# States of Matter and the Water Cycle (Chemistry)

## Year 4

**End Points:**

- There are three main states of matter: solids, liquids and gases.
- Water exists in all these states of matter in nature.
- Water can change into each state in both directions – we call this the Water Cycle.
- Water evaporates from all water sources (e.g. puddles, lakes, oceans).
- When water evaporates, it becomes water vapour.
- The amount of water in the air is called humidity.
- Condensation is when water vapour turns back into liquid.
- High in the sky, the air is cooler and turns vapour back into water droplets.
- There is always water vapour in the air and the temperature changes its appearance.
- Clouds are formed of millions of water droplets and their shape, size and colour can tell us what weather will be like.
- When water droplets get large enough, often in dark cumulonimbus or nimbostratus clouds, they precipitate and fall as rain, sleet, hail or snow.
- Precipitation returns water to the surface of the earth as part of the water cycle.

This unit builds on understanding from Year 1 Seasons and Weather and also from Materials and Matter in Year 2. Previously children have learned about the weather and clouds in Year 1. They learned about cumulus, cirrus and stratus clouds. In Year 2, they began to learn about solids and liquids and how they behave.

In this unit, children will learn about the main parts of the Water Cycle including evaporation, condensation, precipitation and collection. They will learn about each part in detail before piecing them all together to complete the cycle. This approach will support their vocabulary development over time, focussing in on each scientific process before stepping back and seeing the cycle as a whole.

Later, in Year 5, children will build on the substantive knowledge from this unit and will deepen their understanding of meteorology: the study of the weather. They will focus on weather, climate, atmosphere and forecasting before exploring how climate effects people's lives later in the curriculum in Geography when studying Africa and British Geographical Issues.

Within this unit, pupils first reconnect to their prior learning about states of matter. Using the example of water, they consider its different forms, as a solid, liquid and gas. They will learn that When you boil water in a kettle, it turns to a gas called steam, which is invisible. When steam moves away from the kettle where it had reached boiling point, it condenses into water vapour, which we can see. They will work scientifically to monitor the temperature of melting ice.

Later in the unit, children focus upon another process within the water cycle, condensation. They will learn this is the reverse of evaporation. Condensation

occurs when water vapour within the air changes state, it cools and becomes liquid, water. Within a cloud, water droplets become too large for the cloud to hold and gravity brings the water back down to the surface of the earth as precipitation, often this takes the form of rain. This builds on understanding of gravity from Year 3, Forces and Magnets. They will work scientifically to observe condensation appearing on the side of a cold drink can.

After learning about evaporation and condensation, children will learn about precipitation. They will learn about clouds, building on knowledge from Year 1 and will learn that certain types of cloud bring rainfall. In Lesson 5 children will piece together all of their understanding and look at the water cycle as a whole. They will learn that collection is a part of the cycle, and will learn that water collects in rivers, lakes, in areas of vegetation and also seeps into the ground through soil and permeable rock (drawing upon knowledge from Year 3 Rocks).

Finally, children are expected to plan and complete a piece of extended writing (essay) explaining how water changes state within the water cycle. This task requires children to show their understanding of the processes that occur within the water cycle and how water changes state.

**Lesson Sequencing:**

In lesson one, pupils will learn that there are three main states of matter and will be introduced to the fact that water forms each of these states during the water cycle. This will be built upon in lesson two, where pupils will learn that evaporation turns water into water vapour. In lesson three, pupils will learn that condensation occurs when water vapour turns back into a liquid and the role clouds play in the water cycle. Lesson four will explain to pupils that water falls back to Earth in the form of precipitation. Using everything they have learnt so far, pupils will then look at each of these stages as part of the water cycle. In the assessment lesson, pupils will explain how water changes throughout the water cycle.

**Misconceptions:**

- Confusing steam and water vapour
- Solid is another word for hard
- Solids are hard and cannot break, change shape easily and are usually in one piece
- Water in its different forms (i.e. ice, water, vapour) is different substances
- Particles in liquids are further apart than in solids and they take up more space
- Clouds are made of water vapour
- The changing states of water are irreversible
- Melting is the same as dissolving
- Evaporating water makes it disappear
- The substance on a can of drink is condensation rather than water.

**Working Scientifically criteria met in this unit:**

- Asking relevant questions and using different types of scientific enquiries to answer them
- Setting up simple practical enquiries, comparative and fair tests

- Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- Identifying differences, similarities or changes related to simple scientific ideas and processes
- Using straightforward scientific evidence to answer questions or to support their findings.