INFOGRAPHHUB SERIES · 8 PARTS · AGES 11–16

The Water Cycle

Eight infographics that follow water from the sea to the sky and back again.

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Each part is one printable infographic. Work through them in order, or use the part you need. The quiz answers are printed upside down at the foot of the quiz. Sources for every part are listed on its page at infographhub.com.

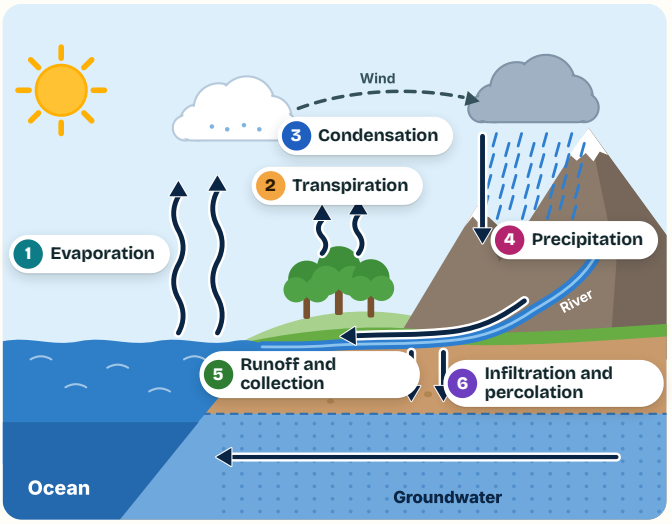
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THE WATER CYCLE · PART 1 OF 8 · AGES 11–16

The Water Cycle Explained

Powered by the Sun and pulled by gravity, water moves endlessly between the sea, the sky and the land.



1 Evaporation

The Sun heats oceans, lakes and rivers, turning liquid water into invisible water vapour. Oceans supply most of it.

2 Transpiration

Plants take up water through their roots and release vapour through tiny leaf pores called stomata.

3 Condensation

Rising vapour cools and condenses into tiny droplets around specks of dust or salt, forming clouds.

4 Precipitation

Droplets join and grow until they are too heavy to float, then fall as rain, snow or hail.

5 Runoff and collection

Water flows over the land into streams, rivers and lakes, and finally back to the sea.

6 Infiltration and percolation

Some water soaks into the soil and trickles down to become groundwater that feeds wells and springs.

Flying rivers over the Amazon

Winds carry Atlantic moisture west over the Amazon rainforest. Trees return rain to the air by transpiration, so it can fall again and again. Near the Andes, up to about 60% of the moisture in the air comes from the forest.

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2. Earth's Water by the Numbers

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THE WATER CYCLE · PART 2 OF 8 · AGES 11–16

Earth's Water by the Numbers

Where all of Earth's water is stored, and how long a single drop stays in each place before it moves on.

2.5%

of all the water on Earth is fresh water

The other 97.5% is salty: in the oceans, in salt lakes and deep underground.

96.5%

of Earth's water is in the oceans, seas and bays

About 1,338 million km³ of salty water, by far the biggest store in the water cycle.

68.7%

of Earth's fresh water is frozen in ice caps, glaciers and permanent snow

About 24 million km³ of ice, mostly in Antarctica and Greenland.

30.1%

of Earth's fresh water is groundwater, hidden underground

It fills cracks and spaces in soil and rock. Wells and springs draw on this store.

0.007%

of Earth's water is in freshwater lakes and rivers

About 1/150 of 1%, yet rivers and lakes supply most of the water people use every day.

~9 days

is how long a water molecule stays in the air, on average

Then it falls back as rain or snow. The range is about 5 to 15 days.

3,000+ years

is how long water typically stays in the oceans

The average residence time in oceans and inland seas is 3,000 to 3,500 years.

200,000 years

is how long water can stay locked in an ice cap

Ice caps hold water for 10,000 to 200,000 years. Deep groundwater can stay put for 3,000 to 10,000 years.

Small store, fast flow

The air holds only about 0.001% of Earth's water, yet it is the cycle's busiest route. Each molecule stays about nine days, so the air is emptied and refilled again and again, while ocean water can wait thousands of years.

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3. How Clouds Form

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THE WATER CYCLE · PART 3 OF 8 · AGES 11–16

How Clouds Form

Six steps that turn invisible water vapour into a cloud you can see, and then into rain or snow.

1

Warm, moist air rises

Air near the surface carries water vapour, an invisible gas. When something lifts this air, such as the Sun heating the ground or wind meeting a mountain, it starts to rise.

2

It expands and cools

Air pressure is lower higher up, so the rising air spreads out. Expanding air cools, by about 9.8 °C for every kilometre it climbs.

3

It reaches the dew point

The dew point is the temperature at which air becomes saturated: it holds all the water vapour it can. If the air cools any further, some vapour has to condense.

4

Vapour condenses on tiny specks

Vapour needs a surface to condense on. Microscopic specks of dust, sea salt and smoke, called condensation nuclei, give it one. Each speck becomes the core of a droplet.

5

Countless droplets make a cloud

Each droplet is only about a hundredth of a millimetre across, so light that it stays up. Together they make a visible cloud. In very cold air, clouds are made of ice crystals.

6

Droplets grow until they fall

Droplets collide and merge, or ice crystals grow by taking vapour from droplets. When they are too heavy for the rising air to hold up, they fall as rain or snow.

What makes air rise?

The Sun heats the ground and warm air rises (convection). Wind blowing into hills or mountains is forced up (relief). At weather fronts, warm air slides up over cold air. Where winds from different directions meet, air is pushed upwards.

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4. Types of Precipitation

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THE WATER CYCLE · PART 4 OF 8 · AGES 11–16

Types of Precipitation

Eight ways water falls from the sky, using the official definitions meteorologists use around the world.

Rain

Drops of liquid water falling from a cloud. Raindrops are bigger than drizzle drops. The biggest, over about 4.5 mm, flatten into a parachute shape and break apart.

Drizzle

Very fine drops, usually under 0.5 mm across, falling close together from low, grey stratus cloud. They are so light they seem to float.

Snow

Ice crystals falling from a cloud, alone or stuck together as snowflakes. It reaches the ground as snow when the air stays at or below 0 °C all the way down.

Sleet

A word with two meanings. In the UK it means rain and snow falling together, or partly melted snow. In the US it means ice pellets.

Ice pellets

Small, clear balls of ice under 5 mm across. Snow partly melts in a warm layer of air, then refreezes in a deep freezing layer below. They bounce when they land.

Freezing rain

Rain that is colder than 0 °C but still liquid. It freezes the moment it hits roads, trees or power lines, coating them in clear, heavy ice called glaze.

Hail

Lumps of ice, generally 5 to 50 mm across, from thunderstorms. Strong updrafts lift drops into freezing air, and more water freezes onto them until they are too heavy.

Graupel (snow pellets)

Soft, white pellets up to about 5 mm across. They form when ice crystals collect cloud droplets that freeze onto them. They break up easily when they land.

Same snow, different landing

Winter precipitation usually starts as snow. Cold air all the way down gives snow. Partly melting then refreezing gives ice pellets. Melting completely then hitting a thin freezing layer at the ground gives freezing rain.

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5. Water Cycle Key Terms

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THE WATER CYCLE · PART 5 OF 8 · AGES 11–16

Water Cycle Key Terms

The words you need to describe the water cycle precisely, each with a one-line definition.

Changes of state

Evaporation	Liquid water changing into water vapour, an invisible gas. Heat, mostly from the Sun, drives evaporation from oceans, lakes, rivers and soil.
Condensation	Water vapour changing back into liquid water as it cools. It forms cloud droplets, fog, dew and the mist on a cold window.
Freezing	Liquid water changing into solid ice. Pure water freezes at 0 °C, but tiny cloud droplets can stay liquid (supercooled) far below that.
Melting	Solid ice or snow changing into liquid water as it warms above 0 °C. Spring snowmelt feeds rivers, lakes and groundwater.
Sublimation	Ice or snow turning straight into water vapour without melting first. A wet shirt left out on a freezing day slowly dries this way.
Deposition	Water vapour turning straight into ice without becoming liquid first. Frost and snowflakes form this way.

Water on the move

Transpiration	Plants releasing water vapour from tiny pores in their leaves, called stomata, after drawing water up from the soil through their roots.
Precipitation	Water falling from clouds as rain, drizzle, snow, sleet or hail, once droplets or ice crystals grow too heavy to stay up.
Advection	Water vapour or clouds being carried sideways by the wind, such as moist air moving from over the ocean to over the land.
Surface runoff	Rain or meltwater that flows over the land surface into the nearest stream or river instead of soaking into the ground.
Infiltration	Water soaking downwards from the land surface into the soil.
Percolation	Water moving further down through the tiny gaps in soil and rock until it reaches the saturated zone, refilling groundwater.

Where water is stored

Store (pool or reservoir)	Any place that holds water for a time, such as the ocean, an ice sheet, a lake or groundwater. In everyday use, a reservoir is a lake made by a dam.
Groundwater	Water stored underground in cracks in rock and in the spaces between grains of sand, soil and gravel. It can be fresh or salty.
Aquifer	An underground layer of rock, sand or gravel that holds enough water, and lets it flow easily enough, to supply wells and springs.
Water table	The top of the saturated zone underground. Below it, all the spaces in the soil and rock are filled with water.
Glacier and ice sheet	A glacier is a mass of ice formed from years of packed-down snow that flows slowly downhill. An ice sheet is a glacier covering over 50,000 km².
Residence time	The average time a water molecule stays in one store: about nine days in the air, but thousands of years in the ocean or deep underground.

Learn them in pairs

Each change of state has an opposite: evaporation and condensation, melting and freezing, sublimation and deposition. The first of each pair takes in heat; the second gives it out.

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6. The Water Cycle in Everyday Life

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THE WATER CYCLE · PART 6 OF 8 · AGES 11–16

The Water Cycle in Everyday Life

You do not need a rain cloud to see the water cycle. Its processes happen every day in kitchens, gardens and car parks.

Washing drying on a line

Evaporation. Water in the clothes escapes into the air as invisible vapour. It is fastest on warm, dry, windy days, but frozen washing still dries slowly as ice turns to vapour.

Sweating to cool down

Evaporation takes heat. As sweat evaporates from your skin, it carries heat away. In very humid air less sweat evaporates, so you feel hotter.

A cold glass 'sweating'

Condensation. Invisible water vapour in the air touches the cold glass, cools and turns back into liquid droplets. The water comes from the air, not through the glass.

Misty glasses and car windows

Condensation. Step from a cool room into warm, humid air and your lenses fog up. In a car, moist breath condenses on the cold windows.

The white cloud above a kettle

Condensation. Boiling water makes invisible vapour. When it meets cooler air it condenses into tiny droplets, and those droplets are the white 'steam' you see.

Dew on the grass at dawn

Condensation. At night grass and leaves cool down. When they reach the dew point, water vapour in the air next to them condenses into drops of dew.

Frost on a car windscreen

Deposition. On a surface below 0 °C, water vapour can turn straight into ice crystals without becoming liquid first. The feathery white layer is frost.

Rain soaking into a lawn

Infiltration. Rain soaks into grass and soil, quickest in sandy soil. On roads and car parks it cannot soak in, so it runs off into drains instead.

Try it: catch a plant's water

Tie a clear plastic bag over a leafy branch of a plant in sunlight. Within about an hour, mist and droplets can appear inside. That is transpiration: vapour from the leaves condensing on the bag.

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7. Water Cycle Myths and the Real Science

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THE WATER CYCLE · PART 7 OF 8 · AGES 11–16

Water Cycle Myths

Eight things many people believe about water, and what scientists have found instead.

MYTH **Clouds are made of water vapour.** 1

FACT Water vapour is an invisible gas. A cloud is a mass of tiny liquid droplets or ice crystals that formed when vapour cooled and condensed onto specks of dust, salt or smoke.

MYTH **The white 'steam' above a boiling kettle is water vapour.** 2

FACT The white plume is made of tiny liquid droplets. The vapour leaving the kettle is invisible; you only see it once it cools in the room and condenses.

MYTH **Water only evaporates when it boils.** 3

FACT Water evaporates at any temperature, just more slowly when it is cold. Puddles dry on cool days, and even frozen washing slowly dries as ice turns to vapour.

MYTH **Groundwater is stored in huge underground lakes and rivers.** 4

FACT Most groundwater fills the tiny pores, cracks and spaces between grains of rock, sand and soil, like the water that seeps into a hole dug in beach sand.

MYTH **The water cycle is a neat circle that every drop follows in order.** 5

FACT Water takes many paths: it can fall straight back into the sea, soak underground or freeze into ice. It stays about 9 days in the air but around 3,200 years in the ocean.

MYTH **Raindrops are shaped like teardrops.** 6

FACT Small drops are nearly round. Drops of 2–3 mm are flattened underneath, like the top of a hamburger bun. Drops over about 4.5 mm become parachute-shaped and break apart.

MYTH **Dew falls from the sky at night, like a very light rain.** 7

FACT Dew forms where you find it. At night grass, leaves and cars cool down, and when they reach the dew point, water vapour in the air touching them condenses into drops.

MYTH **One day we will use up all of Earth's water.** 8

FACT The water cycle keeps recycling water. The real risk is running short of fresh water in one place: only about 2.5% of Earth's water is fresh, and over-pumped wells can run dry.

If you can see it, it is not vapour

Water vapour is a gas and is always invisible. Clouds, fog and the white plume from a kettle are all made of tiny liquid droplets or ice crystals that formed when vapour cooled.

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8. Water Cycle Quiz: Test Yourself

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THE WATER CYCLE · PART 8 OF 8 · AGES 11–16

Water Cycle Quiz

Ten questions on the whole series. Answer them all, then turn the page round to check.

1 Which process turns liquid water into invisible water vapour?

- A Condensation
- B Evaporation
- C Precipitation
- D Infiltration

2 Plants release water vapour through tiny pores in their leaves. What is this process called?

- A Transpiration
- B Percolation
- C Runoff
- D Deposition

3 Roughly what share of all Earth's water is in the oceans?

- A About 2.5%
- B About 30%
- C About 71%
- D About 96.5%

4 On average, how long does a water molecule stay in the atmosphere?

- A About 9 hours
- B About 9 days
- C About 9 years
- D About 3,000 years

5 Rising air cools. What does its water vapour need to condense on to form cloud droplets?

- A Lightning
- B Tiny particles such as dust, salt or smoke
- C Strong wind
- D Direct sunlight

6 Which type of precipitation grows bigger as rising air keeps it inside a thunderstorm cloud?

- A Drizzle
- B Snow
- C Hail
- D Dew

7 Frost forms when water vapour turns straight into ice. What is this change called?

- A Sublimation
- B Deposition
- C Condensation
- D Melting

8 The white cloud above a boiling kettle is often called steam. What is it really made of?

.....

9 Rain falls on a sandy field and on a car park. Where does more water soak into the ground, and what is that process called?

.....

10 True or false: raindrops are shaped like teardrops. Explain your answer.

.....

ANSWERS

1. B: Evaporation
2. A: Transpiration (the pores are called stomata)
3. D: About 96.5% (71% is how much of Earth's surface is covered by water)
4. B: About 9 days
5. B: Tiny particles such as dust, salt or smoke (cloud condensation nuclei)
6. C: Hail
7. B: Deposition (sublimation is the reverse: ice to vapour)
8. Tiny liquid water droplets. Water vapour is invisible; it condenses into droplets when it meets cooler air.
9. The sandy field. Soaking in is infiltration; on the car park most rain becomes surface runoff.
10. False. Small drops are nearly round; bigger ones are flattened underneath like a burger bun, and the largest break up.

SERIES COMPLETE

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