Current Environmental Problems, Environmental Legislation

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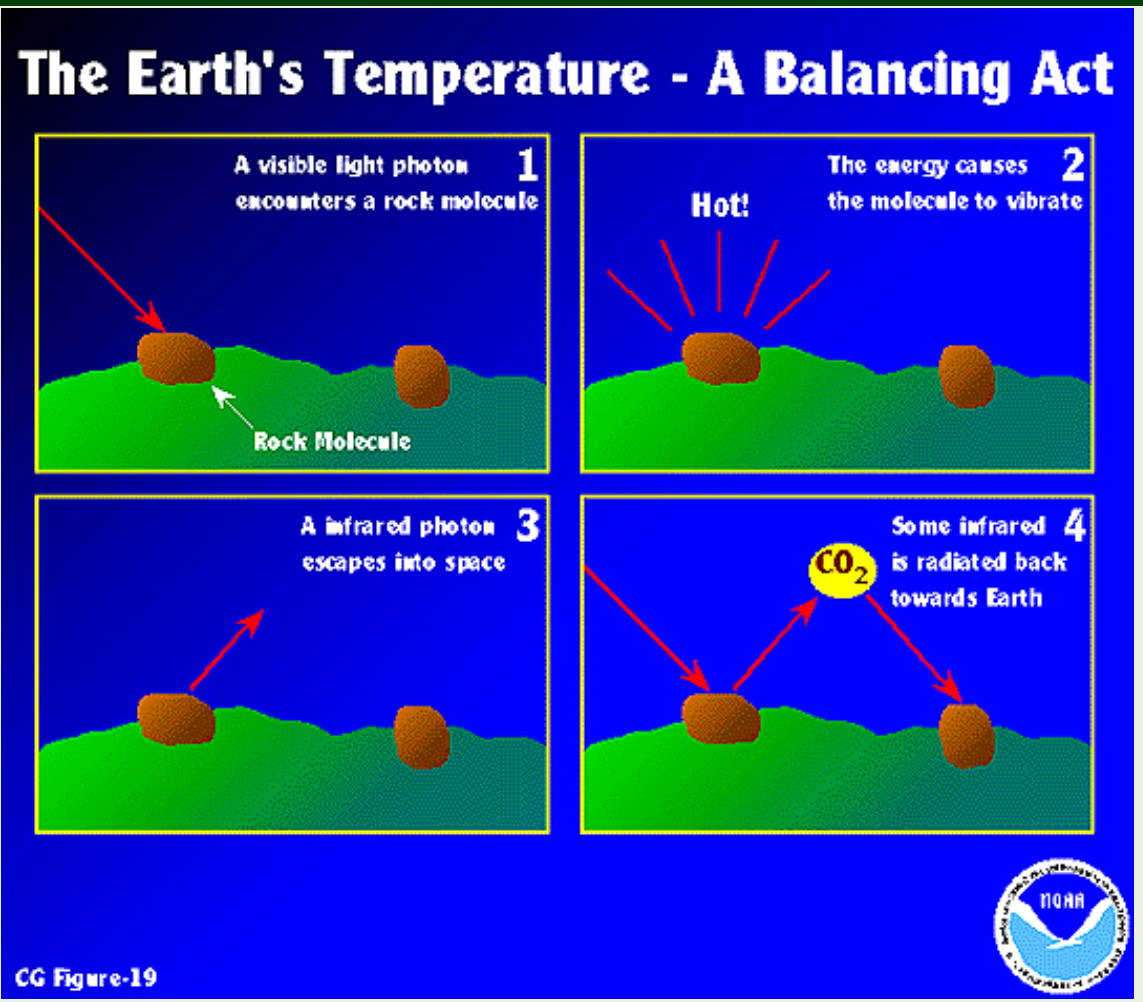
Current Environmental issues

- Greenhouse effect and Global Warming
  - The term greenhouse effect is used to indicate a heat-trapping process caused by gases such as carbon dioxide, and water vapour which are transparent to incoming solar radiations but re-emit the infrared radiations from Earth's surface.
  - Global warming is a long-term rise in the average temperature of Earth as a whole as a result of greenhouse effect.

Current Environmental issues



Process

1. High energy wavelengths hit the earths surface

2. Incoming energy is converted to heat

3. Longer, infrared wavelengths hit greenhouse gas molecules in the atmosphere

4. Greenhouse gas molecules in the atmosphere emit infrared radiation back towards earth

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Greenhouses Gases

Some common greenhouse gases

1. Carbon dioxide
2. Methane
3. Nitrous oxide
4. Chlorofluoro carbons

Causes of greenhouse gases

1. Fossil-fuel burning
2. Industrial processes
3. Deforestation
4. Livestock
5. Biomass burning
6. Coal mining

Global Warming Potential (GWP)

$$GWP_i = \frac{\int_{TR}^{TH} a_i c_i(t)dt}{\int_{TR}^{TH} a_{CO_2} c_{CO_2}(t)dt}$$

Where,
a_i is the instantaneous radiative forcing due to the release of a unit mass of trace gas, i, into the atmosphere, at time TR, C_i is the amount of that unit mass remaining in the atmosphere at time, t, after its release and TH is TR plus the time horizon over which the calculation is performed

GHG	GWP for 100 years
CO_2	1
CH_4	23
N_2O	296
HFC - 23	12 000
HFC – 134a	1 300
SF_6	22 200

Source: *IPCC Third Assessment Report* (2001).

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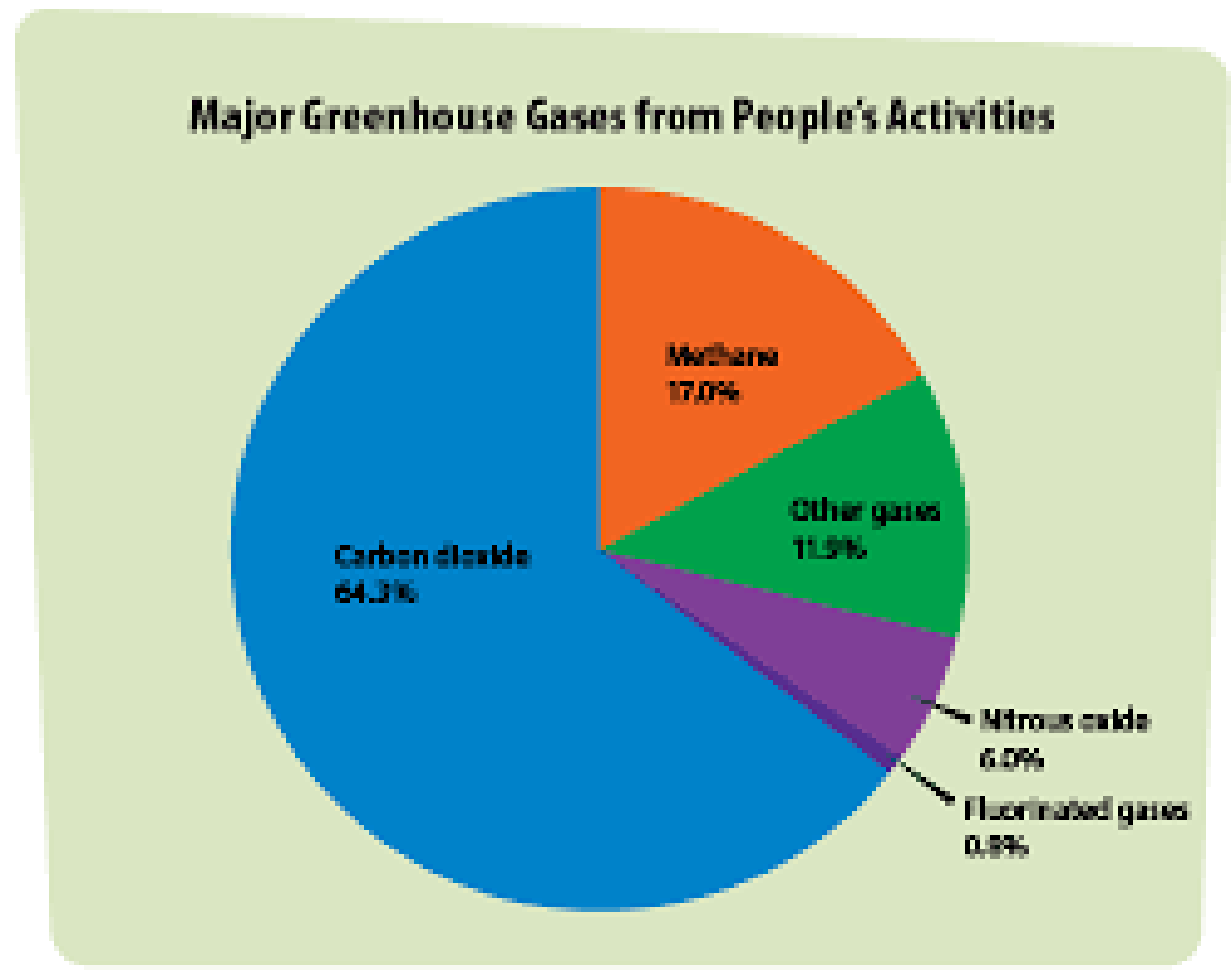
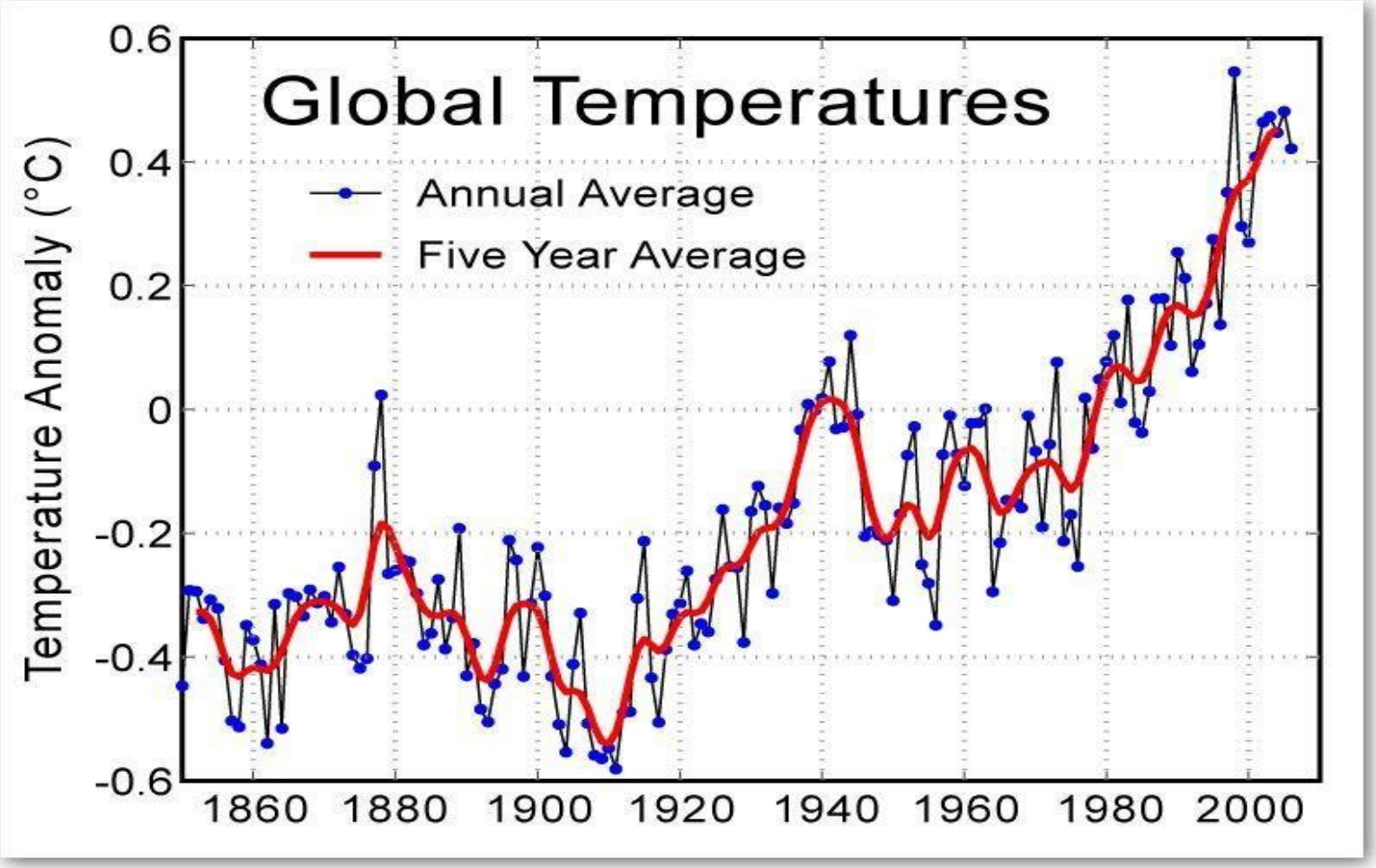
Effects of CO_2 increase

1. Air and the Earth's surface may grow warmer.
2. The stratosphere may become cooler.
3. Temperate and polar regions may become warmer leading to the reduction in the ice cover of the earth.
4. Rainfall may be higher than what it is present in the temperate regions.
5. The greater amount of evaporation due to excess warmth .

Emission of Greenhouses Gases



Emission of Greenhouses Gases



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Environmental Effects of Global warming

1. Climate change
2. Rise in sea level
3. Reduced agricultural production
4. Storms
5. Adverse effects on human health
6. Loss of ecosystems and biodiversity

Control measures of Global warming

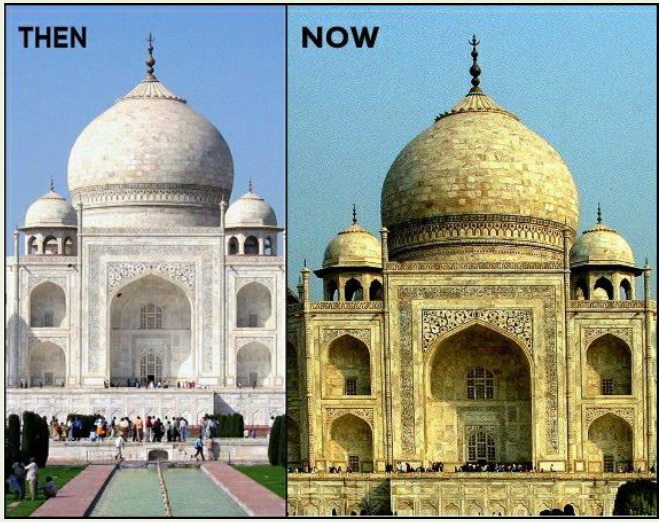
1. Reduction in the use of fossil fuels
2. Shifting to the renewable energy sources that do not emit greenhouse gases
3. Increasing the use of energy efficient and cleaner production technologies and practices
4. Reducing deforestation, adopting better forest management practices, and undertaking afforestation to sequester carbon

Acid Rain

Acid rain refers to a condition in which natural precipitation becomes acidic after reacting chemically with pollutants in the air.

Causes of Acid Rain

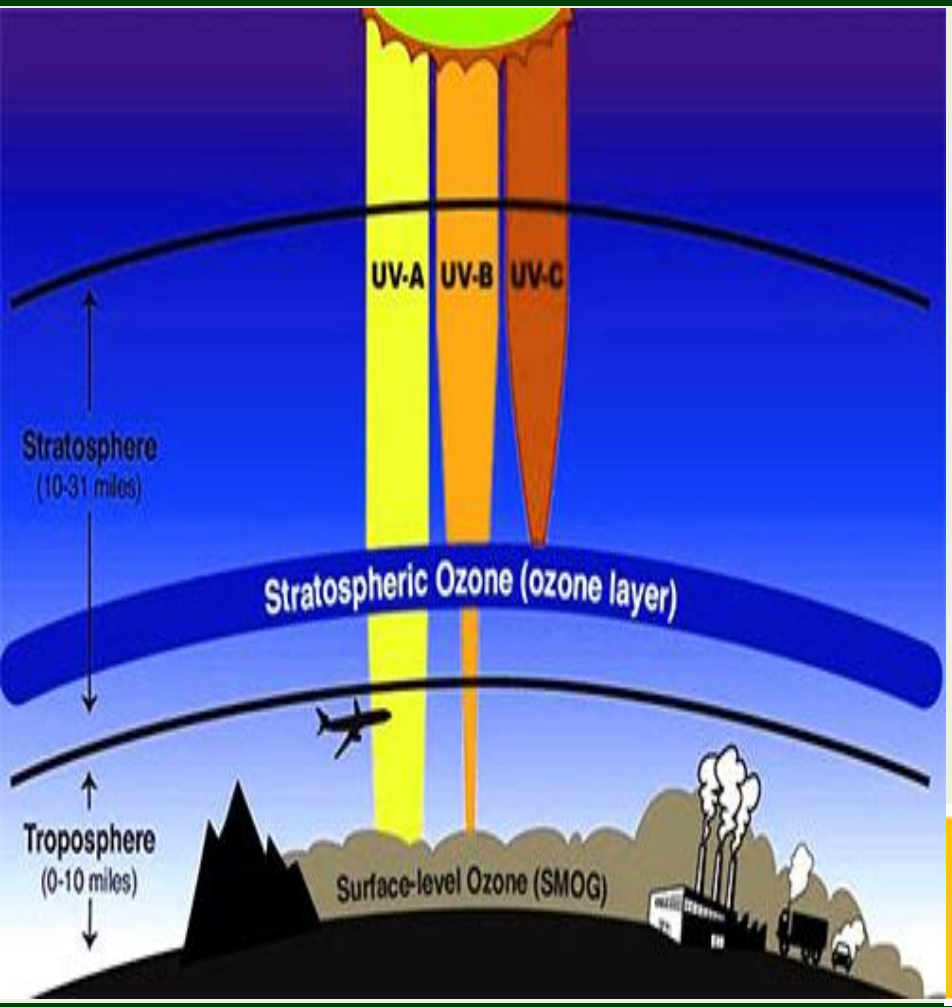
Burning of the fuel as well as the use of nuclear weapons leading to the evolution of large amounts of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), which get converted to sulphurous acid and nitric acid, respectively.



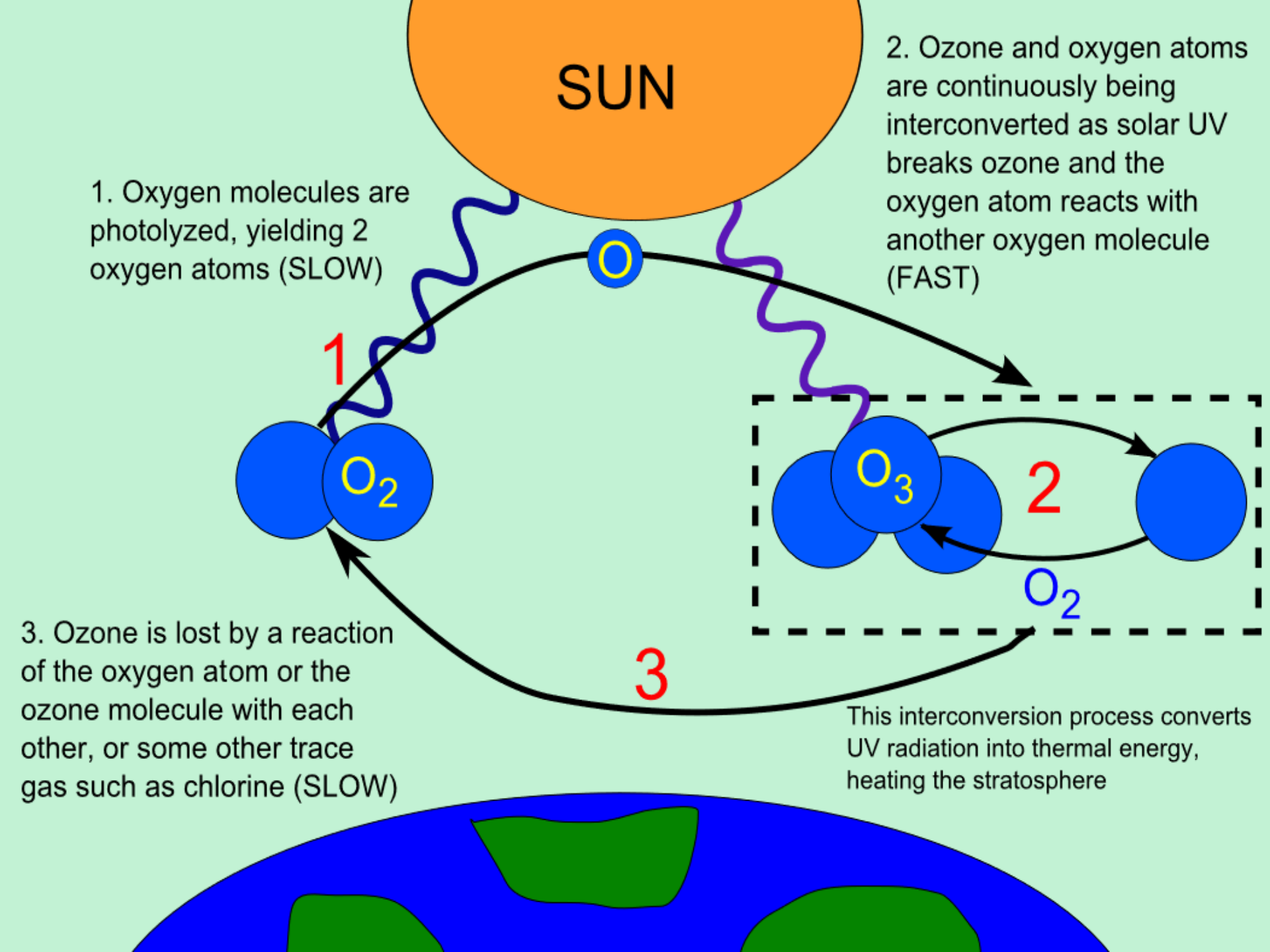
Effects of Acid rain

1. Reduction in population of flora and fauna
2. Damage to terrestrial ecosystems
3. Corrosion of buildings
4. Effect on human beings

Ozone Layer and Its Depletion



The decrease in the concentration of ozone (O_3) in stratosphere is known as ozone layer depletion.


SUN
1. Oxygen molecules are photolyzed, yielding 2 oxygen atoms (SLOW)
2. Ozone and oxygen atoms are continuously being interconverted as solar UV breaks ozone and the oxygen atom reacts with another oxygen molecule (FAST)
3. Ozone is lost by a reaction of the oxygen atom or the ozone molecule with each other, or some other trace gas such as chlorine (SLOW)
This interconversion process converts UV radiation into thermal energy, heating the stratosphere
O
1
O_2
O_3
2
O_2
3

Ozone Depleting Potential (ODP)

Dobson Unit (DU) = 2.6867 x 10^{20} molecules per meter square

Designation	Chemical Name		Relative ozone-depleting potential
CFC-11	CCl_3F	trichlorofluoromethane	1
CFC-12	CCl_2F_2	dichlorodifluoromethane	1
CFC-113	$C_2Cl_3F_3$	trichlorotrifluoroethane	0.80
CFC-114	$C_2Cl_2F_4$	dichlorotetrafluoroethane	1
CFC-115	C_2ClF_5	chlorodifluoromethane	0.6
CFC-22	$CHClF_2$	chlorodifluoromethane	0.05

Source : Report on Chlorofluorocarbons of the Institution of Environmental Health Officers, U.K., 1989.

ODS	Atmospheric lifetimes (years)	ODP
Freons:		
- CFC-11	55	1.0
- CFC-12	116	1.0
- CFC-113	110	1.1
- CFC-114	220	0.8
- CFC-115	550	0.5
Halons:		
- H-1301	67	16.0
- H-1211	40	4.0
- H-1202	33	1.3
CCl_4	47	1.1
CH_3CCl_3	47	0.1
CH_3Br	35	0.6

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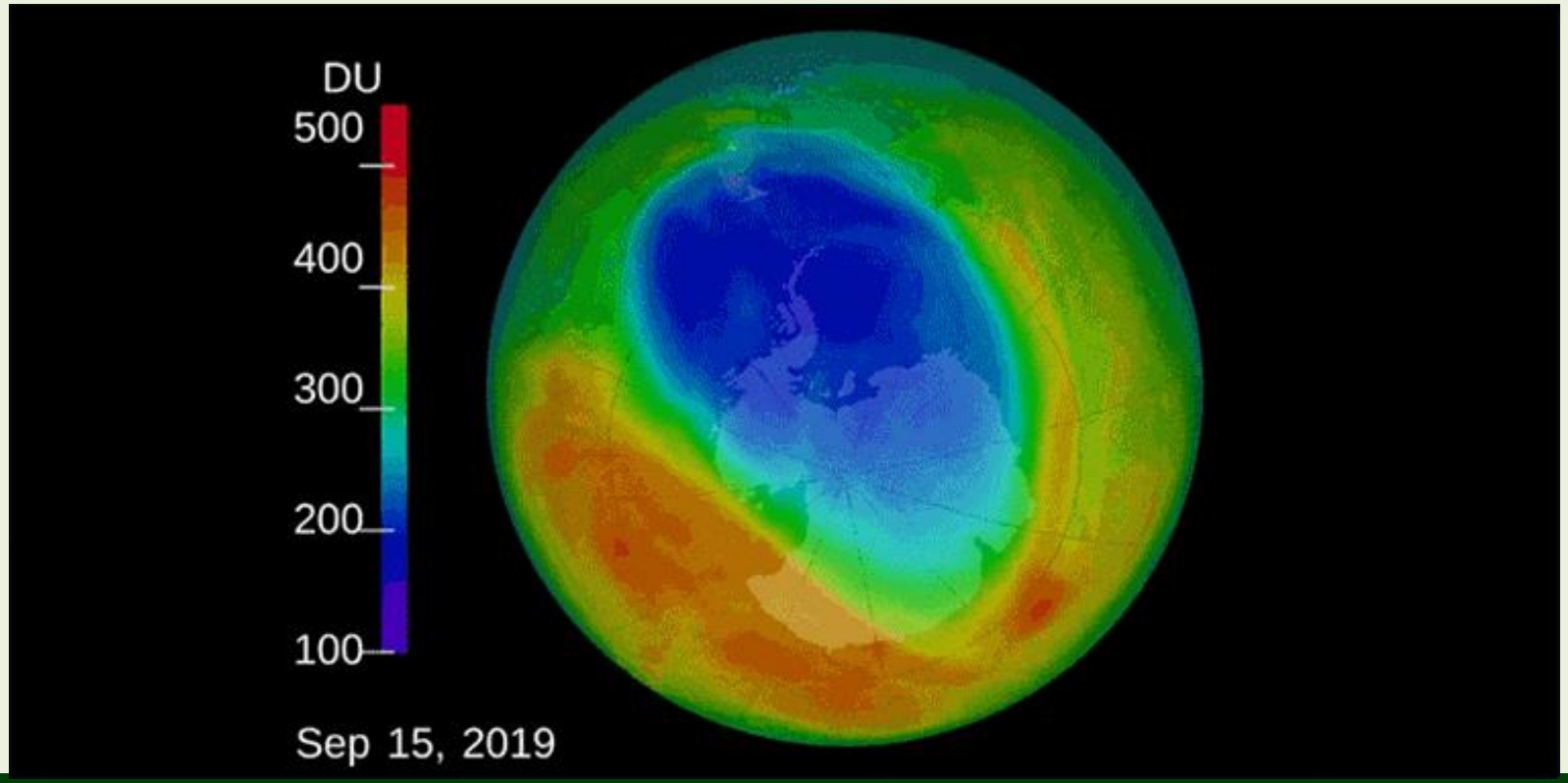
Ozone Hole

The thinning of ozone layer or reduction in concentration of ozone especially over the area of Antarctic continent is known as ozone hole, which covers approximately seven million square kilometer.



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The Environment Protection act 1986

Objective- It provides for the protection and conservation of the Environment.

1. Enacted in 1986, the Environment Protection Act is an important legislation aimed at protecting the environment and preventing pollution in India.
2. The Act provides for the prevention, control, and abatement of environmental pollution, and the protection of the environment overall.
3. The Act also empowers the central government to take necessary measures to protect and improve the quality of the environment.

POWERS OF THE CENTRAL GOVERNMENT

1. Laying down standards for the quality of environment in its various aspects.
2. Planning and execution of a nation-wide programme for the prevention, control and abatement of environmental pollution.
3. Laying down standards for emission or discharge of environmental pollutants from various sources.
4. Restriction of areas.
5. Laying down procedures and safeguards for the handling of hazardous substances.

7. Examination of such manufacturing processes, materials and substances which are likely to cause environmental pollution.

8. Inspection of any premises, plant, equipment, machinery, manufacturing or other processes, materials or substances.

9. Establishment or recognition of environmental laboratories and institutes.

10. Collection and dissemination of information in respect of matters relating to environmental pollution.

11. Preparation of manuals or guides relating to the prevention, control and abatement of environmental pollution.

Salient Features of the Environment Protection Act 1986

1. The Act provides for the establishment of Central and State Pollution Control Boards, which are responsible for enforcing the provisions of the Act and implementing pollution control measures.
2. The Act empowers the government to regulate and restrict industrial activities that may cause pollution, and to impose penalties for non-compliance.
3. The Act also provides for the appointment of Environmental Impact Assessment (EIA) authorities, who are responsible for assessing the potential environmental impacts of developmental projects before they are approved.

Impact of the Environment Protection Act 1986

1. The Environment Protection Act has a significant impact on the protection of the environment in India.
2. The Act has led to the establishment of pollution control measures, such as the installation of effluent treatment plants, and has helped to reduce the pollution levels in air and water.
3. The Act has also led to the promotion of sustainable development practices, and has helped to raise public awareness about the importance of protecting the environment.

Amendments of Environment Protection Act 1986

Amendment	Year	Key Provisions
1st Amendment	1991	-Introduced the concept of "hazardous substances“ -Required certain industries to obtain consent from the State Pollution Control Board (SPCB) before operating
2nd Amendment	1992	- Made it mandatory for industries to disclose information related to the discharge of pollutants into the environment
3rd Amendment	1997	- Established the National Environment Appellate Authority to hear appeals against decisions made by the central and state pollution control boards
4th Amendment	2001	strengthen the provisions for penalizing polluters and introduced the concept of 'polluter pays principle', which makes polluters liable to pay for the environmental damage caused by their activities.
5th Amendment	2003	- Increased penalties for offenses under the Act
6th Amendment	2010	- Introduced provisions related to the regulation of electronic waste
7th Amendment	2021	- Introduced provisions related to the management of air pollution in the National Capital Region (NCR)

Environmental Impact Assessment (EIA)

1. EIA is a process of evaluating the potential environmental impacts of a proposed project or development.
    1. Examples: Construction of a new road or building, Mining and mineral extraction, Large-scale agricultural projects, Oil and gas exploration and production
2. Steps in Environmental Impact Assessment:
    1. Screening
    2. Scoping
    3. Assessment
    4. Mitigation
    5. Review and Monitoring

Air (Prevention and Control of Pollution) Act of 1981

1. Air (Prevention and Control of Pollution) Act, 1981 was enacted by the Indian Parliament to provide for the prevention, control, and abatement of air pollution.
2. The Act aims to protect and improve the quality of air and to prevent and control air pollution in India.
3. Some of the key features of the Act include the establishment of State Pollution Control Boards, the regulation of industries and vehicles, and the imposition of penalties for non-compliance with the provisions of the Act.

Roles and Responsibilities of Air (Prevention and Control of Pollution) Act of 1981

1. The Act assigns certain roles and responsibilities to different entities for the prevention and control of air pollution.
2. The Central Pollution Control Board (CPCB) is responsible for coordinating the activities of State Pollution Control Boards and providing technical assistance and guidance to them.
3. The State Pollution Control Boards (SPCBs) are responsible for implementing the provisions of the Act within their respective states and monitoring air quality.
4. Industries and other establishments are required to obtain a consent to operate under the Act and comply with emission standards and other regulations.

Roles and Responsibilities of Air (Prevention and Control of Pollution) Act of 1981

5. The Act prescribes penalties for various offences related to air pollution. These penalties can range from fines to imprisonment.
6. Some of the offences under the Act include operating an industrial plant without obtaining a consent to operate, violating emission standards, and failing to comply with the directions of the SPCBs or CPCB.
7. The Act also provides for the closure of industries or establishments that violate the provisions of the Act and pose a serious threat to public health and the environment.

Amendments of Air (Prevention and Control of Pollution) Act of 1981

Amendment	Year	Key Provisions
1st Amendment	1987	-Introduced the concept of "hazardous substances" -Required certain industries to obtain consent from the State Pollution Control Board (SPCB) before operating
2nd Amendment	1991	- Made it mandatory for new industries to obtain a "no objection certificate" (NOC) from the SPCB before starting operations
3rd Amendment	1993	-Added provisions related to the prevention and control of vehicular pollution. -Introduced the concept of "pollution under control" (PUC) certificates for vehicles. -Required new vehicles to meet emission standards set by the Central Pollution Control Board (CPCB)
4th Amendment	1998	- Made it mandatory for existing industries to obtain a renewal of their consent from the SPCB every five years
5th Amendment	2018	-Expanded the definition of "air pollutant" to include particulate matter -Introduced new emission standards for thermal power plants and cement industries -Made it mandatory for construction sites measuring more than 20,000 square meters to obtain environmental clearance from the CPCB

NAAQS (National Ambient Air Quality Standard), 2009

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual* 24 hours**	50 80	20 80
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual* 24 hours**	40 80	30 80
Particulate Matter (size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual* 24 hours**	60 100	60 100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual* 24 hours**	40 60	40 60
Ozone (O_3) $\mu g/m^3$	8 hours* 1 hour**	100 180	100 180
Lead (Pb), $\mu g/m^3$	Annual* 24 hours**	0.50 1.0	0.50 1.0
Carbon Monoxide (CO) mg/m^3	8 hours* 1 hour**	02 04	02 04
Ammonia (NH_3) $\mu g/m^3$	Annual* 24 hours**	100 400	100 400
Benzene (C_6H_6) $\mu g/m^3$	Annual*	5	5
Benzo(a)Pyrene (BaP)- particulate phase only, ng/m^3	Annual*	1	1
Arsenic(As), ng/m^3	Annual*	6	60
Nickel (Ni), ng/m^3	Annual*	20	20

Water (Prevention and Control of Pollution) Act 1974

1. Water (Prevention and Control of Pollution) Act, 1974 is a legislation enacted by the Indian Parliament to prevent and control water pollution.
2. The Act aims to maintain and restore the wholesomeness of water and to establish central and state boards for the prevention and control of water pollution.
3. Some of the key features of the Act include the regulation of discharge of pollutants into water, the establishment of standards for water quality, and the imposition of penalties for non-compliance with the provisions of the Act.

Roles and responsibilities of Water (Prevention and Control of Pollution) Act 1974

1. The Act assigns certain roles and responsibilities to different entities for the prevention and control of water pollution.
2. The Central Pollution Control Board (CPCB) is responsible for coordinating the activities of State Pollution Control Boards and providing technical assistance and guidance to them.
3. The State Pollution Control Boards (SPCBs) are responsible for implementing the provisions of the Act within their respective states and monitoring water quality.
4. Industries and other establishments are required to obtain a consent to operate under the Act and comply with effluent standards and other regulations.

Roles and responsibilities of Water (Prevention and Control of Pollution) Act 1974

5. The Act prescribes penalties for various offences related to water pollution. These penalties can range from fines to imprisonment.
6. Some of the offences under the Act include discharging pollutants into water without obtaining a consent to operate, violating effluent standards, and failing to comply with the directions of the SPCBs or CPCB.
7. The Act also provides for the closure of industries or establishments that violate the provisions of the Act and pose a serious threat to public health and the environment.

Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982)

S. No	Water quality parameter	Characteristic of water body				
		A *	B *	C *	D *	E *
1	Dissolved Oxygen (DO) mg/l (minimum)	6	5	4	4	3
2	Biochemical Oxygen Demand (BOD), mg/l (max)	2	3	3	-	-
3	Total Coliform organisms ** MPN/100ml (max)	50 **	500	500	-	-
4	Total Dissolved Solids (TDS) mg/l (max)	500	-	1500	-	2100
5	Chlorides (as Cl^-) mg/l (max)	250	-	600	-	600
6	Colour, Hazen units (max)	-	10	300	300	-
7	Sodium Absorption Ratio (max)	-	-	-	-	20
8	Boron (as B), mg/l (max)	-	-	-	-	-
9	Sulphates (as SO_4^{-2}), mg/l (max)	400	-	400	-	1000
10	Nitrates (as NO_3^-) mg/l (max)	20	-	50	-	-
11	Free Ammonia (as NH_3) mg/l (max)	-	-	-	1.2	-
12	Conductivity at 25°C micro mhos/cm (max)	-	-	-	1000	2500
13	pH value	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5
14	Arsenic (as As), mg/l (max)	0.05	0.2	0.2	-	-
15	Iron (as Fe), mg/l (max)	0.3	-	-	0.5	-
16	Fluoride (as F), mg/l (max)	1.5	1.5	1.5	-	-
17	Lead (as Pb), mg/l (max)	0.1	-	0.1	-	-

Note: * Classes of water use:

A Drinking water source without conventional treatment but after disinfection
B Out door bathing (organised)
C Drinking water source with conventional treatment followed by disinfection.
D Propagation of wild life, fisheries.
E Irrigation, industrial cooling, controlled waste disposal.

Amendments of Water (Prevention and Control of Pollution) Act 1974

Amendment	Year	Key Provisions
1st Amendment	1988	-Introduced the concept of "hazardous substances“ -Required certain industries to obtain consent from the State Pollution Control Board (SPCB) before discharging effluent
2nd Amendment	1991	- Made it mandatory for new industries to obtain a "no objection certificate" (NOC) from the SPCB before starting operations
3rd Amendment	1994	- Made it mandatory for all existing industries to obtain a renewal of their consent from the SPCB every five years
4th Amendment	2003	- Introduced provisions related to the prevention and control of groundwater pollution
5th Amendment	2018	-Introduced provisions related to the regulation of groundwater extraction -Required industries to obtain a "consent to operate" from the SPCB before extracting groundwater -Made it mandatory for all industries to comply with effluent and emission standards set by the CPCB

Wildlife Protection Act of 1972

The Wildlife Protection Act of 1972 is a comprehensive legislation that aims to protect and conserve the wildlife and its habitats in India.

Objective- The objective of the Wildlife Protection Act of 1972 is to protect the wildlife of India and to regulate hunting, poaching, and trade in wildlife and their products..

Functions-

1. To provide protection to all forms of wild animals, birds, and plants.
2. To ensure the conservation of wildlife and their habitats.
3. To regulate hunting, trapping, and poaching of wild animals.
4. To establish protected areas such as national parks, sanctuaries, and biosphere reserves for the conservation of wildlife.
5. To prevent the trade of wildlife and their products.
6. To provide legal framework for the management of captive animals and their welfare.
7. To promote public awareness about wildlife conservation and their importance.
8. To encourage research and scientific studies on wildlife and their habitats.
9. To coordinate with other countries for the protection and conservation of migratory species.
10. To provide punishment and penalties for violation of the provisions of the Act.

Wildlife Protection Act of 1972

Year	Key Provisions
1982	-Included new species in the list of protected animals -Increased penalties for offenses under the Act
1992	-Established the Central Zoo Authority to regulate zoos in the country
1993	- Introduced provisions related to the protection of plants and their habitats
2003	-Established the National Board for Wildlife to advise the government on wildlife conservation issues
2013	-Increased penalties for offenses under the Act

Forest Conservation Act of 1980

Objective- It provides for the protection and conservation of the forests.

Under the Act, a state government may regulate or prohibit in any forest the clearing of land for cultivation, pasturing of cattle, or clearing the vegetation for any purpose.

Functions-

- The Forest Conservation Act was enacted in 1980 to regulate the diversion of forest land for non-forestry purposes such as mining, industries, infrastructure, and other developmental activities.
- The act requires prior approval from the central government for any diversion of forest land for non-forestry purposes.
- The act provides for compensatory afforestation, which means that an equivalent area of land has to be afforested in lieu of the forest land that was diverted.
- The act also mandates the creation of a national committee to oversee the implementation of the act and ensure that the diversion of forest land is kept to a minimum.
- The Forest Conservation Act is aimed at protecting the forests and ensuring their sustainable use, as forests are an important part of the country's natural resources and provide a range of ecological, economic, and social benefits.

Amendments of Forest Conservation Act of 1980

Year	Key Provisions
1988	-National forest policy was introduced
1992	-Established the National Afforestation and Eco-Development Board to promote afforestation and regeneration of degraded forests
1996	- Introduced provisions related to the participation of local communities in forest conservation and management
2003	- Made it mandatory for state governments to seek the approval of the central government before diverting forest land for non-forestry purposes
2017	-Exempted bamboo grown in non-forest areas from the definition of "tree" under the Act -Allowed for the cultivation and harvesting of bamboo grown in forest areas by tribal communities

Environmental protocols

- Kyoto Protocol (1997)
  - Aims to reduce greenhouse gas emissions and combat climate change.
  - It was adopted in 1997 and came into force in 2005.
  - The protocol set binding targets for 37 industrialized countries and the European Union to reduce their greenhouse gas emissions below 1990 levels.
  - The goal was to collectively reduce emissions by 5.2% by the end of 2012.
  - The protocol created a market-based mechanism known as carbon trading, where countries that exceed their emissions reduction targets can sell excess credits to countries that have not met their targets.
  - The protocol also established the Clean Development Mechanism (CDM), which allows industrialized countries to earn credits by funding emission reduction projects in developing countries.
  - The Kyoto Protocol has been criticized for not including major emitters such as China and the United States, who later withdrew from the agreement.
  - Despite these criticisms, the Kyoto Protocol served as an important precursor to the Paris Agreement, which was adopted in 2015 and set more ambitious emissions reduction targets.

Environmental protocols

- Montreal Protocol (1987)
  - The Montreal Protocol was adopted in September 1987 and entered into force on January 1, 1989.
  - The protocol is an international treaty that aims to protect the ozone layer by phasing out the production and consumption of substances that deplete it, such as chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS).
  - The protocol has been successful in reducing the production and consumption of ODS, and as a result, the ozone layer is slowly recovering.
  - The protocol has been amended several times to strengthen its provisions and address new ozone-depleting substances that have been discovered.
  - The protocol has been ratified by nearly every country in the world, making it one of the most widely adopted environmental treaties in history.
  - The success of the Montreal Protocol has demonstrated that international cooperation and action can be effective in addressing global environmental challenges.

Environmental protocols

- Convention on Biological diversity (1992)
  - The CBD has been ratified by 196 countries and the European Union, making it one of the most widely recognized international environmental treaties.
  - Three main objectives:
    - The conservation of biological diversity
    - The sustainable use of its components
    - The fair and equitable sharing of benefits arising from the use of genetic resources.
  - Nagoya Protocol: In 2010, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization was adopted as a supplementary agreement to the CBD.
  - The CBD has set several targets to protect and conserve biodiversity, including the Aichi Biodiversity Targets, which aim to halt the loss of biodiversity by 2020.
  - Despite the efforts of the CBD, the world has not met the biodiversity targets set by the Convention. There are several challenges to the implementation of the CBD, including lack of political will, inadequate financial resources, and insufficient public awareness about the importance of biodiversity conservation.

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Aichi Biodiversity Targets

- **Strategic Goal A:** Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- **Strategic Goal B:** Reduce the direct pressures on biodiversity and promote sustainable use
- **Strategic Goal C:** To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- **Strategic Goal D:** Enhance the benefits to all from biodiversity and ecosystem services
- **Strategic Goal E:** Enhance implementation through participatory planning, knowledge management and capacity building

Issues involved in enforcement of Environmental Laws

- Illiteracy
- Growing population
- Ignorance
- Economic reasons
- Insufficiency of laws

Thank You

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