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Global Warming

- Global warming is a term used to describe the trend of increase in the average temperature of the Earth's atmosphere and oceans that has been observed in recent decades.
- Global warming is defined as a gradual increase in the Earth's temperature gradually due to the greenhouse effect caused by increased levels of Carbon dioxide, CFC's and other Pollutants.
- The increased volumes of CO_2 and other greenhouse gases released by the burning fossil fuels, land clearing, agriculture and other activities are the primary sources of the human induced component of warming.
- The greenhouse effect is a warming of the Earth's surface and lower atmosphere that tends to intensify with an increase in atmospheric carbon dioxide.
- The atmosphere allows a large percentage of the rays of visible light from the Sun to reach the Earth's surface and heat it.
- A part of this energy is reradiated by the Earth's surface in the form of long wave infrared (IR) radiation, much of which is absorbed by molecules of CO_2 and water vapour in the atmosphere and which is reflected back to the surface as heat.

- The trapping of the IR causes the Earth's surface and lower atmospheric layers to warm to a higher temperature. An increase in atmospheric concentration of other trace gases such as CFC, nitrous oxide and Methane, may also aggravate greenhouse conditions.
- Greenhouse gases are mainly CO_2 -52%, CH_4 -24%, N_2O -18%, CFC's 6%.

Impact Of Greenhouse effect :-

- ① Such global warming would cause the polar ice caps and mountain glaciers to melt rapidly and result in appreciably higher coastal waters.
- ② The increase in global temperatures is expected to result in other climate changes including rise in sea level and changes in the amount and pattern of precipitation.
- ③ The rise in global temperature would also produce new patterns and extremes of drought and rainfall, thereby disrupting food production in certain regions.
- ④ Effect on human health.
- ⑤ Effects on agriculture.

⇒ Climatic Change

- Climate change refers to long term changes in climate including average temperature and precipitation
- Earth's climate is changing and this is causing great concern.
- Climate change has started endangering biodiversity, food and fresh water supply, impacting human health world wide.

Causes of Climate Change:-

The earth's climate is dynamic and always changing through a natural cycle. The causes of climate change can be divided into two categories.

i) Natural Cause:-

There are a number of natural factors responsible for climate change such as continental drift, volcanoes, ocean current and earth's tilt.

a) Continental drift

This drift had an impact on the climate because it changed the physical features of the landmass, their position and the position of water bodies.

b) Volcanoes

When a volcano erupts, it produces large

Volumes of Sulphur dioxide, water vapour, dust and ash into the atmosphere. The gases and dust particles can reach the Stratosphere and partially block the incoming radiation leading to cooling. SO_2 combines with water to form tiny droplets of H_2SO_4 acid.

c) The earth's tilt:

- Earth is tilted at an angle of 23.5° to the perpendicular plane of its orbital path. When the season is summer, the northern hemisphere tilts towards the sun. When it is winter, the earth is tilted away from the sun.
- Changes in the tilt of the earth can affect the severity of the seasons - more tilt means warmer summers and colder winters, less tilt means cooler summer and milder winters.

d) Ocean current:-

Ocean currents have been known to change direction or slow down. Much of the heat that escapes from the oceans in the form of water vapour the most abundant green house gas. Water vapour also contribute to the formation of clouds which shade the surface and have net cooling effect.

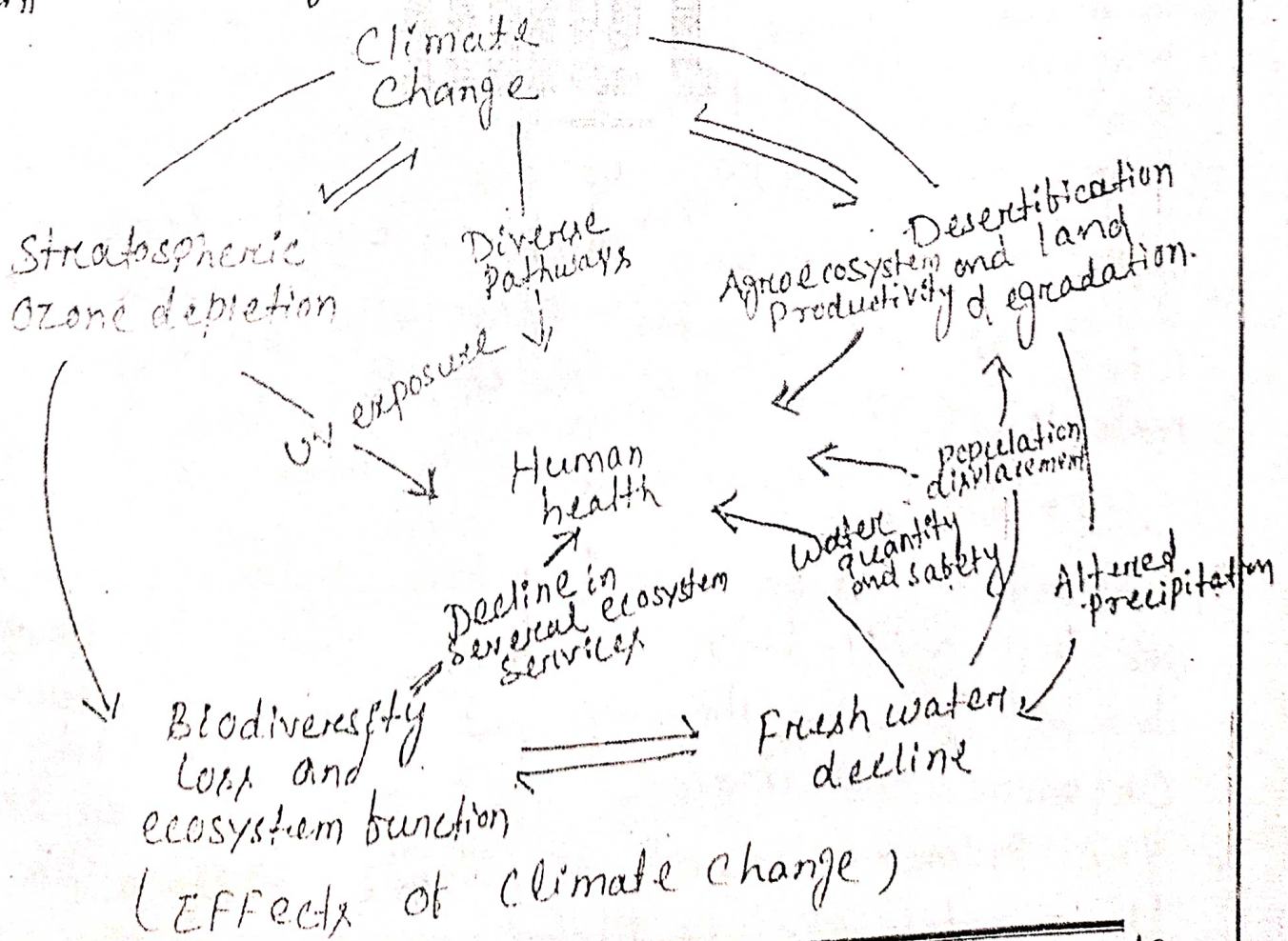
ii) Human Causes :-

- There is huge amount of electricity generated in power plants and these power plants are responsible for the emission of greenhouse gases and pollution.
- We consume large amount of petrol and diesel in transportation which causes pollution and depletion of fossil fuels.
- We generate large quantity of plastics and Polythene which is non-degradable and thus degrading the atmosphere.
- We use huge quantity of paper and timber in our office and school and manufacturing businesses which causes deforestation.
- Large population needs more food, which causes more use of fertilizer thus more emission of nitrous oxide both from the field and the fertilizer industry.

Effect / Impact of climate change

- Agriculture: Change in climate will affect agricultural yield directly because of alteration in temperature and rainfall and indirectly through changes in soil quality, pest and diseases.
- Weather: A warmer climate will change rainfall and snowfall patterns. Leads to increased drought and floods, causes melting of glaciers and polar icecaps and results in accelerated sea level rise.

- Health: - Fluctuation in the climate such as temperature, precipitation and humidity can influence biological organisms and causes spread of infectious diseases.
- Marine life: - An ocean water become warmer due to climate change, this will damage the coral reefs. The damaged coral reefs causes bleaching, zooplanktons, small fish/organisms that float on the sea surface, which results in reducing the numbers of fish and sea birds that feed on these organisms.
- Forests and Wildlife: - plants and animals in the natural environment are very sensitive to change in climate.

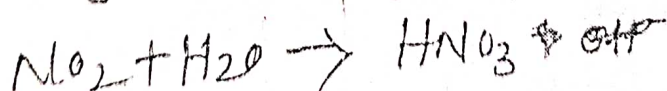
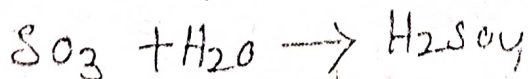
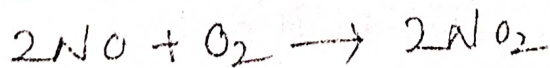
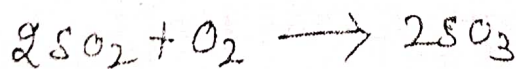


Acid Rain

- Acid rain is one of the most dangerous and widespread forms of pollution.
- Acid rain is the rain that has a larger amount of acid in it. Many living and nonliving systems become harmed and damaged as a result of acid rain.

Causes of Acid Rain

- Acid Rain is caused by smoke and gases that are given off by factories and cars that run on fossil fuels.
- When these fuels are burned to produce energy the sulphur that is present in the fuel combines with O_2 and becomes SO_2 and the nitrogen becomes Nitrogen Oxide.
- These pollutants react with rain water and form acid and produce acid rain.



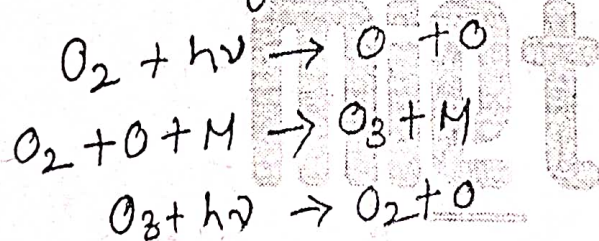
The pH of natural rain water is near about 5.6 but the presence of H_2SO_4 and HNO_3 , its pH becomes acidic (less than 4)

Effect of acid rain on environment:

- Acid rain can make trees lose their leaves or needles. The needles and leaves of trees turn brown and fall off. Trees can also suffer from stunted growth, have damaged bark and leaves, which makes them vulnerable to weather, disease and insects. Lakes are also damaged by acid rain.
- Architecture and artwork can be destroyed by acid rain. Acid particles can land on buildings, causing corrosion. When sulphur pollutants react with the minerals in the stone of buildings, forming a powdery substance that is also called gypsum, which can be washed away by rain.
- Acid rain can damage buildings, stained glass, railroad lines, airplanes, cars, steel bridges and underground pipes.
- Effect on Human
- Acid rain causes in a human being respiratory problems. It ^{can} cause asthma, dry cough, headaches and throat irritations.
- Acid rain can be absorbed by both plants and animals. When humans eat these plants or animals, these pollutants can ^{cause} produce brain damage, kidney damage and Alzheimer's disease.

Ozone layer formation

- Ozone is formed in the stratosphere when oxygen molecules photo dissociate after absorbing an UV photon whose wavelength is shorter than 240 nm. This produces 2 oxygen atoms.
- The atomic oxygen then combines with O_2 to create O_3 (ozone). Ozone molecules strongly absorb UV light between 310 and 200 nm, following which ozone splits into a molecule of O_2 and an oxygen atom.
- The oxygen atom then joins up with an oxygen molecule to regenerate ozone.



- This is a continuing process which terminates when an oxygen atom recombines with an ozone molecule to make $2O_2$ molecules.

Ozone layer depletion

- The major reason behind the polar ozone holes and the midlatitude thinning, but the is due to catalytic destruction of ozone by atomic chlorine and bromine.
- The primary source of these halogen atoms in the stratosphere is photodissociation of CFC compounds.

commonly called Freons and bromofluorocarbon compounds known as Halons, which are transported into the stratosphere after being emitted at the surface.

- Both ozone layer depletion (Polar hole and ozone thinning) Mechanisms strengthened as emissions of CFCs and Halons increased.

- It is suspected that a variety of biological consequences, including increased skin cancer, damage to plants and reduction of plankton populations in the ocean's photic zone, may result from the increased UV exposure due to ozone depletion.

Ozone destruction

Ozone can be destroyed by a number of free radical catalysts, the most important of which are hydroxyl (OH), nitric acid (NO), atomic chlorine (Cl) and bromine (Br). All these radicals have both natural and anthropogenic (manmade) sources.

Human activity has dramatically increased the chlorine and bromine. These elements are bound in certain stable organic compounds - especially CFCs, which may find their way to the stratosphere without being destroyed in the troposphere.

Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by the action of UV light and can destroy an ozone molecule in a catalytic cycle.

- In this cycle, a chlorine atom reacts with an ozone molecule, taking an oxygen atom with it (forming ClO) and leaving a normal oxygen molecule.
- A free oxygen atom then takes away the oxygen from the ClO , and the final result is an oxygen molecule and a chlorine atom. Which then re-initiates the cycle.

Population growth :-

- Population growth is the change in population over time and can be quantified as the change in the number of individuals in a population using "per unit time" for measurement.
- The rapid growth of the world's population over the past one hundred years results from a difference between the rate of birth and the rate of death.
- The growth in human population around the world affects all people through its impact on the economy and environment.
- The combination of a continuing high birth rate and a low death rate is creating a rapid population increase in many countries. In Asia, overpopulation occurs when the population of a living species exceeds the carrying capacity of its ecological niche.

Effects of Overpopulation: -

- ① People struggling to live under poor conditions.
- ② Low life expectancy.
- ③ Low level of literacy.
- ④ Insufficient arable land.
- ⑤ Little surplus food.
- ⑥ Low level of capital formation.
- ⑦ Unhygienic living conditions for many.
- ⑧ Decreasing human population towards equilibrium.
- ⑨ Economically stretched government.
- ⑩ Increase in the dependency burden due to the greater number of younger people in the population.

Automobile Pollution

- Automobile pollution is the introduction of harmful material into the environment by motor vehicles. Pollutants produced by vehicles exhausts CO, hydrocarbons, nitrogen oxides, particles, volatile organic compounds and sulphur dioxide.
- Internal combustion engines need a mixture of air and fuel to burn and produce energy to move the vehicle. The burnt gases which come out the exhaust have the potential to cause pollution.
- In petrol engines, the gases comprise of a mixture of unburnt hydrocarbons (HC), CO, oxides of nitrogen.
- Within a certain range they are acceptable, but when the engine is not tuned properly, or a vehicle uses obsolete technology, or the quality of fuel is not good, all these result in a higher.

level of emission of all the gases. When in excess quantity, these tend to cause automobile pollution.

- Important parameters affecting quality of emission from automobiles are vehicular technology, fuel type and quality, inspection and maintenance of engine, vehicles and road and traffic conditions.

- Further, the intake air, having sufficient significant concentrations of the pollutants and relative deficiency of oxygen particularly in highly polluted urban areas, may also yield test results showing even non-polluting vehicles as polluting.

- Pollution hazards and human health: The major pollutants emitted by motor vehicles include CO, oxides of nitrogen, sulphur oxides, hydrocarbon, lead and suspended particulate matter. These pollutants have damaging effects on both human health and ecology.

- High level of SO₂ and SPM (suspended particulate matter) are associated with increased mortality, morbidity and impaired pulmonary function. Lead prevents haemoglobin synthesis in RBCs in bone marrow, impairs liver and kidney function and causes neurological damage.

Steps to check automobile pollution

- Change engine oil at manufacturer recommended intervals or if the vehicle has been lying unused for a long period.

- while changing lubricant, make sure you use the recommended brand (Good grade of oil)
- check and adjust tappet clearance.
- inspect spark plug clearance, clean and adjust gap. replace plug if necessary.
- check the ignition timing and set as per the manufacturer's recommendation.
- If the vehicle has been parked unused for a long time, have the engine turned and the engine oil replaced.
- Try and drive around the speeds of 50-60 kmph in top gear.
- Speeding increases fuel consumption and this in turn increases pollution.
- Switch OFF the engine at red lights or where you are likely to stop for more than two minutes.

Alternatives

- Methanol, petroleum, natural gas and electricity could all be theoretically utilised with less cost, less emissions and more efficiency than ordinary gasoline.

Burning OF Paddy Straw

- Paddy straw is produced as a byproduct of rice production at harvest. After harvesting, the farmers set paddy stubble ablaze in the Indo-Gangetic plains of farmers in Punjab, Haryana and Uttar Pradesh to prepare ground for Rabi crop sowing. Then the rice straw is openly burnt in the fields.

- due to shortage of funds, shortage of time and as a easy method of disposal before sowing the next crop.
- In rainy season after harvest can leave fields too wet, burning straw is considered a low cost solution, alternative to tilling in the straw.
- Under such circumstances, farmers burn the straw.
- In addition to wheat, paddy, sugarcane leaves are most commonly burnt.

Environment and health risk.

- In the process, they damage soil quality and cause heavy pollution. It will produce smoke and greenhouse gases.
- A study estimates that crop residue burning released 149.24 million tonnes of CO_2 , over 9 million tonnes of CO , 0.25 million tonnes of oxides of sulphur, 1.28 million tonnes of particulate matter and 0.07 million tonnes of black carbon.
- The heat from burning paddy straw penetrates 1 cm into the soil, elevating the temperature to $33.8 - 42.2^\circ\text{C}$. This kills the bacteria and fungal populations critical for a fertile soil.
- Burning of crop residue causes damage to other organisms present in the upper layer of the soil as well as its organic quality.
- Due to the loss of "friendly" pests, the enemy

pests has increased and as a result, crops are more prone to disease.

Solution to the problem:-

- Straw is traditionally used as bedding for livestock, but as with other organic wastes, rice straw can be used for feeding the cattle, energy generation, including ethanol, biogas and biooil.
- Instead of using/burning stubble, it can be used in different ways like compost manure, flooring in rural areas, brick kilns and end products such as pellets, biomass energy, biofuels, particle board, mushroom cultivation, packing materials etc.
- Paddy straw made into pellets or torrefied can be mixed along with coal in thermal power plants. This will save coal as well as reduce carbon emissions.

Measures taken by the Government:-

Burning crop residue is a crime under Section 188 of the IPC and under the Air and Pollution Act of 1981. On December 10, 2015, the National Green Tribunal (NGT) had banned crop residue burning in the states of Rajasthan, Uttar Pradesh, Haryana and Punjab. Punjab Government imposed a penalty of Rs. 72.2 lakh farmers in 2016 for burning of crop residue.