

Fact sheet: the water cycle

Materials are transported around the Earth in enormous cycles, driven by the Sun, gravity and life itself. Alongside the carbon cycle, nitrogen cycle and rock cycle, the water cycle contributes to the ever-changing face of our planet.

Without the **water cycle**, we wouldn't have water to drink, food to eat or materials to build our homes. The water cycle describes the movement of 500 trillion tonnes of water around the Earth every year. Water on Earth is present as all three **states of matter** – **solid**, **liquid** and **gas** – and is continually going through physical state changes including **evaporation**, **condensation**, **freezing** and **melting**.

Did you know ...?

There are about 1.4 billion cubic kilometres of water on Earth, mostly found as a **liquid** in the **oceans** and other **bodies of water** (98.2%).

Processes in the water cycle

- **Evaporation** – the **Earth's surface** absorbs energy from the **Sun**, causing an increase in the rate of evaporation of surface water forming **water vapour**.
- **Condensation** – as the warm moist air rises through the cooler denser air above, the **water vapour** condenses, forming tiny water droplets which eventually form **clouds**.
- **Precipitation** – when the water droplets are large enough, they fall back to the **Earth's surface** as **rain**, **sleet** or **snow**.
- **Runoff** – some of the water will run over the **Earth's surface**, via **streams** and **ivers**, back to the **sea**.
- **Percolation** – some water will travel through the **soil** and **rocks**. It can remain as **groundwater**, transport back to the **oceans**, or be absorbed by **plants**.
- **Transpiration** – water is absorbed by **plants** via their roots and can be released as **water vapour** via their leaves, adding to the water vapour directly evaporating from the **oceans**.

Did you know ...?

Solid water can be found on Earth as **ice** and **snow**, mainly at the planet's poles and at the top of mountains.

Evaporation and condensation

These processes can be seen in our everyday lives and are essential processes in the manufacture of everyday products.

Anywhere in the home where we use hot water, evaporation rates are high and there is lots of **steam**. Boiling pasta increases the concentration of **water vapour** in the kitchen. If we don't use a good extractor fan or open the windows wide, the water

vapour will **condense** on cool surfaces, especially windows and we end up with droplets of **liquid water**.

If you want to make petrol from crude oil, alcoholic spirits from brewed liquids or flavourings for foods and perfumes, you need to use **distillation**. By collecting the evaporated components of a heated mixture, you can condense them back to liquids to separate **fractions** of the whole – we call this **fractional distillation**. Last year, some £30 billion worth of perfume was sold worldwide and chemists are at the centre of the whole development and production process.

Did you know ...?

Water also transfers into the Earth's mantle when tectonic plates get pushed under each other. This water will eventually re-emerge when **volcanoes** erupt!

Runoff and precipitation

Water flowing over and through rocks changes the face of the planet and provides spectacular sights. Over millions of years, the Colorado river has been carving a path through Arizona, USA, forming the Grand Canyon – a channel up to 29 kilometres wide and in places over 1800 metres deep. Water **percolating** through the rocks of the Peak District dissolves **positive and negative ions** out of the rocks. The water is collected, bottled and sold as Buxton Spring Water.