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**Natural Sciences: NATS4**  
**NOTES AND ACTIVIES – US 7509**

**LESSION TWO**

**THEME:** Earth and Beyond & Life and Living

**TOPIC:** Cycles in the Biosphere – PART 1

At the end of this unit, you should be able to:

1. Define and distinguish between water cycle and nitrogen cycle.
2. Explain processes in involved in how the cycles occur.

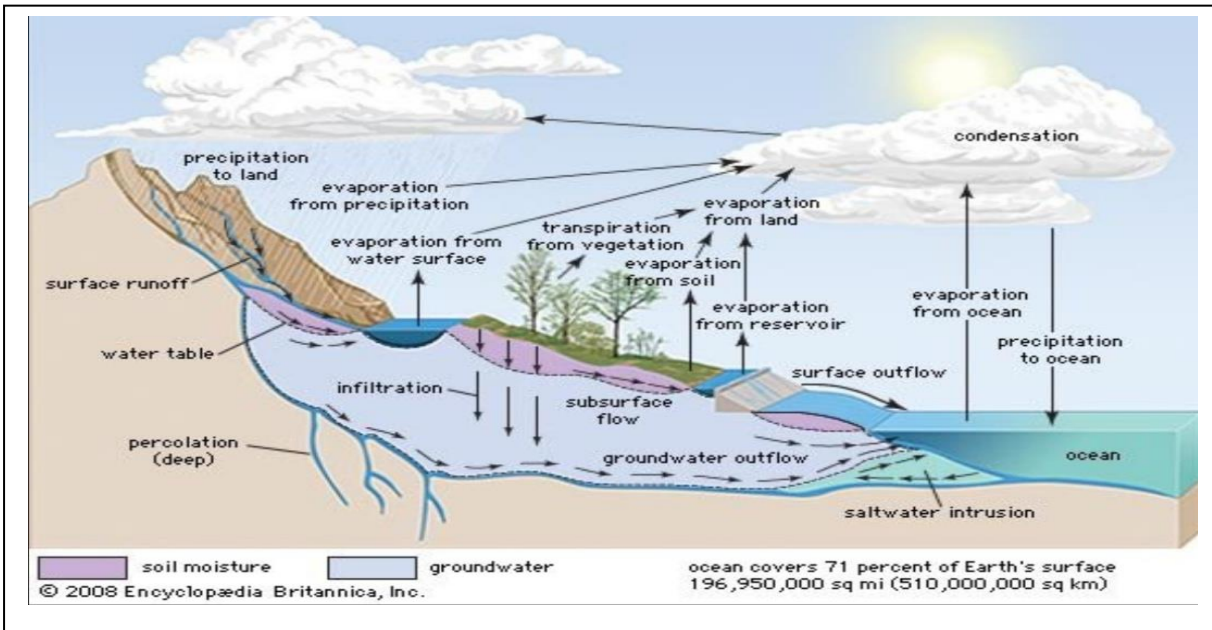
**BACKGROUND**

**Biosphere** is the part of the Earth where living things are found. There are **THREE** main parts of the biosphere – namely: ***Atmosphere, Lithosphere and Hydrosphere.***

- **Atmosphere** – the layer of gases surrounding the Earth
- **Lithosphere** – the layer of the Earth that includes soil and rocks.
- **Hydrosphere**–all the water on the Earth

**A. WATER CYCLE**

1. **Water Cycle** (also called ***Hydrologic or Moisture Cycle***) involves continuous circulation of water between the oceans, land and atmosphere.
2. The water is the common substance on the surface of the Earth.
3. Oceans and seas cover approximately 97% of the Earth's surface. There other 3% collectively comes from lakes, dams, rivers, ground water, ice caps and glaciers.
4. The total amount of water within the cycle remains essentially constant, its distribution among the various processes is continually changing.



5. Of many processes involved in the water cycle, the most important are *evaporation, transpiration, condensation, precipitation and runoff.*

**5.1 EVAPORATION** – *a change of water in liquid state to gaseous or vapour state.*

(a) This is one of the major processes in the cycle, as it transfers water from the surface of the Earth to the atmosphere. This transfer occurs when some molecules in a **water mass** have accumulated sufficient **kinetic energy** to be released from water surface.

(b) The main factors affecting evaporation are **temperature, humidity, wind speed and solar radiation.**

(c) Huge amount of evaporation occurs in the **oceans and seas**, but it can also occur in **soil, snow and ice** – where there's a direct conversion from solid state to vapour state through a process called **sublimation.**

**5.2 TRANSPIRATION** – is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers to the atmosphere. Some water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces including plants – this total evaporation is called **evapotranspiration.**

**5.3 CONDENSATION** – a process taking place in the clouds, where water vapour is converted into droplets of liquid water called *rain*. Sometimes, these water droplets may **freeze** and fall as *snow* or *hail*.

**5.4 PRECIPITATION** – moisture that falls from the clouds in the form of rain, hail, snow, drizzle, sleet, dew or frost. This process transfers water from the atmosphere down through mountain tops, hills and ground.

5.5 **RUNOFF**—is the precipitation that did not get (infiltrated) absorbed into the soil or did not evaporate, and therefore, made its way from mountains, hills and sleepy ground surface into places where water collects like oceans, seas, lakes, dam, etc. *Simply put, runoff is nothing more than water running off down to the land surface.*

**NOTE!!!**

*The circulation of water in the water cycle generally starts from the ocean to the atmosphere and ends up back to the ocean.*

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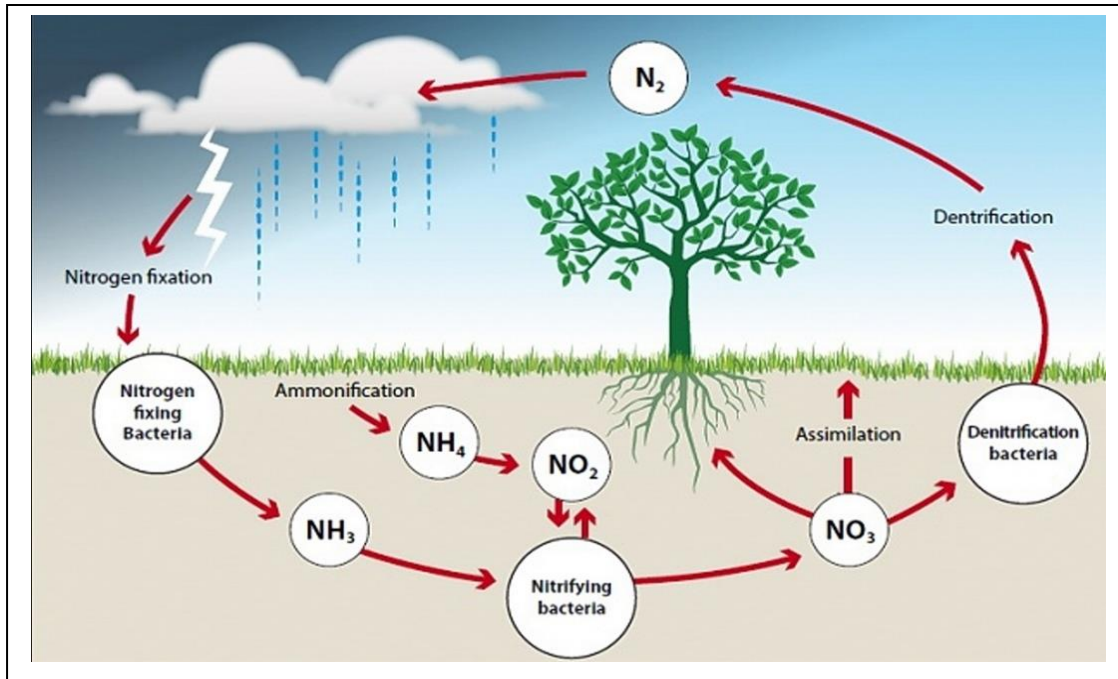
**ACTIVITY**

1. What is water cycle?
2. What is the importance of water cycle in the ecosystem?
3. Why is evaporation is considered to be the major process in the water cycle?
4. Differentiate between precipitation and condensation.
5. Water cycle occurs in all seasons. Which of the four seasons experience a higher rate of water cycle.
6. Draw a diagram of water particles in a liquid state.

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**B. NITROGEN CYCLE**

1. Nitrogen is a colorless and odorless gas at room temperature. It is normally attached to another nitrogen atom, forming a diatomic molecule ( $N_2$ ). The two nitrogen atoms are very stable, meaning they do not react easily with anything else.
2. All living things organisms need nitrogen to make proteins.
3. The atmosphere contains 78% nitrogen gas and most living things cannot use it directly.
4. The air humans breathe in contains nitrogen molecules but the nitrogen remains unchanged as it simply goes through our bloodstream and ends up being breathed out as is, hence it is said to be stable.



5. Before plants and animals can use nitrogen, it has to be **fixed** – meaning, combined with other elements to be changed into a more reactive form.
6. The following process illustrates how nitrogen is fixed so that nitrogen can be transferred in the ecosystem through nitrogen cycle as shown in the diagram above.
  - (a) **Lightning**, in its nature, provides a huge amount of energy which is able to split apart the two stable atoms in a nitrogen molecule ( $N_2$ ). The two atoms react with oxygen in the air, forming nitrogen oxides ( $NO_2$ ). These then dissolve in the rain and fall to the ground as weak nitric acid ( $HNO_3$ ) – *the kind of acid found in the battery of a car which we normally call battery liquid.*
  - (b) **Nitrifying bacteria**, algae and lichens can fix nitrogen. Some nitrogen-fixing bacteria live free in the soil, while others live in little nodules on the roots of plants like peas, beans and clover which takes up nitrites ( $NO_2$ ) and nitrates ( $NO_3$ ) from the soil through assimilation.
  - (c) **Denitrifying bacteria** breaks down animal waste (e.g. urine which contains urea, a nitrogen-rich compound) and dead plants and animals. This releases nitrogen back into the air and the nitrogen cycle continues.
  - (d) Chemical industry produces ammonia ( $NH_3$ ) which is widely used for making fertilizers and explosives, through Haber process to combine nitrogen and hydrogen. These fertilizers are used by farmers and gardeners to enrich the soil and get better crop production. When these industries dispose off their chemical waste, some of it find its way to the soil.

(e) Extreme use of fertilizers can result in nitrates being washed into the rivers. This affects the river ecosystems because too many plants and animals grow in the water. This process is called ***eutrophication***.

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### **ACTIVITY**

1. Why is nitrogen important to living things?
  2. Before nitrogen can be used in the nitrogen cycle, it needs to be fixed.
    - 2.1 What do we mean when we say nitrogen is fixed?
    - 2.2 Give ways in which nitrogen is fixed in the natural environment.
  3. List any TWO nitrogen-compounds found in the nitrogen cycle.
  4. Provide THREE industrial uses of nitrogen.
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