
General science and analytical ability

National Officers academy

Environmental science

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ENVIRONMENTAL SCIENCE

Environment

- ❖ Surroundings in which living and non-living things live.
- ❖ It has two components: abiotic and biotic
- ❖ **Abiotic components**
 - 1-water (hydrosphere)
 - 2-air (atmosphere)
 - 3-land (lithosphere)
- ❖ **Biotic components**
 - 1-plant
 - 2-animal
 - 3-micro-organisms
- ❖ For survival and comfort of these organisms there are resources
- ❖ Renewable & non-renewable resources
- ❖ Renewable resources (*soil, air, sunlight, water*)
- ❖ Non-renewable resources (*oil, coal, gas, radioactive materials*)

Biosphere (Biggest life supporting zone)

The life supporting zone of earth where lithosphere, hydrosphere and atmosphere interact to make life possible is called biosphere.

- It is dynamic and stable system.
- Constant interaction between biotic and abiotic components of the biosphere results in the transfer of food and energy.
- Smallest life sustaining structural and functional unit of biosphere is Ecosystem.
- There are several ecosystems: large & small
- Terrestrial ecosystem (*forests, grassland, deserts, hillsides*)
- Aquatic ecosystem (*ponds, rivers, sea-coasts, oceans*)

Levels of organization

- **Individual:** refers to individual complete organism
 - **Specie:** individuals that can breed
 - **Population:** group of individuals of given specie, living in a specific area at a given period of time.
 - **Community:** populations of different species or all the populations living in a specific area at a given period of time.
 - **Ecosystem:** a biological community of interacting organisms and their physical environment.
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- **Biome:** a set of ecosystems sharing similar properties with their abiotic factors adapted to their environment.
 - **Biosphere:** sum of all ecosystems established on earth.

Hydrosphere

- ❖ Liquid water component of the earth is called hydrosphere.
- ❖ It covers 70% of the earth.
- ❖ Hydrosphere like atmosphere is always in motion.

Importance

Important constituents of living organisms.

- 60% humans
- 80% fish
- 80%-90% plants
- It can make possible many chemical reactions in living organisms.
- It helps in food production.

Global distribution of water

- 97% saline
- 3% fresh water



79% ice caps and glaciers
29% ground water
1% accessible surface fresh water



52% lakes
38% soil moisture
8% water vapours
1% water within living organisms
1% rivers

WATER CYCLE/ HYDROLOGICAL CYCLE

- ❖ Circulation of water between different compartments of hydrosphere, involving changes in physical states of water between solid, liquid and gaseous state.
- ❖ Hydrological cycle is powered by sun light + Earth's gravity.

Water Cycle

1-Evaporation ➡ 2-Evapotranspiration ➡ 3-Condensation

➡ 4-Precipitation ➡ 5-Surface runoff ➡ 6-Infiltration

➡ 7-Groundwaterflow ➡ 8-Absorption/ Drinking water

1-Evaporation

It is a conversion of surface water into water vapours. Solar energy contributes in 90% of atmospheric water.

2-Evapotranspiration

Water evaporated from body of organisms by metabolism and solar radiations and constitutes 10% of atmospheric water.

3-Condensation

Vapours reach at high altitudes (cold places) and condense to convert into liquid state from gaseous state.

4-Precipitation

When products of condensation fall under the force of gravity is known as precipitation.

5-Surface runoff

Water moves down the slope of mountains to the oceans.

6-Infiltration

Infiltration is absorption of surface water to the ground and this absorption depends on soil & rock permeability

7-Ground water flow

Movement of ground water in *aquifers* (an aquifer is an underground layer of water-bearing permeable rock and rock fractures from which ground water can be extracted using water well).

8-Absorption or drinking

In which soil moisture or surface water is taken by living organisms.

Montreal protocol

- ❖ It was a treaty signed to reduce the production and consumption of ozone depleting substances.
- ❖ It was agreed on 16th September, 1987 and entered into force on 2nd January 1989.
- ❖ It was widely considered as the most successful environmental protection agreement.
- ❖ A mandatory timetable for phase out of ozone depleting substances was set.
- ❖ Timetable is reviewed regularly.
- ❖ Phase out dates accelerated with more scientific understanding and technological advances

Ozone depleting substances

- ❖ Chlorofluorocarbons (CFCs)
- ❖ Hydrochloroflourocarbons (HFCs)
- ❖ Halons (*Unreactive gaseous compounds of carbon and halogens, used as fire extinguishers but deplete ozone layer*)

Multilateral fund

First financial mechanism was designed to help developing countries to help them to phase out ozone depleting substances.

Targeted chemicals

96 chemicals were targeted used across 240 industrial sectors of the world and multilateral fund helped them.

Universal ratification

196 countries ratified it so it is said that Montreal protocol get universal ratification.

Kyoto protocol

- ❖ It was an agreement linked to United Nations Framework Convention on Climate (UNFCCC) by setting international binding emission reduction targets.
- ❖ 150 years of industrial growth, made developed countries responsible for high emission of greenhouse gases
- ❖ It was adopted in 11 December, 1997 in Kyoto (Japan) and entered into force on 16 February, 2005.
- ❖ It was an international environmental treaty for stabilisation of greenhouse gases concentration in the atmosphere, at a level that would prevent dangerous interference with the climate system.

Anthropogenic greenhouse gases

- Carbon dioxide
- Methane
- Nitrogen dioxide
- Perfluorocarbons (PFCs)
- Hydrofluorocarbons (HFCs)
- Sulphur hexafluoride (SF6)

Overview

- Industrialized nations agreed to cut out their green house gas (GHG) emission below certain %age of 1990 level
- 1990 was set as a baseline for reduction targets
- Total cuts in emission would have to be accomplished from 2005 to 2008.

Ratification status

- ❖ 84 countries ratified kyoto protocol.

Reduction targets

- ❖ European union agreed to cut by 8%
- ❖ Japan by 7%
- ❖ U.S by 7%
- ❖ Canada by 6%
- ❖ Russia was agreed to stay at 1990 level and it achieved this target and reached below 1990 level.

Checks on developing nations

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- ❖ There were no checks on developing countries as China & India because per capita emission of (GHG) were lower than developed nations.

55/55 target

- ❖ Kyoto protocol itself will come into effect if 55 countries, together producing 55% of the world's 1990 CO₂ will ratify it.

Major players

- ❖ Japan and EU both heavy industrialized countries of the world took this problem of global warming seriously and played a key role in it.

Penalties for non-compliance

- ❖ There is no harsh penalty for non-compliance and countries can withdraw easily with one year withdrawal notice.
- ❖ In future there would be trade sanctions, financial sanctions and emission penalties.

Emission reduction criteria

- ❖ Reduction criteria depend on many factors. As if forests are present in any country over large distances then these forests can easily absorb greenhouse gases and they are known as **carbon sink**. Russia and Canada have large forests so they demanded relaxation in their emission targets.

The Kyoto mechanism

- ❖ In Kyoto mechanism one can buy, generate and trade emission credits.

1-International emission trading

International emission trading is about buying credits from other countries which have exceeded their reduction targets.

2-Joint implementation

Joint implementation is about investing in emission reduction projects in other industrialized countries.

3-Clean development

Investing in clean energy and other emission reduction projects in developing countries.

Criticism

- 1- Exclusion of developing countries.
 - 2- Cost and economic implications.
 - 3- Achieved too little and too late.
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