

Materials and Their Processes

Changes of State and The Water Cycle

Year 4

The Big Questions

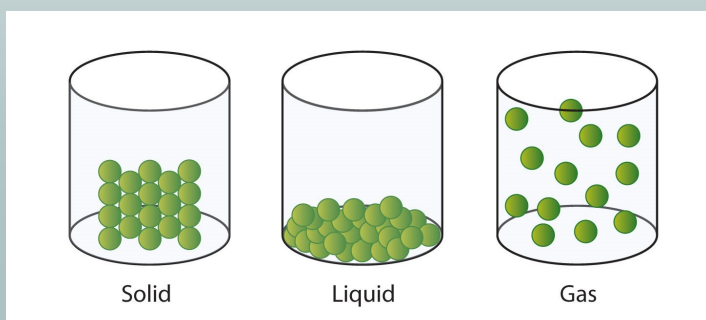
If sand can be poured from a bucket, is it a solid?

Are all solids hard?

Where does a puddle go?

Core Knowledge

- There are three states of matter: **solid, liquid, gas**.
- The **particles** in a solid are close together and cannot move and only vibrate gently.
- The particles in a liquid are close together but move around each other easily.
- The particles in a gas are spread out and move around very quickly in all directions.



(https://saylordotorg.github.io/text_the-basics-of-general-organic-and-biological-chemistry/s11-02-solids-and-liquids.html)

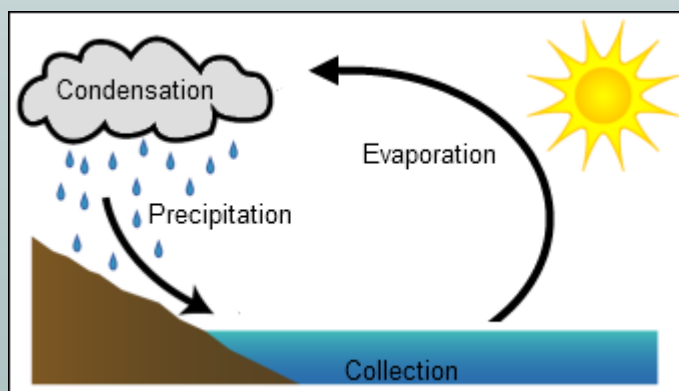
- States of matter can change for example, when most liquids including water reach a certain temperature, they change state into a solid or a gas.
- The temperatures that cause changes in state are called the **boiling, melting or freezing points**.
- When a solid is heated to its melting point, the particles start to move faster and faster until they are moving around over and under each other and the solid has changed to a liquid.
- Freezing occurs when a liquid is cooled so that the particles in the liquid begin to slow down as they get colder and colder. They will eventually only be able to move gently on the spot, giving them a solid structure.

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Core Knowledge

- **Evaporation** occurs when water turns into water vapour. This process can happen slowly over time for example a puddle evaporating in the warm air or very fast like when water is heated in a kettle.
- **Condensation** occurs when water vapour is cooled down and turns into water. You can see this when droplets of water form on a window or other cool surface.
- Condensation and evaporation are both processes within the **water cycle**.



(<https://www.thinglink.com/scene/767790185701179393>)

- 1) Water from lakes, puddles, rivers and seas is evaporated in the sun's heat, becoming water vapour.
 - 2) The water vapour rises, then cools down as it rises to cooler temperatures. This cooling down process (condensation) forms water droplets in clouds.
 - 3) When the water droplets get too heavy, they fall back to the earth as rain, sleet, hail or snow and this is known as **precipitation**.
- Many changes of state like: evaporation, melting and freezing are **reversible** and you can get the materials back to the state they started in, for example: if you melt an ice cube from a solid into a liquid (water) you can freeze it again to make another ice cube (solid).
 - Some changes in state, like heating to the point of burning, can cause **irreversible** changes, which means you won't be able to get the materials involved back to their original state. For example if you make a piece of bread into toast, you won't be able to change it back into bread.

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Key vocabulary

solid— state of matter in which the particles are close together and cannot move around;

solids keep their shape unless a force is applied to them

liquid—state of matter in which the particles can slip and slid over and around each other;

liquids will take the shape of the container they are in and can be poured

gas—state of matter in which the particles can move freely; gases do not have a fixed shape and their particles will spread out to fill a container or room

boiling point—the temperature at which a liquid will turn into a gas

melting point—the temperature at which a solid will turn into a liquid

freezing point—the temperature at which a liquid will turn into a solid

evaporation—the process where a liquid turns into a gas

condensation—the process where a gas becomes a liquid by losing heat.

precipitation— the process of liquid or solid particles falling from a cloud as rain, sleet, hail or snow.

water vapour—the gas form of water that occurs when water boils

water cycle—the path that water follows as it moves across the earth in different states

reversible—a change that can be undone

irreversible—a change that is permanent and cannot be undone

As scientists we will

- 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.
- demonstrate that some 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
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic

