

# Stage 4 Geography WATER IN THE WORLD

Week 8

# **The Water Cycle**

You drink water every day, but have you ever asked how old the water is? The Earth always has the same amount of water and it moves through a cycle. The water in your cup today could have been the same water a dinosaur once took a bath in! The water cycle is important to life on Earth, but it is important to know that without the Sun there would be no water cycle.

#### There are four stages of the water cycle.

#### Accumulation

The first stage of the water cycle is water accumulation. Water accumulation is water that is stored in rivers, lakes, and oceans. Oceans are the largest water accumulations because they hold 97 percent of the Earth's water. Accumulation can also be groundwater, which is water that goes into the Earth's surface, and is absorbed by roots to help plants grow.

#### **Evaporation**

As the Sun shines on accumulated water, the water heats up and turns into water vapour. Water vapour is a gas, so it rises into the air. When the Sun changes water from a liquid to a gas, the process is called evaporation.

evaporated Water can be from plants. This is called transpiration. You can see finding by evaporation α puddle near your home after a rainstorm. As time passes, you will see that the puddle gets smaller. This is because the water is evaporating.



#### Condensation

When water vapour is in the air, it cools. As it cools, the water vapour forms back into a liquid. Groups of water droplets come together to form clouds. When water changes from a gas (water vapour) to a liquid, this process is called condensation.

Even if there are no clouds in the sky, there is still water in the air. Clouds are not the only place to see condensation. On a hot day, you may take a cold glass of water outside. After some time, you feel that the outside of your cup is wet. Is the cup leaking? No, it is actually water vapour condensing when it cools on the side of your cup.

#### Precipitation

As more water condenses in the air, it becomes heavy. The water will fall back to Earth as rain, hail, sleet, or snow, which is called precipitation.

When the water falls back to Earth, it gives water to plants and animals. Some water that does not go into the soil will run-off, which is when gravity pushes water to larger accumulations. The water cycle is now complete and ready to repeat again.

#### Questions

- 1. Does the amount of water on Earth change? Explain your answer.
- 2. List the four stages of the water cycle.
  - 1.
  - 2.
  - 3.
  - 4.
- 3. Describe an example of evaporation you might see at home.

- 4. What happens after water vapour is in the air?
- 5. How does the Sun help the water cycle?
- 6. Explain precipitation in your own words.
- 7. Find and copy a phrase that tells you the Sun is important to the water cycle.
- 8. What role do oceans play in the water cycle? Explain your answer using evidence from the text.

# The uneven distribution of water

Due to the unpredictability of water cycle flows and storages, the distribution of water over Earth's surface is not uniform.

### Types, availability and potential

Salt water is a common resource because seas and oceans contain 96.5% of Earth's water. Saline groundwater contains 0.93% and saline lakes 0.07%. Altogether, 97.5% of Earth's water resources are salt water. In contrast, fresh water, which has a **salinity** of less than 1% of the oceans, is a scarce and valuable resource. It comprises a tiny 2.5% of Earth's water (3.3.1).

#### Distribution

Fresh water is unevenly distributed across the globe and is in high demand by over 7 billion people on Earth.

Distribution of water depends on climate (precipitation) and geology (groundwater). Climatic patterns dictate the movement and amount of precipitation and where and when it falls. About 68.7% of Earth's fresh water is found in the glaciers and ice caps of Antarctica and Greenland. The North and South poles contain 96% of Earth's frozen fresh water. These resources are located in remote, largely uninhabited places, which are difficult and expensive to access.

Groundwater is the most abundant and accessible liquid freshwater resource. It represents 90% of Earth's readily available fresh water. About 22% of people rely on groundwater for their drinking water.

## **i** Geoinfo

The Plateau of Tibet, including the Hindu Kush-Himalayan region, is called the 'Third Pole'. It stores more snow and ice than anywhere else on Earth except the polar regions.





3.3.1 Distribution of Earth's water by type

#### Abundance and scarcity

Regions with water surplus or abundance include the Amazon and Orinoco river basins in South America (15% of global runoff), South and South-East Asia (18% of global runoff), Canada (10% of the world's river water), Siberia (with 5% of the world's fresh water in the Yenisey River basin alone) and New Guinea (the Fly and Sepik river basins). Water deficit or scarcity regions



3.3.2 Distribution of water storages around the world

include deserts, such as the Sahara in Africa and the Atacama in South America.

There are regional variations in the global distribution of water. Asia has a water surplus but deserts exist in the centre of the continent. North America has abundant freshwater resources, yet the state of Texas suffers from water scarcity. About 70% of Australia is arid or semi-arid and 25% of our limited renewable freshwater resources are located in the sparsely inhabited Cape York Peninsula.



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#### The uneven distribution of water

- 1. Outline the three types of salt water on Earth.
- 2. What percentage of Earth's water is fresh?
- 3. Explain why fresh water is a scarce and valuable resource.

4. What percentage of Earth's water is in glaciers? Why is this described as being 'locked away'?

- 5. How much of Earth's surface water is located in freshwater lakes and rivers?
- 6. Explain why groundwater is an important resource.

# **Potential water resources**

Water occurs in three main forms or states: liquid, solid and gas. Water in all its forms is responsible for creating most of Earth's landforms—rivers eroding mountains and ocean waves eroding coastal cliffs—as well as hydrological hazards, such as cyclones and avalanches.

#### Liquid water

Most of Earth's surface is covered with interconnected oceans and seas, making the planet blue from space. Liquid water occurs on the surface of the land in streams, rivers, wetlands and lakes. Humans have built structures such as dams, reservoirs and canals to manipulate water resources and store water for their needs. During floods, surface water breaks out of river channels and spreads over the surrounding area. While liquid water is the most visible form of water over much of the land surface, it also occurs underground. Groundwater is especially important in areas with limited surface water. However, 54% of groundwater is saline and unsuitable for drinking. Groundwater interconnects with surface water by flowing into oases, streams, rivers, lakes and the sea.

#### Potential: desalination of seawater

In 2011 South Africa's biggest seawater desalination plant opened in the seaside town of Mossel Bay. Will this facility ensure future water security and economic growth?



#### **Solid water**

When water freezes, at 0°C, it forms snow, hail, frost and ice. This form of water is common in winter in cold climates (e.g. Siberia), high mountains (e.g. Mt Everest) and polar regions (e.g. the Arctic). Antarctica and Greenland have enormous continental glaciers or ice caps. Arctic ice floats on top of the ocean and shrinks and expands with the seasons. The extent and thickness of Arctic ice has recently reduced as a result of **climate change**. Regions in high latitudes sometimes have permanent snow cover and permafrost. Some high mountainous areas have valley glaciers but many of these have been shrinking in recent decades.

#### **Potential: towing icebergs**

There are 1.1 billion people in the world without clean drinking water. Meanwhile, billions of gallons of fresh water disappear uselessly into the ocean, the result of icebergs that break off from the ice caps of Greenland and Antarctica and melt into the salty mix.

French engineer Georges Mougin has invented a system for towing icebergs across the ocean and straight to the world's thirsty. Using satellite data, Mougin created a method for hauling icebergs using a 'skirt' and a tugboat.

So, why aren't icebergs being towed to where their water can be used by humans? Discuss the environmental damage that large-scale iceberg transportation could cause, at both ends of the journey.



#### **Gaseous water**

When water reaches 100°C, it boils and changes into gas. Water vapour or steam is a small but environmentally significant component of the atmosphere. More than 99% of water vapour is found in the lowest layer in the atmosphere called the troposphere. It forms clouds, mist and fog. The percentage of water vapour in surface air varies throughout the world—in deserts it is almost negligible, while it can be around 10% over oceans.

#### **Potential: geothermal water**

Geothermal water at Paradise Springs, Idaho, USA, is bottled as drinking water and sold commercially throughout the USA. Will geothermal energy replace energy sourced from fossil fuels?

## Geo**info**

The average amount of water vapour in the atmosphere would cover Earth's surface with a 2.5 cm thick layer of liquid water.

#### **Potential water resources**

- 1. What are the three main forms of water?
- 2. Explain the role of water in creating landforms.

3. Why could groundwater be called an invisible resource?

4. Which parts of the world have solid water?

5. Discuss the potential use of water.

## Water in the World

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cyclones	drought	evaporation
flood	groundwater	hail
hailstorm	horticulture	irrigation
isobars	meteorologist	permafrost
precipitation	rain	scarcity
snow	soak	sparse
storm	troposphere	