

# NATURAL RESOURCES

## Concepts Covered

- Biogeochemical cycles.
- The water cycle, nitrogen cycle, carbon cycle, greenhouse effect, and oxygen cycle.
- Ozone layer.

### **Biogeochemical cycle**

A constant interaction between the biotic and abiotic components of the biosphere makes it a dynamic, but stable system. These interactions consist of a transfer of matter and energy between the different components of the biosphere.

## **Extended Learning**

Contaminated water and poor sanitation are linked to transmission of diseases such as Cholera, Diarrhea, Dysentery, Hepatitis A, Typhoid and Polio.

#### Water Cycle

- The constant movement of water from the Earth to the atmosphere as water vapour, and back to Earth as rain is known as the water cycle or hydrological cycle.
- The Sun and the water bodies such as the oceans, seas, rivers, and lakes are the components of the water cycle.
- Water cools down, condenses and comes down in the form of Rain, Snow, or sometimes hailstorms, these are ice balls like forms of rain.
- All these forms are dependent upon the temperature conditions of the region.

#### What happens during this cycle?

- During the daytime, a portion of the Earth's surface gets heated up due to the heat produced by the Sun. The water present in this portion of the Earth evapourates into water vapour and moves into the atmosphere. Later, it cools down and returns to the Earth in the form of rain contributing to rivers, streams, and underground water.
- Water that returns to the Earth does not have any salts with it, and hence can be used in our daily life. It is because when the saltwater vapourizes, it loses its salinity.

The various processes involved in the water cycle Three significant processes that are involved in the water cycle are

Evapouration, Transpiration, and Condensation.





#### (A) Evapouration:

The process in which the water converts into water vapour due to heat is known as evapouration.



It is a process through which the saline water (water from the oceans, lakes, ponds, and rivers), vapourizes and reaches the atmosphere after losing its salts.

#### (B) Transpiration:

Plants use water for the preparation of their food during the process of photosynthesis. The release of the remaining water into the air by the plants is known as transpiration.

#### (C) Condensation:

Through the process of condensation, the water returns to the Earth in the form of rain the process by which a vapour becomes a liquid by cooling down is known as condensation. This is the process through which the water returns to the Earth in the form of rain, snow, or hail. The water vapour cools down and forms water droplets that come closer together and form clouds.

#### (D) Precipitation:

The tiny droplets of water collide with each other and form larger droplets. When the air around these droplets cools down these drops fall on the Earth as rainfall. This is known as precipitation.



Dams Kill Fish: Dams block the migration of fish, deplete rivers of oxygen, and interfere with the biological triggers that guide fish. They also reduce the ability of rivers to clean themselves.

#### The Nitrogen Cycle

- Nitrogen gas makes up 78% of our atmosphere and nitrogen is also a part of many molecules essential to life like proteins, nucleic acids (DNA and RNA), and some vitamins.
- Nitrogen is found in other biologically important compounds such as alkaloids and urea too.
- Nitrogen is thus an essential nutrient for all life forms and life would be simple if all these life forms could use the atmospheric nitrogen directly.
- However, other than a few forms of bacteria, life forms are not able to convert the comparatively inert nitrogen molecule into forms like nitrates and nitrites which can be taken up and used to make the required molecules.



- These 'nitrogen-fixing' bacteria like *Rhizobium* or *Beijernickia* may be free-living or be associated with some species of dicot plants.
- Most commonly, nitrogen-fixing bacteria are found in the roots of legumes the plants which give us pulses in special structures called root nodules.
- Other than these bacteria, the only other way the nitrogen molecule is converted to nitrates and nitrites is by a
  physical process.
- During lightning, the high temperatures and pressures created in the air convert nitrogen into oxides of nitrogen.
- These oxides dissolve in water to give nitric and nitrous acids and fall on land along with rain. These are then
  utilized by various life forms.
- Plants generally take up nitrates and nitrites and convert them into amino acids which are used to make proteins.
- Some other biochemical pathways are used to make the other complex compounds containing nitrogen.
- These proteins and other complex compounds are subsequently consumed by animals.
- Once the animal or the plant dies, other bacteria in the soil convert the various compounds of nitrogen back into nitrates and nitrites.
- A different type of bacteria converts nitrates and nitrites into elemental nitrogen.
- Thus, there is a nitrogen cycle in nature in which nitrogen passes from its elemental form in the atmosphere into simple molecules in the soil and water, which get converted to more complex molecules in living beings and back again to the simple nitrogen molecule in the atmosphere.



## The Carbon Cycle

- Carbon is found in various forms on the Earth.
- It occurs in the elemental form of diamonds and graphite.
- In the combined state, it is found as carbon dioxide in the atmosphere, as carbonate and hydrogen carbonate salts in various minerals, while all life forms are based on carboncontaining molecules like proteins, carbohydrates, and fats.
- The endoskeletons and exoskeletons of various animals are also formed from carbonate salts.
- Carbon is incorporated into life forms through the basic process of photosynthesis which is performed in the presence of Sunlight by all life forms that contain chlorophyll.



- This process converts carbon dioxide from the atmosphere or dissolved in water into glucose molecules.
- These glucose molecules are either converted into other substances or used to provide energy for the synthesis
  of other biologically important molecules.
- The utilization of glucose to provide energy to living things involves the process of respiration in which oxygen may or may not be used to convert glucose back into carbon dioxide.
- This carbon dioxide then goes back into the atmosphere.
- Another process that adds to the carbon dioxide in the atmosphere is the process of combustion where fuels are burnt to provide energy for various needs like heating, cooking, transportation, and industrial processes.
- The percentage of carbon dioxide in the atmosphere is said to have doubled since the industrial revolution when human beings started burning fossil fuels on a very large scale.
- Thus carbon cycled repeatedly through different forms by various physical and biological activities.

#### The Greenhouse Effect

- The greenhouse effect is how heat is trapped close to Earth's surface by "greenhouse gases."
- These heat-trapping gases can be thought of as a blanket wrapped around Earth, keeping the planet toastier than
  it would be without them.
- The main gases responsible for the greenhouse effect include carbon dioxide, methane, nitrous oxide, water vapour, and fluorinated gases.
- Greenhouse gases have different chemical properties and are removed from the atmosphere, over time, by different processes.
- Carbon dioxide (CO<sub>2</sub>) makes up a vast majority of greenhouse gas emissions from diffrent sectors, but smaller amounts of methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) are also emitted.
- These gases are released during the combustion of fossil fuels, such as coal, oil, and natural gas, to produce electricity.

#### Advantages of Greenhouse gases-

- 1. Green House effect promotes life.
- 2. Greenhouse gases protect all living things on Earth from dangerous solar radiation.

#### Disadvantages of Greenhouse gases-

- 1. Global warming- Global warming is the long-term warming of the planet's overall temperature.
- 2. Earth continues to warm due to the greenhouse gases, water heats up and expands causing sea levels to rise.

## The Oxygen Cycle

- Oxygen is an abundant element on our Earth.
- It is found in the elemental form in the atmosphere to the extent of 21%.
- It also occurs extensively in the combined form in the Earth's crust as well as in the air in the form of carbon dioxide.
- In the crust, it is found as the oxides of most metals and silicon, and also as carbonate, sulphate, nitrate, and other minerals.



- It is also an essential component of most biological molecules like carbohydrates, proteins, nucleic acids, and fats (or lipids).
- In the oxygen cycle, we are mainly referring to the cycle that maintains the levels of oxygen in the atmosphere.
- Oxygen from the atmosphere is used up in three processes, namely combustion, respiration, and in the formation of oxides of nitrogen.
- Oxygen is returned to the atmosphere in only one major process, that is, photosynthesis.
- Even the process of nitrogen-fixing by bacteria does not take place in the presence of oxygen.

#### **Ozone Layer**

- Elemental oxygen is normally found in the form of a diatomic molecule.
- However, in the upper reaches of the atmosphere, a molecule containing three atoms of oxygen is found.
- The formula of ozone is O<sub>3</sub>
- The normal diatomic molecule of oxygen, ozone is poisonous, and we are lucky that it is not stable nearer to the Earth's surface.
- It performs an essential function where it is found.
- e, a intee Stratosphere (10-31 miles) Stratospheric Ozone (ozone layer) Troposphere (0-10 miles) Surface-level Ozone (SMOG)
- It absorbs harmful UV radiation from the Sun reaching the surface of the Earth where they may damage many forms of life.
- It was discovered that this ozone layer was getting depleted.
- Various man-made compounds like Chloro-Fluro Carbons or CFCs (Chlorofluorocarbons) were found to persist in the atmosphere.
- Once they reached the ozone layer, they would react with the ozone molecules.
- This resulted in a reduction of the ozone layer and recently they have discovered a hole in the ozone layer above Antarctica.
- The lower layer of the atmosphere that immediately surrounds the Earth is called the troposphere.
- Stratospheric ozone is a naturally occurring gas that filters the Sun's ultraviolet (UV) radiation.





(1) Answer:	What is the effect of oxygen on nitrogen fixation? Nitrogen fixation cannot take place in the presence of oxygen.		
(2) Answer:	What are the harmful effects of ozone? Inhaling ozone causes dryness of the mucous membrane of the mouth, nose, and throat; it changes visual activity; causes headache and pulmonary congestion. It even harms leafy vegetables, field crops, fruits, and forest trees.		
(3)	Why does the percentage of gases like Oxygen, Nitrogen, and Carbon dioxide remain almost the		
Answer:	same in the atmosphere? Cycling these gases maintains consistency of these gases. These are taken up and released by almost every living organism and thus their concentration in the atmosphere is maintained.		
(4) Answer:	How is the ozone layer useful to us? Ozone is present in the upper layers of the atmosphere (stratosphere). Before reaching the Earth, the Sun's rays pass through the stratosphere. The ozone layer present there absorbs the harmful UV rays present in the Sun rays and prevents them from reaching the Earth. Thus, it protects the entire planet from the disastrous effects of UV rays.		
(5) Answer:	Why is it said that nitrogen is very important for us? Nitrogen is the most abundant gas in our atmosphere. It makes up 78% of our atmosphere and is also a part of many molecules essential to life like proteins, nucleic acids (DNA and RNA), and some vitamins. Moreover, it is found in other biologically important compounds such as alkaloids and urea. Thus, nitrogen is very important for us.		
(6) Answer:	Name any four carbon-containing molecules which are essential for human beings. The carbon-containing molecules essential for human beings are: (a) Deoxyribonucleic acid-DNA (b) Proteins (c) Carbohydrates (d) Fats		
(7) Answer:	What is the importance of greenhouse gases present in the atmosphere? The greenhouse gases like carbon dioxide and methane prevent the escape of heat from the Earth. Thus, these gases play an important role in keeping the average temperature of the Earth constant.		
(8)	What is the greenhouse effect? What will happen if the concentration of greenhouse gases		
Answer:	The phenomenon in which the incoming Sunlight is allowed to pass through the atmosphere but heat radiated back from the planet's surface is trapped by the gases like carbon dioxide, water vapour, and methane present in the atmosphere is called the greenhouse effect.		
(9) Answer:	Explain any two processes involved in the cycling of nitrogen in the environment. The two-process involved in the cycling of nitrogen in the environment are nitrogen fixation and ammonification.		
	<ul> <li>(a) Nitrogen fixation in which the atmospheric nitrogen is converted into nitrites and nitrates which are water-soluble and are easily taken up the roots.</li> <li>(b) Ammonification: The formation of ammonia due to the decomposition of dead organic matter is called Ammonification.</li> </ul>		
(10)	What is the percentage of oxygen in the atmosphere? Name any two compounds of oxygen		
Answer:	found in nature. The percentage of oxygen in the atmosphere is approximately 21%. The diatomic form oxygen ( $O_2$ ) and the triatomic form ozone ( $O_3$ ) are the two forms in which oxygen is found in nature.		

## Exercise

## FILL IN THE BANKS

- (1) Elemental oxygen is normally found in the form of a \_\_\_\_\_molecule.
- (2) The main gases responsible for the greenhouse effect include carbon dioxide and \_\_\_\_\_
- (3) Nitrogen is found in other biologically important compounds such as \_\_\_\_\_and urea too.
- (4) The outer crust of the Earth is called.
- (5) The temperature ranges from \_\_\_\_\_ to \_\_\_\_ on the moon as it does not have atmosphere.

## TRUE OR FALSE

- (1) Oxygen in the air is an exhaustible natural resource.
- (2) The process in which the water converts into water vapour due to heat is known as condensation.
- (3) Animals breathe nitrogen gas in and out but cannot use it.
- (4) Nitrogen is found in the elemental form in the atmosphere to the extent of 31%.
- (5) The formula of  $O_3$  is called ozone.

(4)

- (6) 10% Nitrogen gas makes up 78% of our atmosphere and nitrogen is also a part of many molecules essential to life like proteins, nucleic acids (DNA and RNA), and some vitamins.
- (7) Resources that are present in unlimited quantity in nature are called exhaustible natural resources.
- (8) Carbon cycled repeatedly through different forms by various physical and biological activities.
- (9) 'Nitrogen-fixing' bacteria like Rhizobium or Beijernickia may be not free-living
- (10) Carbon-containing molecules like proteins, carbohydrates, and fats.

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## **OBJECTIVE TYPE QUESTIONS**

(')	<ul><li>(A) Water Ozone</li><li>(C) Oxygen and Ozone</li></ul>	(B) Water Oxygen (D) All of the above	
(2)	The process of nitrogen-fixation by bacteria (A) Elemental form of Oxygen (C) Water	does not take place in the presence of- (B) Elemental form of Hydrogen (D) Elemental form of Nitrogen	
(3)	One of the following processes is not a step (A) Evapouration (C) Photosynthesis	involved in the water cycle operating in nature (B) Transpiration (D) Precipitation	
(4)	Which of the following is not a greenhouse ( (A) Methane (C) Carbon Monoxide	gas? (B) Carbon Dioxide (D) Ammonia	
(5)	Which step is not involved in the carbon cyc (A) Photosynthesis (C) Transpiration	le? (B) Respiration (D) Burning of Fossil Fuels	
(6)	<ul> <li>Choose the correct sequences</li> <li>(A) CO<sub>2</sub> in the atmosphere → decomposers → organic carbon in animals → organic carbon in plants</li> <li>(B) CO<sub>2</sub> in the atmosphere → organic carbon in plants → organic carbon in animals → inorganic carbon in soil</li> <li>(C) Inorganic carbonates in water organic carbon in plants → organic carbon in animals → scavengers</li> <li>(D) Organic carbon in animals → decomposers → CO<sub>2</sub> in the atmosphere → organic carbon in plants</li> </ul>		
(7)	<ul> <li>Choose the correct sequence. [NSO]</li> <li>(A) CO<sub>2</sub> in atmosphere → decomposers → organic carbon in animals → organic carbon in plants.</li> <li>(B) CO<sub>2</sub> in atmosphere → organic carbon in plants → organic carbon in animals → inorganic carbon in the soil.</li> <li>(C) Inorganic carbonates in water → organic carbon in plants → organic carbon in animals → scavengers.</li> <li>(D) Organic carbon in animals → docomposers → CO, in atmosphere → organic carbon in plants.</li> </ul>		
(8)	<ul> <li>(b) organic carbon in animals of accomposition of cog in authorphate of organic carbon in plants.</li> <li>A family in a village forget to turn off an angithi at night in a closed room. All the members of the family suffer from suffocation after some time. What could be the possible reason for that? [NSO]</li> <li>(A) Sulphur dioxide originated from smog which blocks the human respiratory system.</li> <li>(B) Nitric oxide formed causes respiratory problems.</li> <li>(C) Carbon monoxide formed due to lack of oxygen in the air, combines with hemoglobin leading to reduce the oxygen-carrying capacity of hemoglobin which results in suffocation.</li> <li>(D) Carbon dioxide is formed to result in choking of the throat.</li> </ul>		



(9)	Arrange the statements in the correct seque I. As the air rises, it expands and cools. II. When water bodies are heated during the III. The hot air rises carrying the water vapor IV. Water vapours in the air condense to for V. Dust particle acts are nucleus to facilitate	ce of formation of rain. day, a large amount of water evapourates and goes into the air. r with it. n tiny water droplets. the process of condensation.	
	VI. The drops have grown big and heavy and (A) $ I \rightarrow I \rightarrow IV \rightarrow III \rightarrow V \rightarrow VI$ (B) $ I \rightarrow III \rightarrow I \rightarrow IV \rightarrow V \rightarrow VI$ (C) $ II \rightarrow II \rightarrow I \rightarrow VI \rightarrow IV \rightarrow VI$ (D) $ I \rightarrow I \rightarrow III \rightarrow IV \rightarrow V \rightarrow VI$	d fall in the form of rain.	[NSO]
(10)	Two friends argue are Manav - If all the oxygen present in the envi Mansi - If all the oxygen present in the envi will kill us. Who made the correct statement (A) Manav (C) Mansi	ronment is converted into ozone, we will be more protect ronment is converted into ozone. It will become poison ? (B) Both of Them (D) None of These	cted. lous and [NSO]

## Answer Key

## FILL IN THE BLANKS

- (1) Diatomic
- (2) Methane, nitrous oxide.
- (3) Alkaloids
- (4) Lithosphere
- **(5)** 190° C, 110° C

## **TRUE OR FALSE**

(1)	False	(6)	True
(2)	False	(7)	False

- (3) True (8) True
- (4) False (9) False
- (5) True (10) True

## **OBJECTIVE TYPE QUESTIONS**

(1)	(C)	(6)	(B)
(2)	(Δ)	(7)	(R)

(2)	(A)	(7)	(D)	
(3)	(C)	(8)	(C)	
		( )		

- (4) (D) (9) (B) (5) (C) (10) (C)