

Nutrient Cycles Notes

Science Exams Sorted



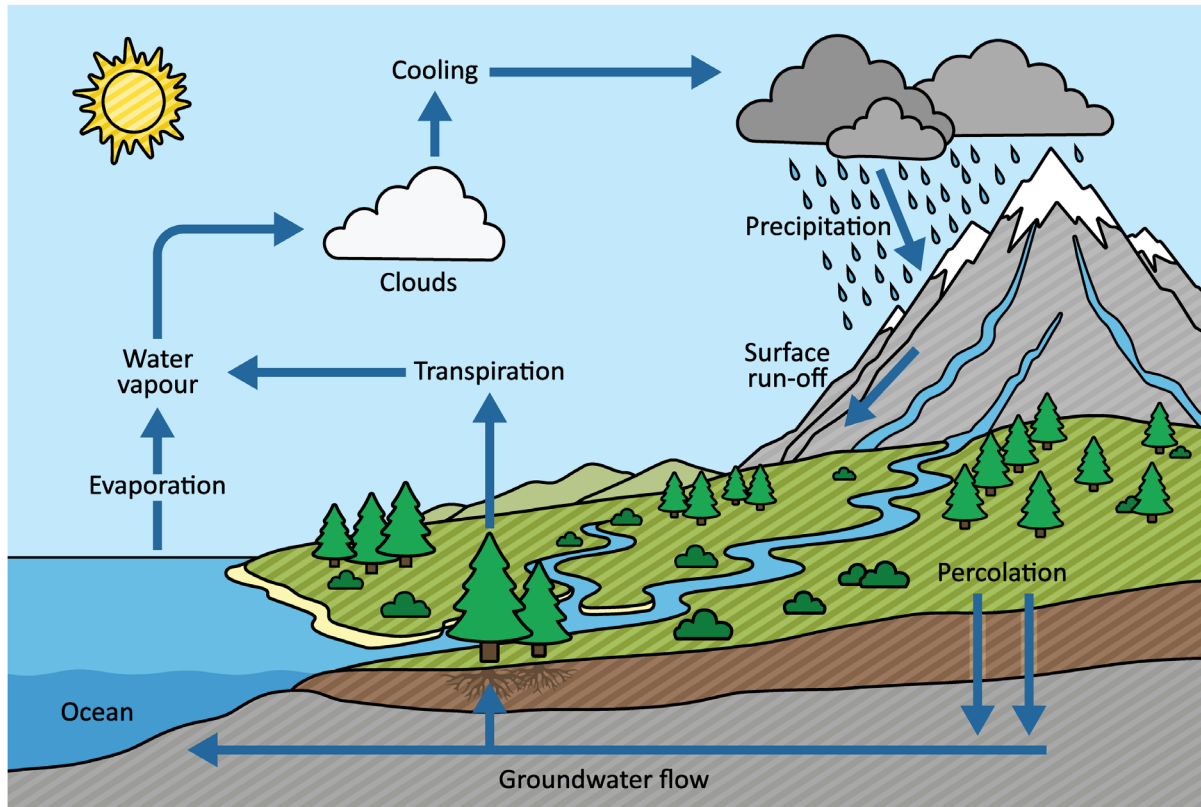
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For the Edexcel GCSE Biology specification we are required to know **three** nutrient cycles. The **water cycle**, the **carbon cycle** and the **nitrogen cycle**. The water cycle is also covered in Geography so if you do Geography that's a help here.

Let's get straight into them 😊

The Water Cycle

The **water cycle** which is also known as the **hydrological cycle** describes how water moves on, above, or just below the surface of the planet.



What do we need to know about the water cycle?

1. How water enters the atmosphere.

- **Evaporation** – energy from the sun heats the liquid water turning some into water vapour.
This rises and cools forming clouds.
- **Transpiration** – is the loss of water from the plants. This water rises as vapour and cools to form clouds.

2. How water leaves the atmosphere.

- **Precipitation** – water vapour/ clouds cool as they rise. The droplets get bigger and fall to the ground as liquid rain.
- This liquid water enters a body of water and at some point, it evaporates again and the cycle repeats.

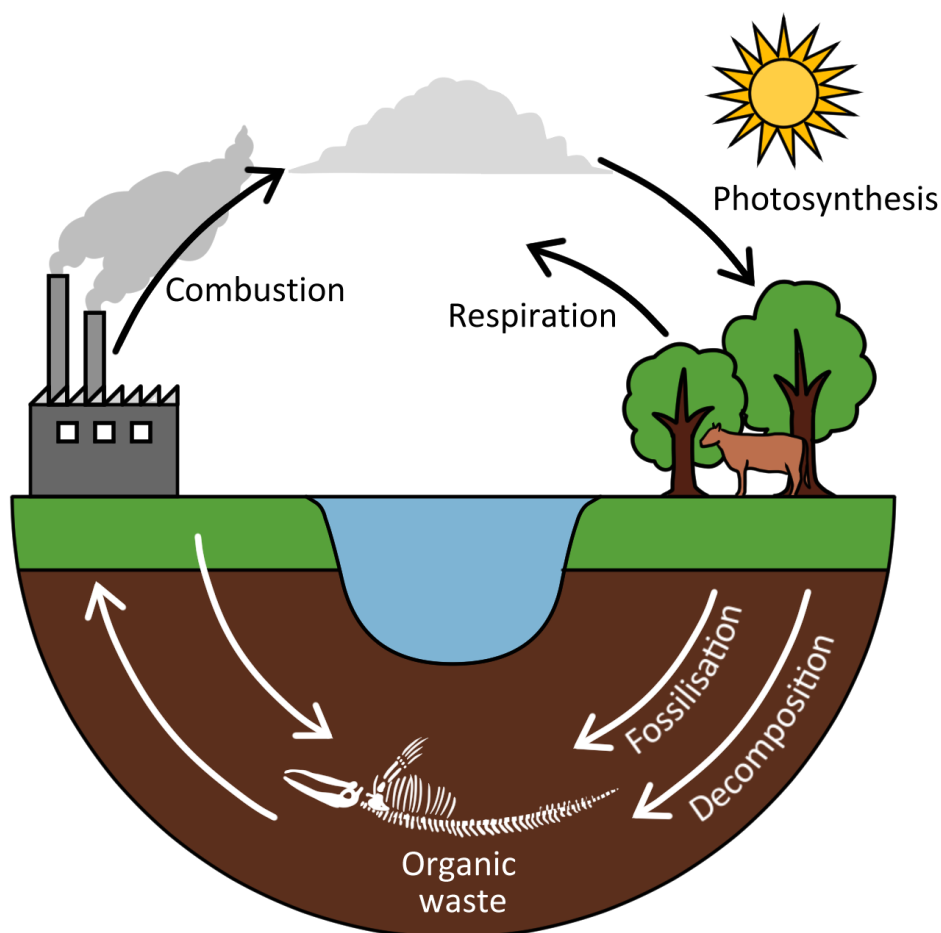
Desalination: in areas of drought, humans can use desalination to produce **potable** (drinkable) **water** from sea water. This is usually done by thermal desalination (boiling the salt water and condensing the pure steam) or reverse osmosis (forcing salt water through a membrane at high pressure to remove the salt).

The Carbon Cycle

The carbon cycle: the process in which carbon is cycled in the atmosphere, the earth, plants and animals.

Carbon moves from the atmosphere, as carbon dioxide, to plants and other photosynthetic organisms. It is then passed from one organism to the next in complex molecules such as glucose, and returned to the atmosphere as carbon dioxide again. This is known as the carbon cycle. This cycle is really straightforward!

Note: Two processes (**combustion** and **respiration**) put CO_2 into the atmosphere, one process (**photosynthesis**) removes it.



What do I need to know about the carbon cycle?

1. How CO_2 enters the atmosphere.

- **Combustion** – any burning will put CO_2 back into the atmosphere.
- **Respiration** – all living organisms respire. Respiration releases CO_2 into the atmosphere.

Note: remember decomposers respire!

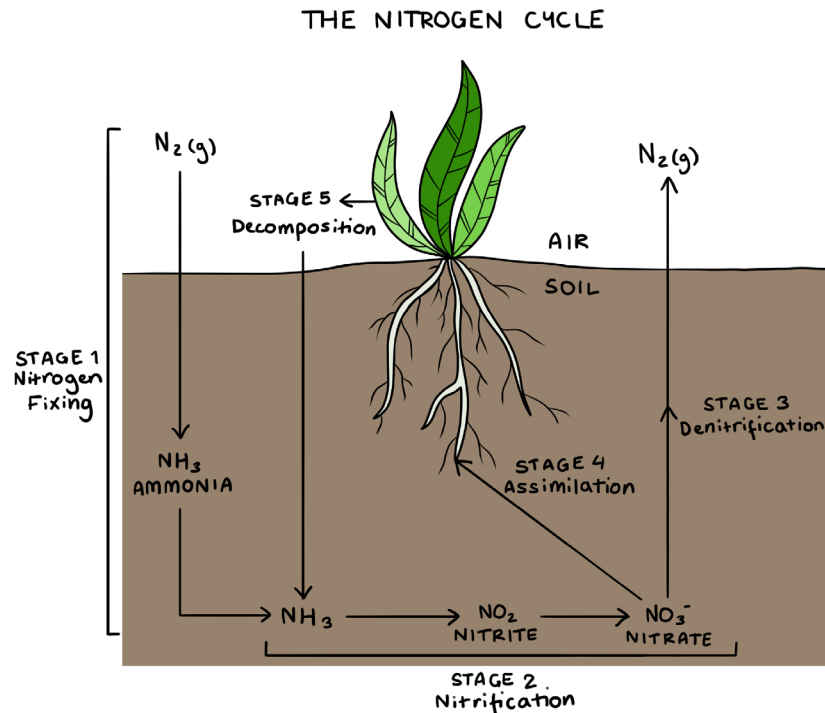
2. How CO_2 leaves the atmosphere.

- **Photosynthesis** – is the only process that removes CO_2 from the atmosphere.

The Nitrogen Cycle

Nitrogen cycle: the process in which nitrogen is cycled through the atmosphere, the earth, and plants and animals.

Nitrogen gas makes up close to 80% of the atmosphere. Organisms use nitrogen to make compounds such as DNA and amino acids. Having access to nitrogen is vital for an organism's survival.



What do we need to know?

What each stage is called and what happens at each stage. Please learn all of the points below 😊

Stage 1: Nitrogen fixation.

What happens in this stage: Nitrogen fixing bacteria in the soil convert $N_2(g)$ into Ammonia, NH_3 .

Stage 2: Nitrification.

What happens in this stage: Nitrifying bacteria in the soil oxidise ammonia (NH_3) first into nitrites (NO_2) and then into nitrates (NO_3^-).

Stage 3: Denitrification.

What happens in this stage: Denitrifying bacteria in the soil convert nitrate ions (NO_3^-) back into nitrogen gas in the atmosphere $N_2(g)$.

Stage 4: Assimilation.

What happens in this stage: The plants absorb the nitrate ions (NO_3^-) and use them to make amino acids, these are then used to make proteins for growth and repair.

Stage 5: Decomposition.

What happens in this stage: decomposers in the soil (bacteria and fungi) **break down proteins and urea in dead matter** and **convert nitrogen containing compounds into ammonia NH_3 .**

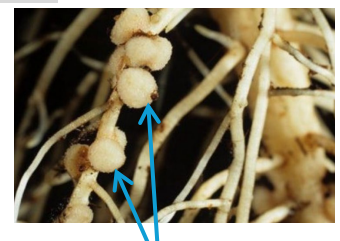
Weird bit! Lightning! ⚡

When lightning strikes the ground, it has enough energy to convert $N_2(g)$ straight into NO_3^-

Legumes

These are a group of plants that contain root nodules. These root nodules are little habitats for bacteria, these bacteria convert nitrogen compounds into nitrate for the plant to absorb. What does the bacteria get out of this arrangement?

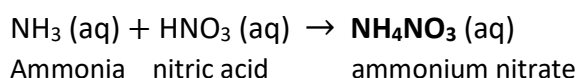
It gets a place to live and the **plant gives the bacteria some glucose.**



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Fertilisers

The main use of ammonia is to make ammonium compounds (by reaction with acids) which are widely used as fertilisers to promote plant growth. E.g.:



Note: Ammonium nitrate is one of the most common fertilisers used.

The advantage of artificial ammonium fertilisers is that they contain a high proportion of nitrogen to help plants grow. The disadvantage is that they are very soluble and are easily washed out of soil and into rivers and lakes so their overuse can cause eutrophication which kills fish and other organisms.

Crop rotation

Crop rotation: is planting a different crop in the same field each year.

A talk through: In a field a farmer might plant potatoes in the first year. In the second year he might plant barley in the same field. In the third year he might plant beans in the field. In the fourth year he might leave the field fallow or plant a legume crop there.

What is the point of crop rotation?

1. If you plant the same crop in the same field year after year the same minerals are being used each year. This will deplete the soil and the crop will not grow as well as it would or it could fail altogether. Potatoes absorb some different nutrients to wheat for example.
2. It prevents pests building up. If a pest eats potatoes and you keep planting them the pests will increase in number each year. By planting a different crop this will reduce the number of pests in the soil.