Evaporation and the water cycle

L1 State changes

When we heat **particles** they move **faster**. This is because the energy in their **kinetic store** increases. As they move more the particles begin to separate. This increases the substances **volume** and it **expands**.

Particles are held together by **attractive forces**. To change state from a solid to a liquid you need to increase the **kinetic energy** store of the particles enough to allow the particles to weaken those bonds. To increase the kinetic energy store of particles you need to heat them. This is called **melting**. If we continue heating the liquid the kinetic energy store increases even more. The particles in the liquid begin to move faster and faster. The attractive forces get weaker and weaker until finally the particles break free and can escape. They begin to bounce around the room randomly hitting the walls, ceiling, and floor. The **liquid** has now turned into a **gas**. This is called **evaporation** (or boiling).

If you reduce the thermal store, by cooling the particles, they move **slower**. As they slow the **attractive forces** get **stronger** and the particles become more attracted to each other. Eventually these forces will hold the particles together. The **gas** will have turned back into a **liquid**. This is called **condensation.** If we further reduce the thermal store the cooling particles become even more attracted each other and get fixed in place. They are now a **solid**. This is called **freezing** (or solidification).

Some solid particles have very weak bonds. This means that once the particles get a small amount of energy in their kinetic store, they skip the liquid state and jump straight into a **gas** state. This is called **sublimation**.

<u>Exothermic vs endothermic</u>

When changes absorb energy from the surroundings they are endothermic.

When changes transfer energy to the surroundings they are exothermic.

<u>Melting and boiling point</u>

Substances melt and boil at specific temperatures, these are known as the melting point and the boiling point. The best example is water which has a melting point of 0°C and a boiling point of 100°C.
Boiling happens to all a liquid at once and occurs only when a liquid is heated to one specific temperature, it's boiling point. Evaporation can happen in a liquid at any temperature below the boiling point of the liquid, but it can only happen to the particles at the surface of the liquid.

These temperatures are different for each substance because the size of their particles and the attractive forces between them are different.

Independent practice

1. Which state of matter has the strongest attractive forces between the particles?
2. Which state of matter has the most energy in its kinetic energy store?
3. What has to be broken for a liquid to turn into a gas?
4. When you heat the particles of a solid they:
5. Why is freezing exothermic while melting is endothermic?
6. What is the physical state of water at these temperatures?

A. 45°C
B. 125°C
C. -24°C
D. 75°C

Extended writing.

1. Explain what happens to the water particles in an ice cube tray when it is placed in the freezer. Refer to energy, speed of particle movement and attractive forces.
2. Explain what happens to the water particles in the pot of water on the stove. Refer to energy, speed of particle movement and attractive forces.

L2 The water cycle

The water cycle, describes how water moves continuously on Earth. It consists of several stages.

Firstly, water evaporates from bodies of water like oceans and lakes due to heat from the sun.

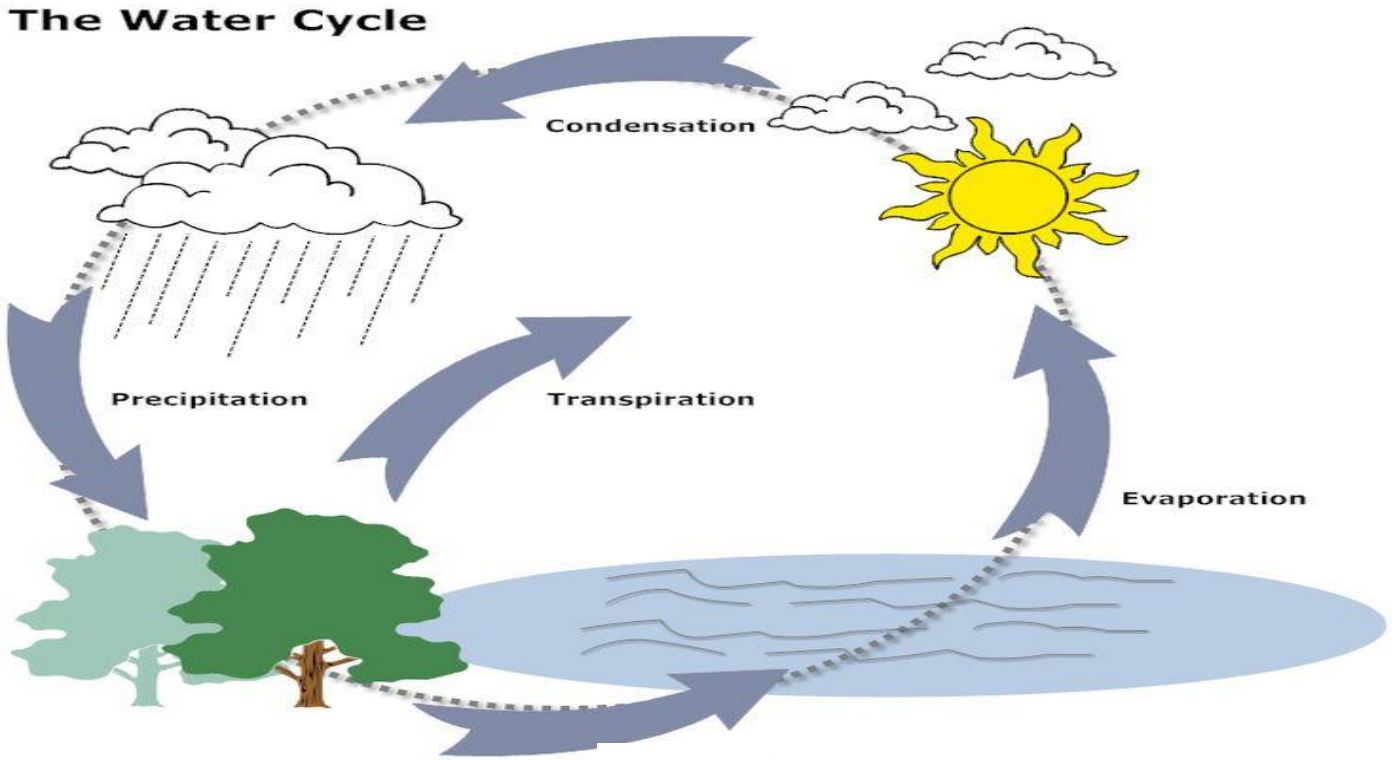
This vapor then rises into the atmosphere, cooling and condensing to form clouds in a process called condensation.

Next, the clouds release water in the form of precipitation such as rain, snow, or hail.

Water is taken into plants for photosynthesis. Some water is lost through the stomata in leaves via transpiration and is released back into the atmosphere.

The water flows into bodies of water or seeps into the ground, known as surface-flow and ground water run off.

This completes the cycle as the water is once again available for evaporation. The water cycle is essential for maintaining Earth's ecosystems and ensuring the availability of fresh water.



Independent practice

1. What provides the energy for evaporation in the water cycle?
2. Explain how clouds are formed.
3. Explain how plants contribute to the water cycle.
4. Why is it called the water cycle?
5. Suggest why clouds do not typically form in the desert.

Extended writing (SAPF)

Explain how water moves around the water cycle. You need to include the following key terms.

- Evaporation
- Condensation
- Precipitation
- Surface water
- Ground water
- Transpiration

L3 Permeability of rocks practical.

Rocks play a crucial role in the water cycle, one of the essential processes on Earth. One important property of rocks is their permeability, which refers to how easily liquids or gases can pass through them. Permeability is influenced by the size and connectedness of pores within a rock.

Some rocks, like sandstone and limestone, are considered highly permeable because they have many large interconnected pores. In these rocks, water can flow easily through the spaces between particles. On the other hand, rocks like granite and shale have low permeability due to their tightly packed structure with smaller or fewer connected pores, making it difficult for water to pass through.

It is possible to identify how permeable rocks are by seeing how the mass changes when added to water.

Reliability refers to the repeatability of an experiment (whether the results can be reproduced under the same conditions).

Validity refers to how accurately a method measures what it is intended to measure

Reliability

For data to be considered reliable, repeats must be carried out.

Repeating a scientific investigation makes it more reliable.

When analysing a set of results or graph, an anomalous result can be identified as one that does not follow the trend.

Once identified, anomalous results can be removed and repeated.

Validity

Controlling factors

The conclusions that can be drawn from the experiment are **valid** if the method makes sure that the effects observed and measured are due to the cause claimed.

It is important that other factors are accounted for. The factors that need to be controlled should be identified and the plan should include how these will be controlled.

<u>Independent practice</u>

1. State the difference between dependent and independent variable.
2. If an experiment is reliable, what does it mean?
3. Why are experiments done at least three times instead of twice.
4. Why are control variables used.
5. Why does the mass increase if a sedimentary rock is placed in water?

Independent practice

6. State the difference between dependent and independent variable.
7. If an experiment is reliable, what does it mean?
8. Why are experiments done at least three times instead of twice.
9. Why are control variables used.
10. Why does the mass increase if a sedimentary rock is placed in water?