, cheese, chocolate, jelly, ice) measure temperature, observe if changes state. Move unmelted materials to the next bowl (warm water), repeat. Children to predict. What will it make the investigation fair? Same temperature for each solid. Length of time. As a class discuss the variables. What equipment will we need? Selection of thermometers to use. Results to be collected at specific intervals to record during the lesson. Children to decide on variables and complete post-it note planners – pictures to record instead of writing in books. Extension: Research the temperatures that other materials melt at. Enquiry question – Why did the cheese not melt?
Lesson 5 **LO:** To understand the water cycle. **Enquiry type:** Research	**Sticky Knowledge:** The main stages of the water cycle are evaporation, condensation, precipitation and collection. The stages of the water cycle work together in a continuous process of recycling Earth's water supply. **Skill:** Asking relevant questions and using different types of scientific enquiries to answer them.	Introduction - What makes rain? Where do the puddles go? What are clouds? Discuss in class what the children think. https://www.youtube.com/watch?v=TWb4KIM2vts (water cycle song) https://www.bbc.co.uk/bitesize/topics/z6p6qp3/articles/z3wpp39 STEM – What stuff does? – Rainy days clip | STEM Definition of the water cycle. Children act out the cycle. Key vocabulary given for independent activity LA/ARE Label diagram with explanations of each process.

		GD – label diagram with explanations of each process. Examples Extension – water cycle wheel
Lesson 6 **LO:** To know that temperature has an effect on the rate of evaporation. **Enquiry type:** Observation	**Sticky Knowledge:** The main stages of the water cycle are evaporation, condensation, precipitation and collection. The stages of the water cycle work together in a continuous process of recycling Earth's water supply. **Skill:** Asking relevant questions and using different types of scientific enquiries to answer them.	Recap on previous learning about water cycle, using their labelled diagram. STEM https://www.stem.org.uk/resources/elibrary/resource/460434/water-cycle What might speed up the rate of evaporation? Discuss as a class. Have selection of wet towels. What happens to the water when the towel dries? Where does the water go? How can we dry them? Will the temperature make a difference as to how fast they dry/ water evaporates? How can we find out? Discuss as a class. Children to decide where to place the towels to see which will dry first. Classroom, outside, outdoor classroom with roof etc. Children to predict. What will it make the investigation fair? As a class discuss the variables. Results to be collected at specific intervals to record during the day. Children to decide on times. . All abilities (SEN scribed if needed) - I predict ____ because _____ Results recorded during the day on a table Conclusion LA/ARE___. What results have shown. Reasons given. GD - What results have shown, explanations and rate an example for real life.

Working towards	**End of unit assessment** Working at Age related expectations	Working at a greater depth