# EVS MODEL QUESTION
# TOPIC :- BIODIVERSITY

1. A plant endemic to India is
   a. Wild life
   b. Fossils fuels
   c. Water
   d. Forest [b]

2. A species restricted to a given area is
   a. Endemic species
   b. Allopatric species
   c. Sympatric species
   d. Sibling species [a]

3. An endangered bird is
   a. Passenger pigeon
   b. Pink-headed duck
   c. Great indian bustard
   d. Vulture [c]

4. An example of ex-situ conservation is
   a. Seed bank
   b. Sacred groves
   c. National park
   d. Wildlife sanctuary [a]

5. An inexhaustible and renewable source of energy is
   a. Wood
   b. Natural gas
   c. Fossil fuel
   d. Hydropower [d]

6. Anthropogenic extinction occurs due to
   a. Earthquakes
   b. Floods
   c. Changing environmental conditions
   d. Human activities [d]

7. Conservation of species in its natural habitat is called
   a. In-situ
   b. Ex-situ

c. In-vitro
d. Both b and c [a]

8. Development of botanical garden in what type of conservation
   a. Ex-situ
   b. A common
   c. An easy
   d. In-situ [a]

9. In a national park protection is provided to
   a. Entire ecosystem
   b. Flora fauna
   c. Fauna only
   d. Flora only [b]

10. Islands have higher number of endemic species as they are separated from land masses by
    a. Deserts
    b. Mountains
    c. Large expanses of water
    d. Valleys [c]

11. Life supporting zone of earth's surface is called
    a. Lithosphere
    b. Biosphere
    c. Stratosphere
    d. Ecotone [b]

12. Main cause of extinction of species from tropical areas is
    a. Afforestation
    b. Deforestation
    c. Pollution
    d. Soil erosion [b]

13. Most of endangered species are victims of
    a. Acid rain
    b. Competition with exotic species
    c. Over hunting
    d. Habitat destruction [d]

14. Plants of endangered species are conserved through
    a. Herbarium
    b. Gene library
    c. Gene bank
    d. Reducing pollution [c]

15. Population of species decreasing over a period is called as
    a. Extinct
    b. Eliminated
    c. Endangered
    d. Rare [c]

16. Red Data book contains information about
    a. Red coloured book
    b. Red eyed birds
    c. Red coloured fishes
    d. Endangered plants and animals [d]

17. Red data book deals with
    a. Maintains and publish list of endangered and endemic species
    b. Maintains and publish list of plants that are extinct.
    c. Maintains and publish list of animals that are extinct
    d. Maintains and publish list of dangerous species [a]

18. Serious threat to wild life is
    a. Habitat destruction
    b. International trade
    c. Introduction of exotic species
    d. Over exploitation [a]

19. The endangered fauna is
    a. The great indian bustard
    b. Viviparous toad
    c. Forest owl
    d. Kashmiri stag [a]

20. The human activities resulting in endangered species are
    a. Poaching
    b. Deforestation
    c. Forest fires
    d. All of these [d]

21. The natural cause for extinction of species is
    a. Floods
    b. Hunting
    c. Industrialization
    d. Destruction of natural habitats [a]

22. Restricted distribution of species in small area called

a. Niche
b. Biome
c. Endemism
d. Ectosphere [c]

23. Which of following is endemic species
    a. Vanda
    b. *Drosera*sp
    c. *Gnetumula*
    d. *Ginkgo biloba* [d]

## TOPIC : Energy Resources Question

1. A non-renewable source of energy is
    a. Wild life
    b. Fossil fuels
    c. Water
    d. Forest [b]

2. A renewable exhaustible natural source is
    a. Forest
    b. Coal
    c. Petroleum
    d. Minerals [a]

3. An exhaustible renewable resource is
    a. Coal
    b. Solar energy
    c. Fresh water
    d. Petroleum [c]

4. An inexhaustible and renewable source of energy is
    a. Wood
    b. Natural gas
    c. Fossil fuel
    d. Hydropower [d]

5. Biogas is which type of natural resources
    a. Renewable
    b. Inexhaustible
    c. Non-conventional

d. Both a and c [d]

6. Inexhaustible resource among the following is
   a. Minerals
   b. Solar energy
   c. Plants
   d. Fossil fuels [b]

7. Which one is not an exhaustible resource
   a. Solar energy
   b. Coal
   c. Rainfall
   d. Wind power [b]

8. Which one of the following is an example of non-renewable resource
   a. Wind
   b. Water
   c. Vegetation
   d. Coal and minerals [d]

9. Which of the following is a renewable resource
   a. Soil
   b. Water
   c. Flora and fauna
   d. All of the above [d]

10. Both power and manure are provided by
    a. Thermal plants
    b. Nuclear plants
    c. Biogas plants
    d. Hydroelectric plants [c]

11. _____ is the major raw material for biogas
    a. Plant leaves
    b. Cow dung
    c. Mud
    d. Grass [b]

12. Atomic energy is obtained by using ores of _____.
    a. Copper
    b. Uranium
    c. Neither a nor b
    d. Bot a and b [b]

13. Which one of the following is not a fossil fuel ?
    a. Natural gas
    b. Petrol
    c. Coal
    d. Uranium [d]

14. Which is not a conventional source of energy
    a. Natural gas
    b. Nuclear energy
    c. Hydel power
    d. Hydrogen energy [d]

15. Which has highest energy potential availability
    a. Small hydro
    b. Wind energy
    c. Ocean thermal
    d. Sea wave power [c]

16. Which has highest potential exploited
    a. Small hydro
    b. Wind energy
    c. Solar energy
    d. Biomass [b]

17. Which is the most widely used fuel source for electric power generation
    a. Coal
    b. Natural gas
    c. Hydro power
    d. Nuclear [a]

18. Which is not a leading country in production of hydroelectric power
    a. Australia
    b. Japan
    c. USA
    d. USSR [a]

19. Energy received from the sun is highest in which spectral region
    a. UV
    b. Visibe light
    c. Infra red
    d. UV and Viisible [c]

20. Wind energy is a form of solar energy, what percentage of solar energy is converted to wind energy

a. 10
b. 15
c. 20
d. 25 [c]

21. The whole world is facing and acute scarcity of
    a. Food
    b. Water
    c. Energy
    d. Wood [c]

22. Prices of energy resources are controlled by the economic principle of
    a. Supply
    b. Demand
    c. Supply and demand
    d. Consumption [c]

23. Out of the total primary energy which contributes the least
    a. Hydel power
    b. Natural ga
    c. Oil
    d. Nuclear power [d]

24. Common energy source in Indian Villages is
    a. Electricity
    b. Coal
    c. Sun
    d. Wood and animal dung [d]

25. Fossil fuels and metabolic minerals are
    a. Renewable resources
    b. Inexhaustible resources
    c. Nonrenewable resources
    d. Exhaustible resources [c]

26. Harnessing nuclear energy often causes
    a. Air pollution
    b. Water pollution
    c. Thermal pollution
    d. Noise pollution [c]

## TOPIC : Food Resources Question

1. _____ and _____ are combination of Agroforestry
   a. Fodder Crops, fibre crop
   b. Food crops, fibre crop
   c. Food crops, tree crop
   d. Tree, grasses [c]
2. Shifting cultivation is also known as
   a. Taungyo system
   b. Jhum cultivation
   c. Social forestry
   d. Plant cultivation [b]
3. planting of trees, shrubs and others in between crop plant for commercial exploitation and stabilization of soil is
   a. taungya system
   b. social forestry
   c. agroforestry
   d. production plantation [c]

# TOPIC : Forest Resources Question

4. a recent technique for study of vegetation is
   a. ground photography
   b. remote sensing
   c. field work
   d. observation [b]
5. agroforestry and social forestry both includes
   a. production forestry
   b. commercial forestry
   c. afforestation
   d. plantation of trees [d]
6. Chipko movement is an example of forest conservation through
   a. Tehri-garhwal district
   b. Uttaranchal
   c. Public awareness and participation
   d. Political issue [c]
7. Chipko movement is related to
   a. Forest conservation
   b. Soil conservation
   c. Water conservation
   d. Wetland conservation [a]

8. Chipko movement was launched for protection of
    a. Forests
    b. Grass lands
    c. Wet lands
    d. Live stocks [a]
9. Deforestation brings about
    a. Soil erosion
    b. Weed control
    c. Decreases drought
    d. Increases sunlight [a]
10. Deforestation is caused due to
    a. Silviculture
    b. Construction of roads
    c. Rainfall
    d. Plantation of trees [b]
11. Deforestation is the major causal agent of
    a. Depletion of natural resources
    b. Environmental pollution
    c. Desertification of habitat
    d. Genetic erosion [c]
12. Deforestation will decrease
    a. Soil erosion
    b. Land slides
    c. Soil fertility
    d. Rainfall [d]

13. Extensive planting of trees to increase forest cover is called
    a. Deforestation
    b. Agroforestry
    c. Social forestry
    d. Afforestation [d]

14. For mapping, remote sensing equipment is mounted on
    a. Aircraft and satellite
    b. Ship and spacecraft
    c. Satellite and spacecraft
    d. All the above [a]

15. Forests control drought by
    a. Preventing soil erosion
    b. Increasing oxygen

c. Increasing humidity and rainfall
d. Preventing floods [c]

16. Gamma and x-rays are not used for remote sensing because
    a. They are absorbed by the object
    b. They are reflected by the object
    c. They are absorbed by atmosphere
    d. They are not absorbed [c]

17. In India, common type of forest is
    a. Tropical thom forests
    b. Sal and teak forests
    c. Tropical most deciduous forest
    d. Tropical dry deciduous forest [d]

18. It is not a protected forest
    a. Reserve forest
    b. Sanctuary
    c. Core of biosphere
    d. Orchard [d]

19. Plantation of trees along with monocot crops is known as
    a. Agroforestry
    b. Silviculture
    c. Social forestry
    d. Afforestation [a]

20. Plantation of trees on unused farm land, road and rail sides etc is called
    a. Social forestry
    b. Agroforestry
    c. General forestry
    d. Commercial forestry [a]

21. radiation not useful in remote sensing are
    a. UV radiation
    b. Microwaves
    c. Ultrasonic waves
    d. Infra-red radiation [c]

22. Reforestation is
    a. Plantation of forests
    b. Plantation of forests in deforested areas
    c. Cutting down of forests
    d. Management of forests [b]

23. The function of trees plantation is celebrated through
    a. Environment day
    b. Vanikaran
    c. Social forestry programme
    d. Vasandmohatsav [c]

24. Which has caused maximum damage to Indian Forests
    a. Selective harvesting
    b. Block cutting
    c. Taungya cultivation
    d. Jhum cultivation

## Topic : Land Resources

1. Which type of land degradation process is most common in India
    a. Land slide
    b. Soil erosion
    c. Soil subsidence
    d. Desertification [d]
2. Chemical weathering of limestone results in formation of
    a. Potassium rich soils
    b. Calcium rich soils
    c. Laterite
    d. Quartz [b]
3. Sand is obtained due to weathering of
    a. Sand stone
    b. Quartz
    c. Silica
    d. Limestone [b]
4. Deforestation rate is alarming in
    a. Temperate countries
    b. Tropical countries
    c. Polar regions

d. None of the above [b]

5. Major causes of deforestation are
   a. Shifting cultication
   b. Fuel requirements
   c. Raw material for industries
   d. All of these [d]
6. Major consequences of deforestation are
   a. Destruction of natural habitat of wild species
   b. Disturbance in hydrological cycle
   c. Soil erosion
   d. All of these [d]
7. Minimum disturbance to soil is done by
   a. Contour farming
   b. No-till farming
   c. Terrace farming
   d. Alley cropping [b]
8. Forest cover of India is
   a. 20.6%
   b. 33.7%
   c. 50%
   d. 46.% [a]
9. Which of the following has largest forest cover?
   a. M.P.
   b. U.P.
   c. Kerala
   d. J & K [a]
10. Factors responsible for deforestation are
    a. Over-harvest of timber
    b. Conversion of forest land to agriculture
    c. Grazing
    d. Both a & b [d]
11. Shifting cultivation is also called
    a. Jhum cultivation
    b. Organic farming
    c. Green farming
    d. Agro forestry [a]
12. Soil fertility is due to
    a. Soil erosion
    b. Crop rotation
    c. Droughts
    d. Floods [b]
13. Agroforestry and social forestry both include

a. Production forestry
b. Commercial forestry
c. Afforestation
d. Plantation of trees [b]

14. Which two constitute agro forestry
a. Fodder crops and fibre crops
b. Food crops and fibre crops
c. Trees and grasses
d. Food crops and tree crop [d]

15. Main source of water to soil is
a. Rain fall
b. Rivers
c. Canals
d. Lakes [a]

16. In India common type of forest is
a. Tropical thorn forest
b. Sal and Teek forests
c. Tropical most deciduous forest
d. Tropical dry [d]

17. Which is best for plant growth
a. Loamy soil
b. Clayey
c. Gravel
d. Sandy soil [a]

18. The major cause of land degradation in our country is
a. Soil erosion
b. Pollution of soil
c. Water logging
d. None of these [a]

19. Where does terrace farming help the most in soil conservation
a. Hill regions
b. Wet areas
c. Deserts
d. Plains [a]

20. Forests control droughts by
a. Preventing soil erosion
b. Increasing oxygen
c. Increasing humidity and rainfall
d. Preventing floods [c]

# Topic : Solid waste management questions

1. The problem of waste management is becoming complicated day by day due to
   a. Obsolete techniques employed for waste management
   b. Large population
   c. Insanitary methods adopted for disposal of solid wastes
   d. All of the above [d]

2. Solid waste is material
   a. That is cheaper to throw away
   b. Cheaper to throw away than to store or use
   c. Recycle and reused
   d. None of the above [b]

3. The residential and commercial wastes mainly consists of
   a. Food wastes
   b. Cardboard
   c. Packaging material
   d. All of the above [a]

4. The cardinal principle in waste management is
   a. Reduction, reuse and recycling
   b. Effective management
   c. Use of latest techniques [a]
   d. None of the above

5. An integrated SWM system includes
   a. Generation of solid wastes
   b. Collection of solid wastes
   c. Waste minimization at source
   d. None of the above [c]

6. Which of the following is not a technique of waste minimization
   a. Minimizing the amount of material used in the manufacture of product
   b. Increase the useful life of the product
   c. Reducing the amount of material used for packaging and marketing of consumer goods
   d. All of the above [d]

7. The processes like composting, anaerobic digestion, incineration, pyrolysis, gasification etc.. are emplyyed for
   a. Volume reduction of wastes
   b. Waste transformation
   c. Recycling of wastes
   d. None of the above [b]

8. Which of the following is not a provision of municipal corporation act regarding collection of municipal solid wastes
    a. Organizing house to house collection of garbage
    b. Wastes from slaughter house, fruits and vegetable markets, which are biodegradable shall be managed of make use of such wastes
    c. Waste (garbage, dry leaves) shall not be burnt
    d. None of the above [d]

9. Which of the following criterion land filling shall meet in disposal of solid wastes
    a. Waste containing renewable material shall not follow the route or recycling
    b. Waste and disposal site shall not be burnt
    c. The landfill storage facility shall be daily attended for cleaning wastes
    d. None of the above [b]

# Topic to be covered for preparation of EVS

## 1. Biodiversity

### Introduction

Biodiversity or Biological diversity means variety of living organisms present on earth. Edward Wilson defines biodiversity as totality of genes, species and ecosystems on earth

- There are three levels of Biodiversity
  1. **Genetic level:** Diverse gene pools that no two individuals have same genetic combination.
  2. **Species Diversity:**Variety of species on earth. Species diversity is measured in terms of species richness. Out of 30 million species on earth only a fraction of it have been identified and documented.
  3. **Ecosystem diversity:**Variety of ecosystems or habitats on earth. Different marine, freshwater and terrestrial ecosystems and several microhabitats and micro ecosystems. Nature tries to maintain a homeostatic stage through environmental feedback mechanisms for long term functioning of ecosystem
- **Types of biodiversity**
  1. **Alpha biodiversity**: Variety of living organisms within a single community or ecosystem.
  2. **Beta diversity:**Variety of living organism along an environmental gradient ex. Mountainous top to low lands
  3. **Gama diversity:**Variety of living organisms over a landscape
- **Patterns of Biodiversity**
  1. **Master gradients of biodiversity:** Biodiversity is not evenly distributed
     **Latitudinal:**there is decrease in biodiversity from tropical region to polar region. It is highest near the equator, in the tropics due to warm climate and high production.
     **Longitudinal:** there is decrease in biodiversity along with ascent to the top of mountain.
     **Marine diversity** is highest along the coasts in western Pacific due to high sea temperature
     **Ex.** Cape floristic region: Yasuni National Park, Ecuador – high biodiversity
     **Terrestrial biodiversity** is 25 times greater than ocean biodiversity
     - **Total no. of species on earth = 8.7%**
     - **Total no of species in oceans = 2.1 %**

### Value of Biodiversity

- **Production:**food, fodder, fine wood, medicines, utilitarian (provisioning)
- **Consumption:**Fibres, medicines, timber, paper, industrial products; obtain raw materials for manufacturing industrial products of convenient and economic value.
- **Moral:** every species has equal right to live on this planet. Hence overexploitation culture is immoral.
- **Ethical:** tribal community are attached traditionally, worship, maintaining sacred groves, obtaining their livelihood etc.

- **Option value:** our knowledge about the use of species is limited, may be in future many species which we think are useless, may be life saving for future generations.
- **Recreational culture:** the beauty and serenity of nature is the best distressing pills for humans. Hence ecotourism is the best form of recreation.
- **Ecological services:** the benefits provided to mankind.

**Magnitude of biodiversity**

There are about 10-14 million species in the world only 1.8 million have been identified (Excluding bacteria) – According to IUCN

| | | |
|---|---|---|
| Plant species | - | 270000 |
| Vertebrate | - | 45000 |
| Insects | - | 950000 |

Plants constitute 22 % of total species
Animals constitute 70% of total species
Of this more than 70 % are insects

Origin of biodiversity:
According to Reice (1994) where ever more disturbances are there in the environment, there is high biodiversity. Hence maximum biodiversity occurs in Tropical rainforests and coral reefs, where ever harsh conditions prevail, minimum biodiversity occurs

**Conservation of Biodiversity**

Majority of species occurs in developing countries.
Tropical forests account for 6 percent of lithosphere but has 50-45 % of world species.
There are 19 mega diverse nations in world

1. Australia
2. Brazil
3. Cameroon
4. China
5. Colombia
6. Costa rica
7. Ecuador
8. Ethiopia
9. India
10. Indonesia
11. Madagascar
12. Malaysia
13. Mexico
14. Myanmar
15. Peru
16. Phillipines
17. S. Africa
18. Venezuela

19. Zaire

## Biodiversity status of India

Since India which has world's 2.4% land area, and has 8.1% of world species diversity, it is one of the 19 mega diversity nations.

Plant species = 45000

Animal species = 81000

Which account for 6.5 percent of world's biodiversity

Those species which occur only in a particular region are called endemic origin of 166 crop species and 320 wild crop species is India

There are about 50000 – 60000 rice species in India

## Biogeographic zones of India

1. **Trans Himalayan:** Tibetan plateau along with Ladakh and Lahaul-spiti cold deserts
2. **Himalays:**
3. **Gangetic plain**
4. **North Eastern Zone:** Plains and North Himalayan Ranges.
5. **Deserts:**Aravalli range, Rann of Kutchch salt desert and Rajasthan Sandy region
6. **Semi-arid zone:** Region lying between desert and Deccan plateau
7. **Western ghats**: along western coast
8. **Deccan peninsula**: south and south – central plateau, south of tapti river.
9. **Andaman and Nicobar Islands**:
10. **Coasts and Lakshdweep Islands**

## Extinction of species

When not even individual of the species occurs in the planet, then the species is known as extinct species. Since evolution of multi-cellular organisms, therewhere about 30 billion species on earth, where as today there are only 14 million species. Hence about 99.9 % of species have become extinct

## Mass extinction

Sudden mass disappearance of any species. Till now there had been 5 mass extinctions

a. 2 million years ago – 95% of marine species disappeared
b. 65 million years ago – disappearance of dinosaurs
c. Toda we are losing 100 species/day due to population explosion and resource utilization. Soon if the causes are unchecked the extinction rate will become 1000 species/day

## Co-extinction

When extinction of one species causes the extinction of other species. Eg. The only pollinator species for plant *Yucca* is the moth *Pronuba*. Hence extinction of moth will lead to the extinction of the plants.

Since 1900 on mammalian specie have become extinct every year.

In tropical forest about 1400 – 4000 species are getting lost. i.e. 2-5 species per hour

Ten high diversity areas of tropical forests have beel lost. 17000 endemic plant species hand 350000 endemic plant species.

10% of living species are in danger of extinction. About 25000 plant species and 1000 vertebrate speies and many invertebrate like, sponges, corals, insects and molluscs.

If proper steps are not taken, then we may lose 50 % of wild species at the end of 21st century

**Causes:** Global cooling, fall in sea levels, predation, competition or asteroid fall on earth.

The secretariat of UN convention on Biological diversity of published "Global Bioldiversityout look 3 in 2010 stating that if changes are not made in ancient trends of resource utilization then many ecosystems will not be able to provide the needs of present and future generations

Global study (2010) of biodiversity by Kew Gargens (UK) and National History Museum (London) and IUCN have highlighted the follosing.

1. 22% of plant species are threatened
2. Plants and mammals are equally threatened more threated than birds and less threatened than amphibians and corals.
3. Most threatened habitat is tropical rainforest
4. Most threatened species occur in tropics
5. Main culprit is **"MAN"** causing habitat loss by converting it to agricultural habitats or for livestock use.
6. Keystone species: that plays a major role towards survival and maintenance of equilibrium in ecosystem. Its extinction leads to collapse of the ecosystem e.g. top predator of grazing food chain.

**Indicator or sentinel species**

These are pollution indicators. Since they are highly sensitive species. For e.g. frogs. Rapid reduction in no of amphibians is indication of deterioration of environment.

**Major causes of Loss of Biodiversity**

1. Habitat loss due to fragmentation and environmental pollution.
2. Introduction of exotic species, which disrupts the natural food chains. Thus disfunctioning of the ecosystem. Eg. Cockroach *Periplaneta Americana* replaced Indian Cockroach (*Blattaorientalis*)
3. Hunting and poaching of animals for commercial use.
4. Population explosion (Human ): overexploitation of resources, intensive agriculture.

5. Natural calamities like floods, droughts and forest fires.
6. Illegal trade in endangered species.

Examples of alien species invasion: following specie have been introduced in India and Have become Nuisance

*Eucalyptus* and *Casuarina, Lantana camara (*Srilanka), *Eichornia*(Water hyacinth), *Parthenium*(Congress grass), Nile perch – predatory fish from Lake Victoria (S. Africa)

A species with reasonable number of individuals is threatened or vulnerable. If not conserved then will become endangered.

A species which has very few members left and if not protected will become critically endangered, which is on the verge of extinction.

**Hot spot**

it is a megadiversity region where the endemic species are threatened by human.

In India, biodiversity hot spots are

1. Eastern Himalayas
2. Western ghats

150 medicinal plants have become extinct, 10 percent flowering plants, 20 percent mammals and 5 percent birds are threatened/

Loss of rainforests will lead to disruption of climate-control mechanisms and thus affect world's climate.

Note: loss of biodiversity is irreversible.

**Biodiversity Conservation**

Red Data Book: it contains the list of all rare, endangered and threatened species all over the world.

A few endangered mammals of India out of a list of more than 100 animals

**Mammal:** Bison, Black Buck, Blue whale, Cheetah, Chital, Chinkara, Desert cat, Gangetic Dolphin, Himalayan ibex, Hyaena, Indian Lion, Indian elephant, Indian wild ass, Kashmir stag, leopard, Rhinoceros, Sloth bear, Tiger, Wild buffalo

**Reptiles:** monitor lizard, crocodile, Gharial, Turtle, Python, Tortoise, Water lizard

**Birds:** Black necked crane, Great Indian Bustard, hornbills, Falcons, Mountain quail, Peacock, Pea fowl

In India,

No of national Parks = 102

Wild life sanctuary = 515

Biosphere reserve = 18

Of 42 Articles in CBD which are about

In-situ conservation – 8

Ex-situ conservation – 9

In India, there are 25 wet lands of International Importance under Ramsar Convection.

Some are as follows

Rudrasagar – Tripura

Wularlake – J and K

Chilikalake – Orissa

Upper Ganga – U.P.

Bhoj Wet land – M.P.

Ashtamudi – Kerala

Pong Dam lake – H.P.

Keolades NP – Rajasthan

**Conservation of wild life**

1. In-situ Conservations

   **National parks:** A large area of environmental conservation where forestry operation and grazing activity is prohibited.

   **Wild life sanctuary:** Are for wild life species, where forestry operations are allowed

   A. P.: Kolleru (Elloru) – Pelicans
   Manjiri (Medak) – WLS – Crocodile
   Corianga (Godavari) – WLS-Heron, Flamingo
   Pulicat (Nillore) – WLS – Heron, Flamingo

   Andaman & Nicobar – North Reef Island – WLS

   Andaman & Nicobar – Barren - WLS

   Arunachal Pradesh – Itanagar – WLS – Elephant

   Arunachal Pradesh – Pakkui – WLS – Nawgeng

   Assam – Kaziranga (Project tiger) – Jorhat – one horned rhino

| | | |
|---|---|---|
| Jharkhand | - | Hazaribagh National Park – Tiger<br>DalmaWLS -Singhbhum – Elephant<br>Palamu WLS – Daltonganj – Elephant |
| Bihar | - | Rajgir WLS – Patna |
| Goa (Daman & Diu) | - | Mollen WLS – Goa – Gaur, Panther<br>Bondla WLS - Goa– Gaur, Panther<br>Cotigoa - Goa– Gaur, Panther |
| Gujarat | - | Gir NP. – Bhavnagar – Asiatic lion<br>NalSarovar Bird Sanct. – Ahmedabad<br>Wild Ass Sanct. – Surendra<br>Marine Sanct. – Gulf of kutch |
| Haryana | - | Sultanpur lake bird Sanct – Gurgaon |
| J & K | - | Dachigam WLS Srinagar – Musk deer<br>Shankarachari WLS – Srinagar – Chakor |
| H.P | - | Bandi, Mandi, goral, partridge,<br>Gobindsagar, BIlaspur– Birds |
| Karnataka | - | Bannarghatta NP – Bangalore – Elephant, chital<br>Bandipur NP (Project tiger) – Mysore – tiger, elephant<br>Tungabhadra WLS – Bellary) – Chinkara, florican<br>Ranganthittoo Bird sanct. – myrore – open bil stark |
| Kerala | - | Periyar WLS (Project tiger) – idukki – Nilgai<br>Wunad WLS – Cannore – Sambhar |
| M.P. | | Bandhargarh NP (Project tiger)<br>Kanha NP – Mandla<br>Panna NP – Panna<br>PanchmarhiSAnct. – Hoshangad<br>GandhisagarSanct. – Mandsaur |
| Maharashtra | - | Panchi NP – Nagpur<br>Borivli NP – Bombay |
| Manipur | - | KeibulLamjao NP – Wild Goat, water birds |
| Meghalaya | - | Sajii S – Garo hills – wild goat<br>BalpakramSanct – Garo hills – wild goat |

| | | |
|---|---|---|
| Mizoram | - | Dampa WLS – Aizwal |
| Nagaland | - | Intangki WLS – Kohima |
| Orissa | - | Chilka Lake BS, Ganjain<br>Chaudaka WLS, Puri<br>Debrigarh WKS – Sambalpur<br>RAigoda WLS – Angul |
| Punjab | - | Birmotibagh WLS – Patiala |
| Rajasthan | - | Ranthambor NP – Sawaimadhopur (project tiger)<br>Sarisa WLS (Project tiger) – Alwar<br>Ghana BS – Bharatpur – *350 species of birds*<br>Mt. Abu sanct. – Sirohi<br>Doli closed area – Jodhpur<br>Desert sanct. – Jaisalmer |
| T.N. | - | Guindy NP – Madras<br>Mudumalai WLS – Cheetal and sambhar<br>Annamali WLS |
| U.P. | - | Corbet NP (Project tiger) – Nainital<br>Dudhwa NP (project tiger) – Lakhimpur<br>GovindPashuvihar – Uttarkashi<br>Nanda Devi Sanct – Chamoli<br>Rajaji NP – Saharan pur<br>KedarnathSanct. – Chamoli<br>RanipurSanct – Banda<br>Chambal sanct. – Lalitpur |
| W.B. | - | Jaladapara WLS – Jalpaiguri<br>Sanchal WLS – Darjeling<br>Sundarban (Project tiger) – Birbhum |

**Biospehrereserces**

Well protected, undisturbed natural area. It consists of
**Core zone –** strictly prohibited
**Buffer Zone –** Controlled exploitation (intermediate)

Nilgiri, Nanda devi, Manas, Sunderbans, Gulf of Mannar, Great Nicobar, Panchamarhi, KanchenJunga

**Ex – situ conservation**

Zoos, Botanical gardens, Seed banks, Pollen storage, Tissue culture, Genetic engineering

**Conservation projects**

Save barasingha campaign – M.P.
Gir lion project – Gujarat
Project tiger – Lucknow, Himachal
Project Crocodile – Orissa
Operation Rhino – Assam, Kazirangha
Project Elephant – All over India
Project Hangul – J&K
Project Musk Deer – J&K
Project Brow – Antlered Deer (Sangi) Manipur
Project Lion – Tailed Macaque – W. Ghats, Kerala
International & National organizations for Wild life protection

**Tiger Reserves in India**

| | | |
|---|---|---|
| Bandipur | - | Karnataka |
| Corbett | - | Uttarakhand |
| Kanha | - | M.P |
| Manas | - | Assam |
| Palamau | - | Jharkhand |
| Ranthambore | - | Rajasthan |
| Sunderbans | - | West Bengal |
| Periyar | - | Kerala |
| Sariska | - | Rajasthan |
| Dudhwa | - | UP |
| Dampa | - | Mizoram |
| Satpura | - | M.P. |
| Kaziranga | - | Assam |
| Mudumalai | - | T.N. |
| Sahayadri | - | Maharashtra |
| Valmiki | - | Bihar |

**Criteria for Biosphere reserve**

- Major climate region
- Has unique communities
- Traditionally protected by local people
- Degraded but originality can be restored if proper care is taken

Concept of Biosphere took birth in the conference on Human environment at Stockhokm in 1972

In 1975 MAB was launched by UNESCO

Focuses on management and conservation of renewable natural resources

In 1980 Indian MAB committee was set up which identified 12 sites for setting up Biospheric reserves.

NIlgiris

Namdapha – AP

Nanda devi UP

North Andaman Islands

Gulf of Mannar TN

Kaziranga

Sundarban

Thardesert

Mnnas in Assam

Kanha – MP

Kokrek in Meghalaya

**Objective type questions**

1. Where does majority of the species occur
   a. In developing countries
   b. Developed conutries
   c. In U.S.
   d. In Europe [a]

2. If a species is becoming extinct then the first step could have been
   a. Ecological extinction
   b. Mass extinction

c. Local extinction
d. Biological extinction [c]

3. What is the present status of loss of species in an year
   a. About 350 species
   b. 3500 species
   c. About 35000 species
   d. About one million species [ ]

4. MAB stands for
   a. Man and Biosphere
   b. Man and Biota
   c. Man and Biomes
   d. Man and Bacteria [a]

5. World Environment Day is observed on
   a. $5^{th}$ June
   b. $7^{th}$ June
   c. $28^{th}$ May
   d. $14^{th}$ April [a]

6. Endemic species is
   a. Restricted to particular region
   b. Amphibious in nature
   c. Cosmopolitan in distribution
   d. Narrowly distributed [a]

7. Which is famous for conservation of Asiatic lion
   a. Dachigam National Park
   b. Corbett National Park
   c. Sundarbans
   d. Gir forest [d]

8. Which is the symbol of WWF
   a. Lion
   b. Deer
   c. Giant panda
   d. Tiger [c]

9. Corbett National Park is located in which state
   a. M.P.
   b. U.P.
   c. A.P
   d. H.P. [b]

10. Rann of Kutch is famous for
    a. Cats
    b. Ass
    c. Rhino
    d. Elephant [b]

11. Project Musk Deer was launched in
    a. Bharat Pen Sanctuary, Rajasthan
    b. Kanha National Park, M.P.
    c. Kedarnath Sanctuary, U.P.
    d. Kaziranga National Park, Assam [b]

12. Which animal has become extinct in India
    a. Asiatic Lion
    b. Cheetah
    c. Snow Leopard
    d. Rhinoceros [b]

13. First National Park to be established in India is
    a. Kanha National Park
    b. Kaziranga National Park
    c. Periyar National Park
    d. Corbett National Park [ ]

14. Red Data Books are produced by
    a. IUCN
    b. WWF
    c. IBWL
    d. CITES [a]

15. What is under protection in a National Park
    a. Flora only
    b. Fauna only
    c. Both flora and fauna
    d. Entire ecosystem [ ]

16. Biodiversity is totality of which of the following in the world
    a. All the species
    b. All the genes and species
    c. All the genes, species and ecosystem
    d. All the flora [c]

17. The expanded form of CBD is

a. Conference on Biodiversity
b. Convention on Biodiversity
c. Committee on Biodiversity
d. Consortium on Biodiversity [b]

18. The term biodiversity was coined by
    a. Mount ford
    b. Walter G Rosen
    c. Mae Cabe
    d. Russell [b]

19. How many megadiversity countries are there in world
    a. 8
    b. 10
    c. 12
    d. 14 [c]

20. Which two are the hotspots of biodiversity in India
    a. Eastern Himalayas & Western Ghats
    b. North west Himalayas & Western Ghats
    c. Eastern Himalayas & Eastern ghats
    d. North west Himalayas & eastern ghats [a]

21. Hot spots of biodiversity means a region which has
    a. Rich biodiversity
    b. High endemism
    c. High endemic species which are threatened
    d. High threatened species [c]

22. Number of hot spots in the world are
    a. 20
    b. 25
    c. 30
    d. 35 [b]

23. Biodiversity within a particular habitat is called
    a. Point diversity
    b. Alpha diversity
    c. Beta diversity
    d. Gamma diversity [b]

24. The index that relates the contribution made by each species to the total number of individuals present is called
    a. Shannon index

b. Simpson index
c. Margalef index
d. Menhinick Index [b]

25. How many mammalian species have become extinct according to IUCN list
    a. 52
    b. 65
    c. 86
    d. 104 [c]
26. Presently Indian Bustard is endangered because
    a. Desertification
    b. Deforestation
    c. Climate change
    d. Hunting [d]
27. Which of the following has become extinct recently
    a. Dodo
    b. Archaeopteryx
    c. Mammoth
    d. Dinosaurs [a]
28. Which are best for conservation of wild life
    a. Zoos
    b. Sanctuaries
    c. National Parks
    d. Botanical gardens [c]
29. Kaziranga National Park is mainly for conserving
    a. Elephant
    b. Nilgai
    c. Musk deer
    d. Rhinoceros [d]
30. Which group is endangered most
    a. Birds
    b. Mammals
    c. Fishes
    d. Reptiles [d]

# 2. Disaster Management

**Disaster Management**

**Earthquakes**

Earthquakes refer to shaking of earth. There is continuous activity going on below the surface of the earth. There are several large plates (size of continents) below the surface of the earth, which move (at a very slow speed). As a part of this movement, sometimes, they collide against each other. And, after the collision, they might still continue to push each other. As they continually keep pushing each other, there is a pressure building up – across these plates below the surface. And, then, at a certain time, one of the plates might slide over another. This causes an earthquake.

Some earthquakes might be caused by activity above the surface. For example in a mountainous region, there might be a heavy landslide. Due to a huge mass of land falling, at the point of the fall, there could be a minor shaking of earth, due the impact of fall. However, usually, such earthquakes are not very major.

Classifying an Earthquake

The impact of an earthquake (at any location) is characterized by two primary characteristics:

Intensity

This measures the magnitude of the event. Higher is the value, the bigger is the magnitude. The most common scale used for measuring an earthquake is Richter Scale. It should be understood that Richter scale is a logarithmic scale. What this means is an earthquake measuring 6.0 is 10 times more powerful than an earthquake measuring 5.0

Epicenter

This denotes the exact location, where the earthquake originated. The deeper it is inside the earth, the lower will be the impact on the surface – where human beings reside.There are 100s of earthquakes taking place on a daily basis all around the world. However, most of these earthquakes are really low-intensity, too-low to be noticed. However, sometimes there are some earthquakes which are significantly intense.

<u>Fault Lines And Earthquakes</u>

Usually, areas around fault-lines are more prone to earthquakes.

Some of the major fault lines are around:

1. Italy (hit in 1980; magnitude: 7.2)
2. Hayward, San Francisco in California (hit in 1906 at San Francisco; magnitude: 7.8 and again in 1989 at Loma Preita; magnitude: 6.9)
3. Himalayan region (hit several times since 1999, at various places spanning across Afghanistan, Pakistan, India etc.)

<u>Nature of Losses And Damages</u>

The most common kinds of loss that are caused by an earthquake (depending on the severity) are:

<u>Damage to structures</u>

Causing partial or total collapse, damage to road and rail network, damage to utility carriers etc.

Sea activity

Water level in the sea could rise suddenly, causing very high waves, several meters in height, which could then flood the coastal areas. These could give rise to tsunamis, causing damage to coastal areas.

Landslide

As earth shakes, in mountainous regions, huge chunks of land could fall/slide onto lower regions of the mountains. This could have several impacts, including: changed topography, blocked roadways, damage to anything that comes in the way of the landslide, massive damage to the structure which sits on the piece of sliding land – and massing damage to the houses and roads where the piece of land finally lands. The landslide could also trigger another set of minor earthquakes.

Quake Lakes: In the earthquake in China (May 2008), landslides blocked Jiangjiang river, resulting in creations of (about 35) lakes. These lakes in turn posed severe threat of flooding downstreams - due to possible bursting. More than 1,50,000 people had to be evacuated - due to this threat of flooding.

Earthquakes typically impact a huge area, spanning whole city, and many times, several cities. The impact due to this is that besides the instantaneous damage to life and property at the time of the event, there is a long-drawn suffering.

Aftershocks

Earthquakes are also characterized by aftershocks. After any major seismic activity below the earth, the new order might take a while to finally settle down. During this time, there might be some more activity below the earth (sort of "adjusting" of the new positions for the various plates, layers etc.) These activities result in several more earthquakes. These are called, "aftershocks". Typically, "aftershocks" are much smaller in magnitude, however, some times, one of the "aftershocks" could be more severe than the main earthquake. Also, "aftershocks" could strike up to several days after the main event.

The implications of "aftershocks" are the following:

- Structures which are not severely damaged during the main earthquake could now get damaged during one of the "aftershocks" – as they are getting continuously weakened by the earthquake and the "aftershocks".
- While rescue teams are trying to search through the debris of fallen buildings/bridges etc for trapped people, an aftershock could destabilize the debris further, causing these rescue teams themselves to become a victim. Besides, increasing the list of victims, it has two other major impacts:
    - Loss of trained people and specialized equipments; which in turn means significant impediment to the speed of further rescue
    - Fear among rescue teams for their own lives – due to the possibility of an "aftershock" causes them to proceed with extreme caution; thus, they are not able to work to their fullest capability

      In the May 2008 earthquake of Sichuan, about 200 relief workers died in mudslides triggered by aftershocks.

- People who have suffered during an earthquake are in psychological trauma. Each "aftershock" causes immense panic amongst them.

Recognizing an Earthquake

The most common ways to identify the onset of an earthquake would be:

- A feeling of shaking of the ground below you, if you are sitting/standing. The most common feeling is – as if the person is feeling giddy.
- Swinging of overhead hanging stuff, e.g. fans, chandeliers etc. However, in this situation, you should distinguish between swaying of overhead hanging stuff – due to wind
- A feeling as if both the rear tires of your car are flat (if you are driving)

Immediate Injuries

During an earthquake, there are many ways by which one can get hurt (many times, fatally)

1. People inside buildings could get hurt (even critically) by fall of objects/walls/ceilings
2. People outside the buildings could get hurt by falling debris from damaged buildings, glasses etc.
3. People traveling could get hurt by their vehicles falling off the tracks, bridges, material falling from overhead bridges etc.
4. People could get electrocuted by snapped electrical wires
5. People could get washed away by floods – caused due to tsunamis, breaches in dams etc.

Immediate Safety

Hence, in case of an earthquake, the safest place to be would be in an open ground – away from all kinds of buildings and tall structures.

If you can not rush out of your building, you can duck under some sturdy desk etc. which might provide protection against heavy objects falling on your body.

If even that is not possible, sit against a wall, with your back pushing the wall firmly, and, lean forward – to take your head in between both your knees, and, put your hands at the back of your head – to provide protection to your head and spine.

Or, you could stand directly below one of the door-frame in your house. This one appears a bit strange to many people. In fact, there are jokes that after an earthquake – you don't see all those door-frames standing. So, whats the reasoning behind advising people to stand below door-frames? In most styles of construction, doorframes are made very strong, or, would have a "RCC beam" running right above these frames. Either way, this "strong" structure would take the impact of objects falling from above, and, would break the impact of the heavy objects falling on the person. If you use this posture, remember to save your arms and fingers from swaying doors etc. If not careful, they could cause damage by chopping off fingers etc. due to the banging of the doors against the frame.

Predicting An Earthquake

Earthquakes have very low predictability in short term, i.e. in most cases, there is no warning – even a few minutes before an earthquake. However, in most cases, a much higher degree of predictability exists in long term – in the sense that if a certain area is sitting on a fault line, it can be said that over a long period of time, there is a high risk of earthquake. However, whether the earthquake occurs within the next few minutes, few years, few decades – or, maybe a few centuries might not be predicted.

In April 2008, USGS reported that the state has a 46% chance of a 7.5 or larger earthquake in California state during the next 30 years. So, relatively high predictability over the next 30 years, but, absolutely zero predictability in the immediate short term!!

There are certain schools of thoughts that believe that there are certain animal instincts which provide certain degree of indication of an impending earthquake. While the beliefs in this matter are varied, the closest scientific successful attempt to predict an earthquake is known to be the incident of earthquake at Haicheng, Liaoning Province of China in Feb. 1975. An alert local community and the earthquake administration noticed a change in water level in ground-wells as well as behaviour patterns of certain animals. Taking this to be an indication of an impending earthquake, many people were evacuated out of their houses. Even though, many people had to stay outdoors in the cold, it is believed that timely evacuation helped in saving thousands of lives.

Still, the scientific community is divided about the possibility of accurately predicting earthquakes. Even if the above example is considered as an example of ability to predict earthquakes, its a matter of fact – that since 1975 many more earthquakes have jolted our earth, without anybody being forewarned. Some of these have been in China itself.

Many countries monitor the seismic activity below the earth. Since there are a lot of seismic activities below the earth on a continuous basis, these countries are not necessarily interested in these low-intensity activities. However, their interest is to see if there is a sudden increase in seismic activities. An increase in seismic activity could imply an impending earthquake in the near-future. However, how close (in "time") might still not be predictable.

Constructing Your House

People who stay in an earthquake prone area might do well to make investments in earthquake-proofing of their houses.

The process starts with the construction of the house.

Traditionally, people in earthquake prone areas used to build homes using lighter materials, and, also materials which could be reused, e.g. wood. The advantage with wood is: being lighter – it does not cause heavy damage – when it falls on the residents, and, secondly, most of the wood can be salvaged from the debris, and, reused. This reduces the cost of rebuilding.

However, during the last several decades, due to change in construction technology, people are going in for concrete structures – specially designed to withstand earthquakes or other seismic activities. The choice of concrete over wood is gaining ground, because: if the structure is well-designed to withstand earthquakes, it would not get damaged. So, there is "no" cost of rebuilding, and, there is no damage due to falling material. However, the cost of construction would be high. Since people build houses for long-term, and, earthquakes have a certain degree of predictability in long period, there is an increasing acceptance to the idea of this investment.

Some simple thumb rules to follow for constructing a house in an area prone to earthquake:

1. The entire construction should be a single monolithic structure, so that the whole structure can move as a whole
2. To the extent possible, material used should be something that has been available locally. This would allow very little differential in the movement of your building vis-à-vis the material over which the house sits – thus reducing the chances of sinking

Some of the possible reasons for such huge discharge of water could be:

A. very heavy rainfall (say: due to cyclones, typhoons etc.) in a short span of time. It should be noted that the amount of rainfall itself is not a sufficient cause, the duration within which the rainfall is receive is equally important contributor
B. breach in levy, dams etc
C. very high tidal waves (sometimes in the aftermath of a seismic activity, e.g. earthquakes) etc. – also called tsunamis

3. Minimum use of glass in building facades. These decorative pieces could be deadly, during an earthquake. Glass being very brittle, even a minor twist in the structure could cause breakage. And, glass being very heavy and injurious could cause severe damage.

4. Doors and windows should have fasteners, so that they can be fastened. If the doors and windows are not fastened, they might cause any of the following situations:
    - Swaying/banging of doors and windows against the frame could damage your limbs/fingers/toes etc.
    - The doors might get "stuck" due to damaged/misaligned frame – making it difficult for you to run out, or, for the rescue teams to reach you.
5. Consult a good structural engineer to ensure that the structure is strong enough to withstand seismic activities

<u>Earthquake-Proof Your Home</u>

When staying in the house, simple precautions should be used:

1. Large/heavy items should be fastened, so that they don't fall-off, during earthquakes.
2. Hanging items (like: fan, chandeliers, decorations etc.) should be fastened, rather than just left hanging through a hook.
3. You should be adequately prepared to live without utilities for several days. As earthquake causes severe damages over large areas, most of the utilities that we might take for granted, might not be available for several days.

These are anyways <u>generic precautions</u> against disasters of any kind.

**Floods**

Floods refer to huge amount of water reaching land in a short span of time, causing land surface to be submerged under water – at places, where, land surface is usually not covered with water.

Floods could be caused due to natural causes, or, human activities, or, a combination of both. Floods are caused by discharge of huge volume of water in a short span of time, at a rate, such that the water can not be carried away from the scene of discharge.

Usually, flooding impacts a large area, wherein entire district or states might be flooded. However, sometimes, flooding is very local, i.e. limited to just one city, or, parts of it. Most often, the localized flooding is caused due to human activities, rather than natural phenomenon. A natural phenomenon might seem like the immediate trigger, but, in reality, this is caused by human activity.

There are some places, which get flooded almost every year. One such example is Bangladesh. Some of the other places which had incidents of bad flooding in the recent past include:

- Florida, in the aftermath of hurricane Katrina (2005)
- Myanmar (2008)
- Portions of Coastal India get flooded almost each year

Among various kinds of disasters, flooding is unique in the sense that it has a very high degree of predictability, both in the short term, as well as long term. In most situations, flood prone areas are quite known – in the sense that they have a history of flooding. Only in very rare situations, a place might be flooded – without having any past history of flooding. Even in such cases, a careful study of the area could give an indication of possible flooding.

**Flood Prone Areas**
The areas, which are prone to flood-risks are:

A. places, which have a history of flooding (most important)
B. area receiving heavy rainfall, with not much naturally sloping landscape
C. areas at the lower levels of naturally sloping landscape – where, the higher areas are receiving heavy rainfall
D. areas around sea-coasts, or, river banks
E. areas downstream of dams etc. As water level upstream of dams might rise, the dam authorities might be forced to release water (to safeguard the dam) – which might cause flooding of downstream areas
F. areas on the other side of levies (in case, the levy gets breached)
G. low-lying areas (say: foot of an overbridge etc.)

- **Loss due to Flooding**
  The most common kinds of loss that are caused during flooding include:
- Lack of water: Its an irony, that a disaster which mean water everywhere, results in lack of water to drink and sanitation. Lack of proper drinking water and sanitation causes widespread outbreak of diseases.

a. Lack of food: Most of the food items get damaged, causing a severe shortage of food. This shortage could be for the food to be consumed in the near future, or, even standing crops could be damaged, causing long-term food shortage.
b. Lack of utilities: Utility services might have to be turned off, for the fear of electrocution, as, there is water everywhere.
c. Widespread damage to structure
d. Drowning: People, livestock, goods etc. might get drowned.
e. Snakes and other creatures: Some of the dangerous creatures which usually stay underground would be forced to come up, as their natural habitat becomes unlivable. These could prove dangerous to human beings and cattle.
f. Submerging of vehicles and other equipments: Vehicles and other equipments might get permanently damaged – as they remain submerged under water – for prolonged duration.
g. Submerging of vehicles and other equipments: Vehicles and other equipments might get permanently damaged – as they remain submerged under water – for prolonged duration.

Because of wide-spread impact of such floods, the suffering could be long-drawn, besides the immediate impact – as mentioned above.

**Indicators of Possible Flooding**
Usually, any of the following situations should indicate the possibility of flooding:

- heavy rainfall in/around the vicinity, especially, if the specific location falls in the pathway of the water-discharge system from the area receiving heavy rainfall
- if there is heavy rainfall/flow of water/accumulation of water, on the other side of a boundary, e.g. across a dam, across a levy, side of a river-embankment etc., because, these boundaries might get breached

  As can be seen, both the above situations can be predicted to a reasonable degree. These days, the meteorological predictions are accurate enough for upto 4-5 days. Hence, its usually possible to know about the possibility of heavy rainfall about 4-5 days in advance.

Also, areas which are prone to heavy rainfall, cyclones, typhoons etc. are also well-known. Hence, the predictability is very high even in long-term, in the sense, that certain areas are known to be flood-prone. The advantage of long-term predictability is that people might be able to take long-term precautionary measures also – requiring heavy investments.

Also, for situations, where, there is a boundary between huge mass of water, and, your living place, again, keeping an eye on the following two situations should be a good indication of the possibility of flooding:

1. increase in the volume/mass of water being built up on the other side of the boundary
2. general maintenance and upkeep of the boundary

   General level of civic maintenance is a good indication of the possibility of flooding, during rainfall. If the drains and streets are generally clean, the possibility of flooding gets reduced; on the other hand, if the drains and streets are generally choked or dirty, the chances of flooding (atleast at the local level) gets increased.
   Now, that we know, how can we figure out the possibility of flooding, lets look at the possibility of preventing it.

**Prevention of Flood**
Sometimes, it might not be possible to prevent a flood, even if we know that its about to get flooded. However, there are certain actions that can be taken to reduce the impact significantly, or, to reduce the possibility of flooding:

1. The first step is to keep the drainage system clean. This allows water to be carried down very fast. Choked drains cause a significant reduction in the ability and speed of the water to be drained away. In most situations of urban flooding – this is a major cause. The drains might get choked due to throwing of solid-wastes inside storm drains. These solid-wastes might include construction material, plastics, paper etc. This is a clear example, how human activity can amplify the process of flooding. Drains might also get choked due to falling tree-leaves etc.
2. General clean-up of streets is also important. As rain-water falls down the street, it rushes into the storm drains. if the streets are not clean, the rain water trying to go into the drain – carries solid wastes into the drain with itself, which then obstructs the flow of water by the drainage system.
3. Rain water harvesting system: As more rain-water tries to flow down the drains, it puts that much more stress on the drainage system. Instead, if there are several rain-water harvesting systems, the rainfall falling in that much area would try to go to the sub-soil of the region locally, rather than straining the drainage system. Lower is the amount of water trying to go through the drainage system, the easier it is for the drainage system to drain off the water.
4. The drains should be desilted before the onset of the rainy season. This prevents the drains from getting choked. And, it also inceases the holding capacity of the drain, as, accumulated silt prevents that much more water from being accumulated in the drains.

5. Inspection and repair of dams, levees, embankments etc: Before the onset of seasons causing accumulation and/or carrying of heavy volume of water (such as rainy season), these structures should be thoroughly inspected for possible weak-spots, and, these should be repaired.
6. Afforestation: Forestation helps in binding the loose soil. The most major impact of this is, as flood-water races through, it might take loose soil with it. This loose soil will now choke the drains, as well as water-harvesting systems, thus, rendering both of these as ineffective. On the other hand, trees will prevent soil to flow with the water, as, the roots of the trees will act as binding force. Another major impact that afforestation provides is by reducing the impact of flowing water. This has impact on large-scale flooding, such as overflowing river. As water charges forward, its speed is reduced to some extent due to resistance offered by trees. This can reduce the force of the charging water – thereby, reducing structural damage – due to weakening in the force with which water hits various structures.
7. Local lowlands (say: foot of an overbridge) should have storm drains, so that water does not get accumulated there. These drains should have some kind of mesh covering, so that only water can flow in. Leaves and other solid debris should not go in these drains.
8. Local embankments around low-lying houses etc: Lets say, for some reason, your house is at a level lower than its vicinity (e.g. road-level). This can happen, because, say: you have constructed a basement – which is obviously lower than the road-level, or, over a period of years, the road-level has risen due to repeated tarring etc. In such cases, you should create a "local" embankment between the street/road and your property, so that water can not flow "down" from the street/road inside your house. These embankment might be permanent – in the form of concrete structure.

Besides impacting the process of flooding itself, most (not all) of these factors also have an immense impact on the rate at which water levels might recede – after the source of the flooding has been removed. e.g. Lets say a city got flooded, after heavy rainfall. Now, once the rainfall is stopped, the water levels in the streets etc. might tend to recede. At this stage, once again, the rate at which water levels can recede is dependent on the ability of the storm drains to carry the accumulated water, as well as the total amount of water that has been accumulated – which needs to be drained out.

**Being Prepared**

People who stay in flood-prone areas should construct their houses using material which does not get damaged severely due to flood-water. Also, since, there is a strong risk of structural damage (for large-scale flooding), the material used to construct the house should be such that it can withstand high impact – due to the charge of flowing water. One should prefer areas, which are slightly elevated. These could be local elevations, i.e. higher parts of the city etc. There should be strong embankments along all entrances of the houses – so that flood water does not enter the house easily.

Cement bags, covered with plastic sheets might be used to keep the flood water from entering the houses.

Besides, long boots should always be kept, so that one does not run the risk of being bitten by snakes and/or other insects that might also be trying to save themselves from the twirling flood-waters.

One should keep arrangements for raising the height of items, which might get damaged in water, e.g. put a few pieces of bricks below the legs of the furniture, such as bed etc. to raise its height.

Important document should always be kept on higher shelves.

As water, food and utilities would not be available – and that too – for possibly several days, one should also take measures towards General Preparedness

**Macro Level Efforts**

While some of the steps mentioned above need to be taken at municipal/city level, and, some at individual level,

there are some other techniques which have been tried/used at some places. However, these require efforts at a much larger level. Some of these steps include:

- Identified flood diversion areas: Flood waters are diverted to these unpopulated areas, so that populated urban areas may be protected.
- Construction of dams etc. at strategic locations
- Levees, embankments around cities lying along river/sea coasts. The flooding of New Orleans – in the aftermath of Katrina hurricane was due to a breach in such a levee.
- Sea walls
- Beach nourishment: The sea-beaches are widened, so that they can absorb the impact of flood-waters – due to rise in sea-levels.
- Conversion of flood-prone areas into wetlands, where, urbanization is not allowed, i.e. one can not construct residential houses, or, any other permanent structures etc.

As can be seen, such efforts require a very high degree of financial commitment, not just for constructing the system, but, also for maintaining it.

**Cyclone**

**Cyclone Categories:**

- **Category 1** - wind gusts less than 125 km/hr
- **Category 2** - wind gusts 125 to 169 km/hr
- **Category 3** - wind gusts 170 to 224 km/hr
- **Category 4** - wind gusts 225 to 279 km/hr
- **Category 5** - wind gusts more than 280 km/hr

**During a Cyclone:**
If a cyclone is approaching and an official evacuation order has not been issued, you may decide to shelter in your home until the cyclone has passed through.

**If you decide to shelter at home:**

- Turn off all electricity, gas and water and unplug all appliances
- Keep your Emergency Kit close at hand
- Bring your family into the strongest part of the house
- Keep listening to the radio for cyclone updates and remain indoors until advised
- If the building begins to break up, immediately seek shelter under a strong table or bench or under a heavy mattress
- BEWARE THE CALM EYE OF THE CYCLONE.
  Some people venture outdoors during the eye of the cyclone, mistakenly believing that the cyclone has passed. Stay inside until you have received official advice that it is safe to go outside.

**If you must evacuate:**
If an official evacuation order is issued then you and your family must leave your home immediately and seek shelter with friends or family who are further inland or on higher ground.

- Turn off all electricity, gas and water, unplug all appliances and lock your doors
- Ensure all family members are wearing strong shoes and suitable clothing
- Take your Emergency Kit and your Evacuation Kit and commence your Evacuation Plan

- If you are visiting or holidaying in Queensland and do not have family or friends to shelter with, contact your accommodation manager immediately to identify options for evacuation.

**After a Cyclone:**
The time immediately after a cyclone is often just as dangerous as the initial event itself.
Many injuries and deaths have occurred as a result of people failing to take proper precautions while exploring collapsed buildings and sightseeing through devastated streets.
Once you have been advised that the cyclone has passed you must adhere to the following:

- Listen to your radio and remain indoors until advised
- If you are told to return to your home, do so using the recommended routes only
- Do not go sightseeing
- Check on your neighbours if necessary
- Do not use electrical appliances which have been wet until they are checked for safety
- Boil or purify your water until supplies are declared safe
- Stay away from damaged powerlines, fallen trees and flood water

If your home has become uninhabitable due to cyclone damage, contact your local council to identify where you can seek further assistance.

# 3. Energy Resources

## Energy Resources

Economic growth of a country is directly related to energy needs. For advancement of any country, growth in sectors like agriculture, transport, business and domestic requirements is a must and are all dependent on energy resources.

Energy resources can be broadly classified into

1. Primary energy resources: those which are directly obtained from environment, Fossil fuels, nuclear fuels, hydroenergy, geothermal, solar energy, wind energy, tidal energy

PRIMARY ENERGY RESOURCES

1. RENEWEABLE: everlasting or non-exhaustible – solar, wind, wood, geothermal, hydro
2. NON-RENEWABLE: finite and exhaustible – fossil fuels and nuclear fuels.

SECONDARY ENERTY RESOURCES

Those that are obtained from prime resources

| | | |
|---|---|---|
| NON-COMMERCIAL | : | firewood, cow dung, vegetable wastes |
| COMMERCIAL | : | electricity and gas |
| CONVENTIONAL | : | crude oil, natural gas |

NON-CONCENTIONAL : solar, wind, geothermal, OTEC, hydel and Hydrogen

In India large potential is there for renewable energy, but only a fraction has been exploited till date.

COAL : igneous organic rock, flammable, mainly containing carbon, hydrogen and oxygen, accumulation of pre-historic vegetation after its death in the geological past over 300 million years ago formed dense layer called peat.

It accounts for 40% of world's electric power generation

Major reserves are in US, Russia, China and India, accounting for 50% of world's reserves.

Coal mining has resulted in adverse impacts on hyman health, agriculture and wild life habitats, most concerns are for black lung of coal workers pneumoconiosis – lung disease due to coal dust

Coal combustion produces fly ash, results in particulate pollution of air and GHGs

Estimated reserves in India – 24074 crore tonnes and 90% of this occurs in Chotanagpur in Jharkhand, Orissa, W. Bengal, M.P., Chattisgarh and Godavari Valley.

Most of country's coal is used for power generation. Godawari coals are best as cooking fuels. Power generation from coal is 3 times more expensive than hydropower.

In India coal reserves mostly occur in form of thick shallow seams and hence mechanized open cast mining is the most widely used technology for coal mining and accounts for 90% recovering. The country has to import coal to meen tis coal demand. Sectors like railways and industries also consume much coal.

Conservation of coal is must for our future demands. The coal conservation and development Act 1944 provides for imposition of excise duty on coal dispatches. Researches are being done in coal sector. Under the guidelines laid dound by standing scientific and research committee.

## Petroleum and Natural Gas

Petroleum is of utmost importance in modern society. It s a major energy provider to agriculture, industries and transport.

90% of it is used for transportation sector

Its combustion releases GHGs

Today india's production is 34 MMTPA for which ONGC and Oil India ltd. Are to be given credit. It has risen from zero at the time of independence to 29 billion cubic meters during five decades and is supplied to consumer through 4100 km gas pipeline system.

PCRA – petroleum conservation and research association continuously spread mass awareness energy conservation in industries, transport, household and agriculture through energy audits, studies and educating the user of petroleum products. This involves professionals, and home makers.

## Nuclear Energy

This energy reserves have not yet been exploited much

It can be produced by two ways

1. Nuclear fusion breeder reactors: utilizing the principle of production of energy in the sun. that is fusion of hydrogen atoms to produce He. For production of energy in reactor one plutonium ($^{239}Pu$) when bombarded with neutron releases large amount of energy and 3 neutrons and the process continues. These neutrons can be used to convert $U^{238}$ to $^{239}Pu$. Hence Pu mixed with U can produce unlimited energy. In a fast breeder reactor 80% energy is released as compared to 1% release in conventional reactor. Fusion reaction occur at very high temperature and thus matter exists as plasma and energy release process is less polluting. Main fuel for fusion reaction is Deuterium (about one tonne f sea water can contribute to 34g Deuteriou = 300 tonne $1.5 \times 10^8$ tonnes of ocean water exists, hence unlimited energy potential.
2. Nuclear fission reactors: uses splitting up of radioactive atoms, according to report (2000) of power reaction information system at international atomic energy agency (IAEA) about 438 nuclear plants were in operation all around the world. Six NP each of 3056 MW capacity were connected to grid: on in Brazil, One in Czech, 3 in India and one in Pakistan.
   Total estimated reserves are as follows
   Uranium = 30000
   Monazite = 50000
   Limenite = 80000
   Hence energy production till now is negligible as compared to reserves. NP accidents are rare but their occurrence results in deleterious effects on human health and environment.

## HYDROELECTRIC POWER

The potential energy of the waters is used to drive turbo-generators, which produce electrical energy.

Leading producers are USSR, Japan, USA followed by Norwar, Switzerland, Canada, Sweden and New Zealand.

In India Major projects are

1. Bhakra Nangal: over river Sutlej
2. Bokaro Panchet and Tilaiya in Damodar Valley
3. Hirakud
4. Rihand
5. Nagarjuna
6. Sagar
7. Kosi
8. Koyana

Projects like Tehri Dam on Bhagirathi (Uttarakhand), Sardar Sarovar (Gujarat), Narmada Valley project have not been completed due to political and environmental controversies. Construction of micro hydel project henerating even 2KW of power should be envouraged. Rourkee University has designed a small dam costing 30000 and generating 4-5 kw of power.

Hydropower is a clean, renewable, non polluting source of energy\

Low operating cost

Available when required

Reservours can be used for recreational activities, fishing, boating and swimming

Disadvantages: cannot be stored for future, mega multipurpose projects cause devastation of envirionment and displacement of people,

Floods, earthquakes, block the migration of fish for spawning, deteriorate water quality by reducing $O_2$ levels, uncontrolled growth of algae and aquatic weeds in the reservoirs.

## SOLAR ENERGY

It is obtained as electromagnetic radiation produced as a result of fusion reaction nof $H_2$ at very high temperature and pressure

Ultraviolet = 2%

Visible light+ 47%

Infrared = 51%

The received sun energy is visible region (400 nm to 700 nm) and reflects it in infrared region (about 10 nm) region reaching the earth = $2.68 \times 10^{24}$ joules per year. With solar constant of 2 Kcal/$m^2$/min

DISADVANTAGES: harvesting solar energy economically becomes difficult, complicated desigh is required to harvest diffused light.

ADVANTAGES: best alternatives to fossil fuels and nuclear fuels

- Inexpensive, unlimited and non-polluting
- Required for photosynthesis which is basis of life
- Main utilization is its conversion to electrical energy through photovoltaic conversion using solar cells.

SOLAR CELLS (PHOTOVOLTAIC CELLS)

1st time developed for providing power supply for space satellites in 1950s. a typical solar cell consists of two thin layers of silicon, one layer acts as n-type which releases the electrons when sunlight fall on it. And other p-type layer (outer) accepts the electron, thus resulting in generation of electric current.

The power thus produced can be stored as chemical energy by charging Ni-Cd or Lead-acid batteries. The power can be used for producing H2 by electrolysis.

Disadvantage – solar cell is expensive.

SOLAR POND: 1st solar pond was constructed in Israel. It was the principle of organic Rankine cycle, an artificial pond with bottom layers of brine and upper layer of fresh water. Sunlight is stored as heat in the brine, which can be circulated through buildings for heating or converted to electrical power by vaporizing organic fluids which drive turbo-generators

SOLAR COOKER: it is used for cooking food. The solar energy is absorbed by collectors made of Cu, Al, Steel etc. and blackened with paints oxides of Cr, Cu, Co, etc. the collectors may be a flat plate, a plane mirror etc. these materials should have absorption in the range of visible region of spectrum, emission at high temperature and low cost of production.

LIMITITATION

It has to be placed in open for availability of light

Indian chapatis and deep fried items cannot be prepared.

SOLAR SILL: it can be used for desalination

Solar air can be used for circulating hot air through a room for room heating. Solar water heaters for heating water for domestic purpose and hotels.

## WIND ENERGY

Wind energy can be harnessed for electric power generation. It is inherent in solar energy and only a fraction of it is converted to wind energy every year. Wind turbines and wind mills can be best operated in windy regions like along coast lines in Gujarat and Western ghats, rajasthan. Even in eastern states like Nagaland, Mizoram, Mghalaya and Manipur low speed wind mill can operate.

**Advantages**:

abundant of available, cost effective, non-polluting, and hence can be regarded as the key source to meet the future energy demands

in india wind mills can be used to pump water for rural irrigation of rabi season.

**DISADVANTAGES**

IT is unreliable, because of its seasonal availability, further not present at all places, may cause harm to migratory birds.

## BIOMASS

It is the oldest source of energy and basically a form of solar energy since organic matter is synthesized mainly through photosynthesis which can occur only in presence of sunlight

Sources of biomass: land crops (eucalyptus, firs, pines), Aquatic plants (algae, hyacinth, hydrilla etc.), wastes (manure, municipal waste, cooking), agro industrial wastes (wood and crop residues, peels, molasses, sludge)

Biomass: can be classified in to three types

1. Traditional: solid form – wood and agricultural waste
2. Non-traditional: liquid form – ethanol, methanol
3. Gaseous form

ADVANTAGES: it is renewable and can be stored and transported easily, low initial cost, high energy fuels can be obtained, non-polluting.

DISADVANTAGES: requires large are for operation, water utilization is very high, collection and storage is expensive, low conversion efficiency,

BIOGAS (METHANGE)

A mixture of usually 65% methane (high calorific value), 4 percent hydrogen, I percent sulphur dioxide, 30 percent carbon dioxide and traces of other gases.

Can be produced at different levels

a. Village, frm level – agricultural/vegetable wastes
b. House hold – animal/domestic garbage
c. City level: municipal garbage/sewage
d. Industrial level: industrial effluents, dairy, distillery, brewery, food processing industries, canning, chemical industries

Anaerobic digestion is carried out by micro organisms in special digesters.

a. Solubilization and hydrolysis of organic components bh fermentative bacteria produced organic acids, alcohols, esters, sugars and $CO_2$.
b. Acidogenesis: by microorganisms to produce hydrogen and acid
c. Methanogenesis: conversion of acetate and hydrogen into biogas by methanogenic bacteria.

Uses:

For cooking – about 8 cuft/day

For lighting – about 4-5 cuft/100 candle power/lamp/hr.

For motive power – about 15 cuft/MP

In india biogas production is equivalent to 35 lakh tonnes of fuel wood.

ADVANTAGES:

1. Environmentally clean technology
2. Efficient cooking fuel, reduces incidence of eye diseases in women

3. So much cowdung available that 22,425 million $m^3$ gas can be produced
4. Improve sanitation.

LIMITATIONS

Uses large land areas, high quantity of water and better strains of methanogenic bacteria. Normal bacterial activity -> 90% water.

Human waste -> 80% water

Temperature requirement = 35 degree centigrade.

BIOFUELS: these are obtained from biomass like wood, straw, and refuse. They can also be obtained from wet organic matter like sludge, sewage and vegetable oil matters, through digestion and fermentation.

Municipal wastes is used to get heat and power

Liquid biofuels (alcohols and vegetable oil) used as transport fuels.

METHANOL AND ETHANOL: are being used with unleaded petrol and burn in internal combustion. Methanol has 25% less energy per gallon than ethanol and 50% less than petrol. Hence can be used as efficient fuel than petrol and diesel.

In India

1. 10 MW rice straw based thermal plant set up by BHEL in Punjab.
2. Pilot plant to generate electricity from municipal waste at Delhi.
3. The first large scale plant to produce fuel pellets from municipal garbage began in Mumbai

GEOTHERMAL ENERGY: heat energy stored in the earth's crust specially the hot molten core. This heat can be transformed to electrical power or directly used. The GHS emissions during its exploitations is much less than coal burning.

In Newzealand about 320 gm of Carbon dioxide is produced for each KW hour of electricity produced against 950 to 960 gm if coal was used.

DISADVANTAGES:

It releases $H_2S$ gas.

Water from geysers and hot springs contain salts and minerals that cause pollution. Subsidence may occur after water has been pumped out. Geothermal power plants are at Indonesia in Java, Newzealand, France, Germany, Iceland, Italy, USA, San Fransisco, California (largest user of this energy)

Largest geysor near San Fransisco, US.

IN INDIA

Puga valley (ladakh)

The energy used for extraction and refining of borax, sulphur and salt in valley.

Manikaran (5 KW pilot plant)

Tattapani (surgaja District, C.G.)

Combay basin (Alakhananda valley, U.P.)

Parvathi valley – H.P.

12 regions in M.P., Jabal pur, etc.

## TIDAL POWER

The periodical rise and fall of sea water level with rising and setting of sun and moon is tide. Which can be used to generate power. To harvest tidal energy, a dam could be build at the mouth of bay with large gates, a reversible surbine is fitted in the dam. A tidal basin if formed at the bay. The basing gets filled ruing high tide and empties during neep tide. During both events it drives the turbine that runs the generator which generate electricity power.

In India

Estimated to be 15000 MW

Potential sites are at gulf of canbay (7000 MW), gulf of Kutch (1000 KW) sunderbans (100 MW)

Other prospective sites are

a. Lakshdweep, Andaman and nicobar, coasts of Orissa, Kerala, TN, Karnataka and Maharashtra

ADVANTAGE:

Inexhaustible

Independent of rainfall

Pollution free

Do not require large areas.

LIMITATIONS

Variation in power is high

Generation is intermittent

Turbine large, expensive, hinder the activities like fishing, migration etc,

Large barrage construction

Fesible only where high tidal energy is there.

# 4. Food Resources

**Changes Caused by Agriculture and Overgrazing**

Agriculture is the world's oldest and largest industry; more than half of all the people in the world still live on farms. But, because of production, processing and distribution of food — and that took on a large scale larger effects on the environment are unavoidable.

Agriculture has both primary and secondary environmental effects. A primary effect is an effect on the area where the agriculture takes place i.e. on-site effect. A secondary effect, also called an off-site effect, is an effect on an environment away from the agricultural site.

**The effects of agriculture on the environment can be broadly classified into three groups, viz. global, regional and local:**

**(1) Global Effects:**

These include climate changes as well as potentially extensive changes in chemical cycles.

**(2) Regional Effects:**

These generally result from the combined effects of farming practices in the same large region. Regional effects include deforestation, desertification, large scale pollution, increase in sedimentation in major rivers and in the estuaries at the mouths of the rivers and changes in the chemical fertility of soils over large areas. In tropical waters, sediments entering the ocean can destroy coral reefs.

**(3) Local Effects:**

These occur at or near the site of farming. These changes / effects include soil erosion and increase in sedimentation downstream in local rivers. Fertilizers carried by sediments can also transport toxins and destroy local fisheries.

**Changes caused by Overgrazing:**

The carrying capacity of land for cattle depends on the fertility of the soil and the rainfall. When the carrying capacity is exceeded, the land is overgrazed.

**The changes that result from overgrazing include:**

(a) Reduction in the growth of vegetation.
(b) Reduction in the diversity of plant species.
(c) Increased soil erosion as the plant cover is reduced.
(d) Damage from the cattle trampling on the land, like paths made by cattle develop into gullies, which erode rapidly in the rain.
(e) Dominance of plant species that are relatively undesirable to the cattle.

**Effects of Modern Agriculture**

Modern agricultural practices have substantially changed the farming, crop production and harvesting, on the other hand it leads to several ill effects on environment.

***Some Local and Regional Changes of Modern Agricultural Practices:***

1. It leads to soil erosion.
2. It results into increase in sedimentation towards downstream side of river.
3. Alteration in the fertility of soil.
4. Increase in deforestation for more cultivated land.
5. Leads to soil pollution.
6. It leads to desertification i.e. lands converting into deserts.
7. It results into change in the ecology of estuaries due to increase in sedimentation at the junctions of rivers.

***Disadvantages of Use of Artificial Chemical Fertilizers:***

1. Increase in water borne diseases due to contamination of surface and ground water resources.
2. Loss of natural fertility of the soil.
3. Loss of organic matter from the soil.
4. Threat to the quality of drinking water due to disposal of fertilizers into landfills sites and lands.

***Disadvantages of Use of Pesticides:***

Pesticides are the chemicals used to mixed with the soil to kill pests. Following are its disadvantages:

1. Species which are not targeted are also killed or injured.
2. After sometime the pest develop resistance against the pesticides.
3. Soil fertility is reduced.
4. On short duration exposure it causes illness and slow poisoning to human beings.
5. On long duration exposure it causes cancer, genetic defects, immunological and other chronic diseases.

**Effects of modern agriculture - Fertilizer Pesticide problems, Water logging, Salinity**

AGRICULTURE

Agriculture is an art, science and industry of managing the growth of plants and animals for human use. Agriculture includes preparation of soil for cultivation of crops, harvesting crops, breeding and raising livestock, dairying and forestry.

The two major types of agriculture are:

1. Traditional agriculture and
2. Modern or Industrialized agriculture

MODERN AGRICULTURE

Modern agriculture makes use of hybrid seeds of single crop variety, technologically advanced equipment, fertilizers, pesticides and water to produce large amounts of single crop.

Problems using fertilizers

1. Micronutrient imbalance: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus and Potassium (N,P,K) which are macronutrients. Excess use of fertilizers in fields causes micronutrient imbalance. Ex: Excessive use of fertilizers in Punjab and Haryana caused deficiency of micronutrient Zinc thereby affecting productivity of soil.
2. Nitrate pollution: Excess Nitrogenous fertilizers applied in fields leach deep into the soil contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L it leads to a fatal condition in new-born babies. This condition is termed "Blue Baby Syndrome"
3. Eutrophication: The application of excess fertilizers in fields leads to wash off of the nutrient loaded water into nearby lakes causing over-nourishment. This is called "Eutrophication". Eutrophication causes the lakes to be attacked by "algal blooms". Algal blooms use nutrients rapidly and grow fast. Their life is short, they die and pollute water thereby affecting aquatic life in the lake.

Problems in using Pesticides:

In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types:

1. First generation pesticides that use Sulphur, Arsenic, Lead or Mercury to kill pests
2. Second generation pesticides such as Dichloro Diphenyl Trichloroethane (DDT) used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:
    1. Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial not target organisms
    2. Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "superpests"
    3. Bio-magnification: Most pesticides are non-biodegradable and accumulis ate in the food chain. This is called bio-accumulation or bio-magnification. These pesticides in a bio-magnified form are harmful to human beings.
    4. Risk of cancer: Pesticide enhances the risk of cancer in two ways (i) It acts as a carcinogen and (ii) It indirectly suppresses the immune system.

WATER LOGGING

If water stands on land for most of the year, it is called water logging.

In water logged conditions, pore-voids in the soil get filled with water and soil-air gets depleted. In such a condition the roots of plants do not get enough air for respiration. Water logging also leads to low mechanical strength of soil and low crop yield.

CAUSES OF WATER LOGGING

1. Excessive water supply to the croplands
2. Heavy rain
3. Poor drainage

MEASURES TO PREVENT WATER LOGGING

1. Avoid and prevent excessive irrigation
2. Sub-surface drainage technology
3. Bio-drainage by trees like Eucalyptus

SALINITY

Water not absorbed by soil, is evaporated leaving behind a thin layer of dissolved salts in the top soil. This is called salinity of the soil. Saline soils are characterized by accumulation of soluble salts like sodium chloride, calcium chloride, magnesium chloride, sodium sulphate, sodium carbonate and sodium bicarbonates. Saline conditions are exhibited when pH is greater than 8.0

PROBLEMS IN SALINITY

1. Saline soils yield less crop

In order to remedy the condition of saline soils the following two techniques may be used:

1. Salt deposit is removed by flushing with good quality water
2. By using a sub-surface drainage system, the salt water is flushed out slowly.

CASE STUDIES

Canal irrigation in Haryana resulted in rising water table followed by water logging and salinity causing low crop productivity thereby huge economic losses.

Similarly the "Indira Gandhi Canal Project" in Rajasthan converted a big area into a "water soaked waste land".

In Delhi, accumulation of pesticides and DDT in the body of mothers caused premature deliveries or low birth weight infants.

Food centre at Center for Science and Environment (CSE) India reported Pepsi and Coca-Cola companies sold soft drinks with a pesticide content 30-40 times higher than EU guidelines permit. At the reported concentrations the pesticides damage the nervous system

# 4. LAND RESOURCES

Introduction : - Land resources is a valuable resource bestowed to mankind by nature since all the basic needs of living beings on earth (food, fibre, fuel and shelter ) are provided by it Population explosion has made us think whether these will be sufficient level resources to meet the future demand.

We are aware of the fact that total land area is shrinking due to increasing population, unplanned urbanization, deforestation indiscriminate construction of highways , airport ,residential and commercial buildings , , conversion of agricultural land for industrial purpose . All theses activity have put a severe stress on land resource .

Land resources are the basis for sustenance of life on earth, specially for developing countries as they are an asset to the poor people who use the resource as means of their livelihood it also serves as food security in adverse conditions. Hence sustainable management of land resources' will help in reducing poverty.

In UN earth summit, 1992 sustainable land management was defined as The use of land resources including soils, water, plants and animals for production of goods to meet changing human needs while simultaneously, ensuring long term productive potential of these resources and maintenance of environmental functions.

Harmony between production and environment can be established through following objectives

a) Maintaining long term productivity of the ecosystem functions(land, water and biodiversity)
b) Increasing productivity (quality, quantity and diversity) of goods and services, safe and healthy food in particular

Pattern of land use and management of resources' should be done very judiciously otherwise it will adversely affect the functioning of ecological processes.

The rate at which we are losing the land resources that is 5-7 million hectares/yr. of agricultural land shows urgent need to stop land degradation. About 2 million hectare of land has become unproductive in the world .About 70% of the global arable land is degraded and lost its productivity by 33%. About 20% is in critical condition.

**Factors that have led to land degradation**

**1** Water Erosion

2 Wind Erosion

3 Physical degradation , water logging , soil crusting , compaction , desertification etc .

4 Chemical degradation , alkalinisation and Salinization , ossification , acid , acidic fiction, nutritent removal , decrease in organic matter.

5 Biological degradation .

**Strategies to Conserve land resources**

1 Proper documentation of land production status.

2 Soil characteristics and properties to be monitored well

3 Adoption of water and soil conservation technique in areas having high water requirement like crop fields.

4 Regulation of Industrial activities in areas adjoining the crop land and residential regions.

5 To Follow sustainable and effective land use pattern .

6 Amendment of waste and marginal lands to check further land degradation .

7 Implementation of agro-forest ecosystems in the areas where there is serious threat of water erosion

8 Adoption of integrated water shed management system .

9 Increasing the efficiency of causative factors for production .

10 Auto- regenerating the soil fertility by adding organic matter , crop residue and vermicompost.

Implementation of Schemes

Since Land degradation is a serious threat to food security hence immediate conservation strategies must be adopted . The department of waste land development has implemented and planned to implement further schemes for conservation of land .

1 Integrated waste lands –Development Project Scheme which is 100 % centrally sponsored was started in 1989-90 , to initiate pilot projects like structure , trenching ,bonding , planting , multipurpose trees , pasture growing , agroforestry , horticulture and fuel wood conservation involving local people participation .

2 Area oriented fuel wood and fodder projects – These are 50% centrally sponsored for integrated water shed management system involving the village community. It promotes activities like tree planting , argoforestry , silvipasture development , horticulture and soil moisture conservation .

Each projects requires at least 200 HA and additional 10 HA at suitable site for treatment procedure. Forest Department is the nodal agency.

3 Grant in aid schemes -

It is 100% centrally sponsored to help registered voluntary agencies cooperatives etc for organization of awareness training and extension programs for integrated water shed management.

4 Proples Nurseries Scheme - Implemented at state level to motivate people for plant raising , to provide good quality seedling and encourage farm forestry.

5 Margin money Scheme –

This is also 100% centrally sponsored to finance the farm forestry projects and bring them within the viability of NABARD .

## Soils –

Maintenance of soil fertility , quality , water holding capacity , preventing soil degradation from erosion is the foremost criterion for conserving the land resources . adequate amounts N2 , P , & K , physical properties like PH texture and conductivity , presence of organic matter , total soluble salts is of utmost importance .

Natural process of soil erosion almost balances the soil formation but anthropogenic activates have accelerated the soil erosive mechanisms called soil erosion . It result in removal of plant food in solution , removal of plant food in solutions , removal of silt and humus and removal of soil surface .

Types of soil erosion –

1 **sheet erosion** : Removal of soil in thin layers over sloping land due to heavy down pour of rain water .

2 If unchecked may lead to rill erosion i.e runoff water forms thin rivulets and stream lets which form dendrite pattern of stream flow .

3 finally leading to gully erosion . Increasing velocity and volume of water cuts deep incisions over the land surface called gullies which tend to become larger depending on texture of soil are present then vertical walls develop due to collapse of the banks . They finally develop V-shaped or u-shaped valleys miniature waterfalls and intricate systems of gullies over the entire land surface.

Factors affecting soil erosion –

1 climate conditions

2 Topography of land

3 Drainage area or hydraulic characteristics of catchment basin .

4 Physical and chemical properties of soil .

5 Nature and extent of vegetative covering .

6 Economic Factors : Traditional outlook social economy and economic structure of community .

Desertification :-

Deserts are fragile ecosystems developed due to land –ocean-atmosphere-cryosphere interaction.

The moisture content is not enough to support it .Changes in climate conditions and human activates may cause desertification .

According to recent estimates by Govt Of India ,32.7% of country land areas (107.43 million HA) is affected by land degradative processes .

**Causes of desertification**

1. Water erosion
2. Wind erosion

3. Mining
4. Vegetation degradation

**Control measures**

**a. Sand – dune stabilization:**

This is done by

- Protection of dunes from biotic interference
- Development of micro wind breaks
- Reseeding grass and creeper seed in-between micro wind breaks

**b. Shelter belt plantation**

By planting 3-5 rows of trees across the wind direction.

**c. Aerial seeding**

Aerial seeding is done so that sowing of seeds can be done with 2-3 days to favour germination.

**d. Silvipasture systems**

This reduce salinisation and wind erosion and increases the productivity for long term.
For eg. Combination of trees like *Acacia tortilis* yielding 60a/ha of fuel wood and grasses yielding 55.8/ha would yield more fuel ass when sown singly.

5. **Agronomic Manipulations minimum tillage**

Tillage is necessary for seed bed preparation, moisture conservation and weed control but excessive tillage exposes the land to wind action. Summer tillage should be discouraged

6. **Conservation tillage/farming**

Depending upon the soil type, climatic conditions and the type of crops to be grown, extent of tillage must be decided. For e.g. tillage for loamy soil is more intensive than for sandy soil.

7. **Stubble Mulch farming**

Crop residues of 2-5 tonnes/ha and pearl millet stubbles of 45 cm height when used as mulch are very effective in preventing soil erosion in sandy soil of Bikaner. Long stubbles of coarse cereals are more effective than short stubbles. Perennial weeds may be used as mulch in arid regions where crop residue is not available.

8. **Strip cropping**

A method of planting erosion susceptible and erosion tolerant crops alternatively and perpendicular to prevailing wind direction. It reduces the velocity of wind, trap saltating sand particles and thus controls soil avalanching.

9. **Judicious use of irrigation water**

Use of sprinkler system of irrigation increases production as has been observed in production of *Zasiurus sindicus* in western part of Rajasthan

10. **Controlled mining activities** involving conservative technology and suitable land reclamation procedures prevents land degradation.

QUESTIONS

21. Which type of land degradation process is most common in India

e. Land slide
f. Soil erosion
g. Soil subsidence
h. Desertification [d]

22. Chemical weathering of limestone results in formation of
    e. Potassium rich soils
    f. Calcium rich soils
    g. Laterite
    h. Quartz [b]
23. Sand is obtained due to weathering of
    e. Sand stone
    f. Quartz
    g. Silica
    h. Limestone [b]
24. Deforestation rate is alarming in
    e. Temperate countries
    f. Tropical countries
    g. Polar regions
    h. None of the above [b]
25. Major causes of deforestation are
    e. Shifting cultication
    f. Fuel requirements
    g. Raw material for industries
    h. All of these [d]
26. Major consequences of deforestation are
    e. Destruction of natural habitat of wild species
    f. Disturbance in hydrological cycle
    g. Soil erosion
    h. All of these [d]
27. Minimum disturbance to soil is done by
    e. Contour farming
    f. No-till farming
    g. Terrace farming
    h. Alley cropping [b]
28. Forest cover of India is
    e. 20.6%
    f. 33.7%
    g. 50%
    h. 46.% [a]
29. Which of the following has largest forest cover?
    e. M.P.
    f. U.P.

g. Kerala
h. J & K [a]

30. Factors responsible for deforestation are
    e. Over-harvest of timber
    f. Conversion of forest land to agriculture
    g. Grazing
    h. Both a & b [d]
31. Shifting cultivation is also called
    e. Jhum cultivation
    f. Organic farming
    g. Green farming
    h. Agro forestry [a]
32. Soil fertility is due to
    e. Soil erosion
    f. Crop rotation
    g. Droughts
    h. Floods [b]
33. Agroforestry and social forestry both include
    e. Production forestry
    f. Commercial forestry
    g. Afforestation
    h. Plantation of trees [b]
34. Which two constitute agro forestry
    e. Fodder crops and fibre crops
    f. Food crops and fibre crops
    g. Trees and grasses
    h. Food crops and tree crop [d]
35. Main source of water to soil is
    e. Rain fall
    f. Rivers
    g. Canals
    h. Lakes [a]
36. In India common type of forest is
    e. Tropical thorn forest
    f. Sal and Teek forests
    g. Tropical most deciduous forest
    h. Tropical dry [d]
37. Which is best for plant growth
    e. Loamy soil
    f. Clayey
    g. Gravel
    h. Sandy soil [a]

38. The major cause of land degradation in our country is
    e. Soil erosion
    f. Pollution of soil
    g. Water logging
    h. None of these [a]
39. Where does terrace farming help the most in soil conservation
    e. Hill regions
    f. Wet areas
    g. Deserts
    h. Plains [a]
40. Forests control droughts by
    e. Preventing soil erosion
    f. Increasing oxygen
    g. Increasing humidity and rainfall
    h. Preventing floods [c]

## 5. Waste management

**Waste management** is the "generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes". There are various types of solid waste including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge). The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics.

There is a wide array of issues relating to waste management and those areas include:

- Generation of waste
- Waste minimization
- Waste removal
- Waste transportation
- Waste treatment
- Recycling and reuse
- Storage, collection, transport, and transfer
- Treatment
- Landfill disposal
- Environmental considerations
- Financial and marketing aspects
- Policy and regulation
- Education and training
- Planning and implementation.

Waste management practices are not uniform among: countries (developed anddeveloping nations); regions (urban and rural area), and sectors (residentialand industrial).

A landfill compaction vehicle in acti

Spittelau incineration plant in Vienna

Disposal of waste in a landfill involves burying the waste and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, miningvoids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills and open dumps can create a number of adverse environmental impacts such as wind-

blown litter, attraction of vermin, and generation of liquid leachate. Another common product of landfills is gas (mostly composed of methane andcarbon dioxide), which is produced fromanaerobic breakdown of organic waste. This gas can create odor problems, kill surface vegetation and is a greenhouse gas.

Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability and covered to prevent attracting vermin (such as mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

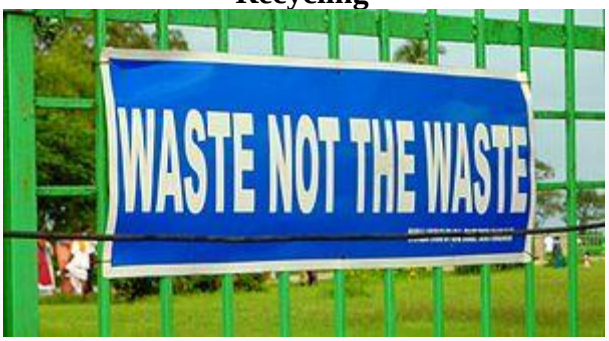
**Incineration**

Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash.

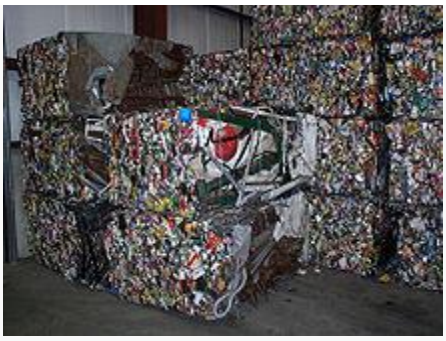
Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous wastematerials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organic compounds such as dioxins, furans, and PAHs, which may be created and which may have serious environmental consequences.

**Recycling**




Waste not the Waste. Sign in Tamil Nadu, India



Steel crushed and baled for recycling

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, a procedure called kerbside collection. In some communities, the owner of the waste is required to separate the materials into various different bins (e.g. for paper, plastics, metals) prior to its collection. In other communities, all recyclable materials are placed in a single bin for collection, and the sorting is handled later at a central facility. The latter method is known as "single-stream recycling."

The most common consumer products recycled include aluminium such as beverage cans, copper such as wire, steel from food and aerosol cans, old steel furnishings or equipment, polyethylene and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes.

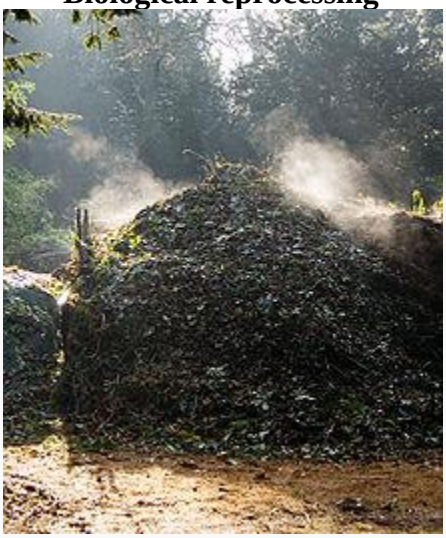
PVC, LDPE, PP, and PS (see resin identification code) are also recyclable. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required.

The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale value of the material once it is reprocessed.

**Sustainability**

The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainability-related activities. One way to do this is by shifting away from waste management to resource recovery practices likerecycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal.

## Biological reprocessing



An active compost heap.

Recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch orcompost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat (CHP/cogeneration) maximising efficiencies. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter. (See resource recovery).

## Energy recovery

Anaerobic digestion component ofLübeck mechanical biological treatment plant in Germany, 2007

Energy recovery from waste is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas recovery. This process is often called waste-to-energy. Energy recovery from waste is part of the non-hazardous waste management hierarchy. Using energy recovery to convert non-recyclable waste materials into electricity and heat, generates a renewable energy source and can reduce carbon emissions by offsetting the need for energy from fossil sources as well as reduce methane generation from landfills. Globally, waste-to-energy accounts for 16% of waste management.

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Thermal treatment ranges from using waste as a fuel source for cooking or heating and the use of the gas fuel (see above), to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxideand hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation).

## Resource recovery

Resource recovery is the systematic diversion of waste, which was intended for disposal, for a specific next use. It is the processing of recyclables to extract or recover materials and resources, or convert to energy. These activities are performed at a resource recovery facility. Resource recovery is not only environmentally important, but it is also cost effective. It decreases the amount of waste for disposal, saves space in landfills, and conserves natural resources.

Resource recovery (as opposed to waste management) uses LCA (life cycle analysis) attempts to offer alternatives to waste management. For mixed MSW (Municipal Solid Waste) a number of broad studies have indicated that administration, source separation and collection followed by reuse and recycling of the non-organic fraction and energy and compost/fertilizer production of the organic material via anaerobic digestion to be the favoured path.

## Avoidance and reduction methods

An important method of waste management is the prevention of waste material being created, also known as waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery), removing any food/liquid remains from cans and packaging, and designing products that use less material to achieve the same purpose (for example, lightweighting of beverage cans).

## Pyrolysis

Pyrolysis is a process of thermo-chemically decomposition of organic materials by heat in the absence of oxygen which produces various hydrocarbon gases. During pyrolysis, the molecules of object are subjected to very high temperatures leading to very high vibrations. Therefore every molecule in the object is stretched and shaken to an extent that molecules starts breaking down. The rate of pyrolysis increases with temperature. In industrial applications, temperatures are above 430 °C (800 °F). Fast pyrolysis produces liquid fuel for feedstocks like wood. Slow pyrolysis produces gases and solid charcoal. Pyrolysis hold promise for conversion of waste biomass into useful liquid fuel. Pyrolysis of waste plastics can produce millions of litres of fuel. Solid products of this process contain metals, glass, sand and pyrolysis coke which cannot be converted to gas in the process.

Vacuum pyrolysis is a process in which organic material is heated in vacuum to lower its boiling point and to avoid adverse chemical reactions. It is used in bio chemistry as synthetic tool. Pyrolysis also has an important role in combustion of wood and sawdust.

# Solid waste policy in India

**Solid waste policy in India** specifies the duties and responsibilities for hygienicwaste management for cities and citizens of India. This policy was framed in September 2000, based on the March 1999 Report of the Committee for Solid Waste Management in Class 1 Cities of India to the Supreme Court, which urged statutory bodies to comply with the report's suggestions and recommendations. These also serve as a guide on how to comply with the MSW rules. Both the report and the rules, summarized below, are based on the principle that the best way to keep streets clean is not to dirty them in the first place. So a city without street bins will ultimately become clean and stay clean. They advocate daily doorstep collection of "wet" (food) wastes for composting, which is the best option for India. This is not only because composting is a cost-effective process practiced since old times, but also because India's soils need organic manures to prevent loss of fertility through unbalanced use of chemical fertilizers.

**Municipality Solid Waste Rules** To stop the present unplanned open dumpingof waste outside city limits, the MSW rules have laid down a strict timetable for compliance: improvement of existing landfill sites by end-2001, identification of landfill sites for long-term future use and making them ready for operation by end-2002, setting up of waste-processing and disposal facilities by end-2003, and provision of a buffer zone around such sites. Biodegradable wastes should be processed by composting, vermicomposting etc. and landfilling shall be restricted to non-biodegradable inert waste and compost rejects.

The rules also require municipalities to ensure community participation in waste segregation (by not mixing "wet" food wastes with "dry" recyclables like paper,plastics, glass, metal etc.) and to promote recycling or reuse of segregated materials. Garbage and dry leaves are not allowed to be burnt. Biomedical wastes and industrial wastes are not allowed to be mixed with municipal wastes. Routine use of pesticides on garbage has been banned by the Supreme Court on 28.7.1997.

Littering and throwing of garbage on roads is prohibited. Citizens should keep their wet (food) wastes and dry (recyclable) wastes within their premises until collected, and must ensure delivery of wastes as per the collection and segregation system of their city, preferably by house-

to-house collection at fixed times in multi-container handcarts or tricycles (to avoid manual handling of waste) or directly into trucks stopping at street corners at regular pre-informed timings. Dry wastes should be left for collection by the informal sector (sold directly to waste-buyers or given free or otherwise to waste-pickers, who will earn their livelihood by taking the wastes they need from homes rather than from garbage on the streets. High - rises, private colonies, institutions should provide their own big bins within their own areas, separately for dry and wet wastes.

**Report of a Committee for Solid Waste Management in Class 1 Cities of India to the Supreme Court** The report recommends that cities should provide free waste collection for all slums and public areas, but charge the full cost of collection on "polluter pays" principle, from hotels, eateries, marriage halls, hospitals & clinics, wholesale markets, shops in commercial streets, office complexes, cattle - sheds, slaughter - houses, fairs & exhibitions, inner-city cottage industry & petty trade. Debris and construction waste must be stored within premises, not on the road or footpath, and disposed of at pre - designated sites or landfills by builder, on payment of full transport cost if removed by the Municipality.

For improved work accountability, "pin-point" work assignments and 365-day cleaning are recommended, with fixed beats for individual sweepers, including the cleaning of adjoining drains less than 2 ft deep. Drain silt should not be left on the road for drying, but loaded directly into hand-carts and taken to a transfer point . Silt and debris should not be dumped at compost - plant.

The quantities of garbage collected and transported need to be monitored against targets, preferably by citizen monitoring, through effective management information systems and a recording weigh - bridge: computerised for 1 million+ cities. At least 80% of waste-clearance vehicles should be on-road, and two-shift use implemented where there is a shortage of vehicles. Decentralised ward-wise composting of well-segregated wet waste in local parks is recommended, for recycling of organics and also for huge savings in garbage transport costs to scarce disposal sites.

The report also recommends that waste-management infrastructure should be a strictly-enforced pre-condition in new development areas. It advocates temporary toilets at all construction sites (located on the eventual sewage-disposal line) and restriction of cattle movement on streets. Livestock should be stall-fed or relocated outside large cities.

Cities must fulfil their obligatory functions (like waste management) before funding any discretionary functions, while being granted fiscal autonomy to raise adequate funds. Solid-waste-management and other charges should be linked to the cost-of-living index, along with levy of "administrative charges" for chronic littering. Funds should be earmarked for minimum expenditure on solid waste management: Rs 100 per capita per year in more than half a million cities, or a minimum of Rs 50 per capita in smaller towns. Many cities are already providing conditional funding to residential areas or colonies willing to take responsibility for improved waste-management of their respective areas.

The Supreme Court intends to monitor compliance with the MSW rules through the High Courts in each State. This gives all citizens both the opportunity and the obligation to ensure that hygienic waste-management becomes a reality, soon.

Municipal solid waste (MSW), commonly known as trash or garbage referspecifically to food waste, as in a garbage disposal; the two are sometimes collected separately.

## Composition

The composition of municipal solid waste varies greatly from municipality to municipality (country to country) and changes significantly with time. In municipalities (countries) which have a well developed waste recycling culture, the waste stream consists mainly of intractable wastes such as plastic film, and un-recyclable packaging materials. At the start of the 20th century, the majority of domestic waste (53%) in the UK consisted of coal ash from open fires In developed municipalities (countries) without significant recycling activity it predominantly includes food wastes, market wastes, yard wastes, plastic containers and product packaging materials, and other miscellaneous solid wastes from residential, commercial, institutional, and industrial sources. Most definitions of municipal solid waste do not include industrial wastes, agricultural wastes, medical waste, radioactive waste or sewage sludge. Waste collection is performed by the municipality within a given area. The term *residual waste* relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing.

Waste can be classified in several ways but the following list represents a typical classification:

1. **Biodegradable** waste: food and kitchen waste, green waste, paper (can also be recycled).
2. **Recyclable** material: paper, glass, bottles, cans, metals, certain plastics, fabrics, clothes, batteries etc.
3. **Inert** waste: construction and demolition waste, dirt, rocks, debris.
4. **Electrical and electronic** waste (WEEE) - electrical appliances, TVs, computers, screens, etc.
5. **Composite** wastes: waste clothing, Tetra Packs, waste plastics such as toys.
6. **Hazardous** waste including most paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and containers.
7. **Toxic** waste including pesticide, herbicides, fungicides Medical waste.

## Components of solid waste management

The municipal solid waste industry has four components: recycling, composting, landfilling, and waste-to-energy via incineration. The primary steps are generation, collection, sorting and separation, transfer, and disposal. Activities in which materials are identified as no longer being of value and are either thrown out or gathered together for disposal. Collection The functional element of collection includes not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a materials processing facility, a transfer station or a landfill disposal site. Waste handling and separation, storage and processing at the source Waste handling and separation involves activities associated with waste management until the waste is placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Separating different types of waste components is an important step in the handling and storage of solid waste at the source. Separation and processing

and transformation of solid wastes The types of means and facilities that are now used for the recovery of waste materials that have been separated at the source include curbside collection, drop off and buy back centers. The separation and processing of wastes that have been separated at the source and the separation of commingled wastes usually occur at a materials recovery facility, transfer stations, combustion facilities and disposal sites. Transfer and transport This element involves two main steps. First, the waste is transferred from a smaller collection vehicle to larger transport equipment. The waste is then transported, usually over long distances, to a processing or disposal site.

**Mixed municipal waste,** today, the disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from materials recovery facilities (MRFs), residue from the combustion of solid waste, compost, or other substances from various solid waste processing facilities. A modern sanitary landfill is not a dump; it is an engineered facility used for disposing of solid wastes on land without creating nuisances or hazards to public health or safety, such as the breeding of insects and the contamination of ground water. Landfills Landfills are created by land dumping. Land dumping methods vary, most commonly it involves the mass dumping of waste into a designated area, usually a hole or sidehill. After the garbage is dumped it is then compacted by large machines. When the dumping cell is full, it is then "sealed" with a plastic sheet and covered in several feet of dirt. This is the primary method of dumping in the United States because of the low cost and abundance of unused land in North America. Landfills pose a threat to pollution, and can intoxicate ground water. The signs of pollution are effectively masked by disposal companies and it is often hard to see any evidence. Usually landfills are surrounded by large walls or fences hiding the mounds of debris. Large amounts of chemical odor eliminating agent are sprayed in the air surrounding landfills to hide the evidence of the rotting waste inside the plant.

**Energy generation**

Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing of MSW for energy generation cleaner and more economical than ever before, including landfill gas capture, combustion, pyrolysis, gasification, and plasma arc gasification. While older waste incineration plants emitted high levels of pollutants, recent regulatory changes and new technologies have significantly reduced this concern. United States Environmental Protection Agency (EPA) regulations in 1995 and 2000 under the Clean Air Act have succeeded in reducing emissions of dioxins from waste-to-energy facilities by more than 99 percent below 1990 levels, while mercury emissions have been by over 90 percent. The EPA noted these improvements in 2003, citing waste-to-energy as a power source “with less environmental impact than almost any other source of electricity”.

# EVS TOPIC ON

# ENVIRONMENTAL POLLUTION

## AIR & WATER POLLUTION

**Environmental Pollution (Definition)**

It is the contamination of the environment with harmful wastes arising essentially out of human activities.

The wastes are termed Pollutants, which when present in certain concentrations, are harmful to natural environment i.e. animal, human plant and aquatic life on account of their toxicity.

**Threshold Limit Value (TLV)**

It is the permissible limit of a pollutant in the atmosphere to which when a healthy worker is exposed. 8 hours a day or 40 hours a week for life time has no adverse effects.

Eg:- TLV of $CO_2$ (Pollutant) is 5000 PPM.

### AIR POLLUTION

**Air Pollution Definition**

It is the contamination of the atmosphere by toxic chemicals or other matter discharged directly or indirectly by human activities or nature is such concentrations which produce adverse effects to human, animals, vegetation and aquatic life.

**Atmosphere -** The gaseous cover round the earth is divided into four layers :-

(i) **Troposphere :-** The layer adjacent to earth's surface extending 8-12 KM above sea level. It contains 95% of mass of air and water vapours temperature decreases continuously upto 220 k.

(ii) **Stratosphere :-** Extends upto 12-55 KM above earths surface. It contains Nitrogen, Oxygen and Ozone. Temperature remains constant. (220 k)

(iii) **Mesosphere :–** It lies beyond stratosphere, extends 55-80 KM above sea level. Temperature falls continuously to 180 k.

(iv) **Ionosphere/Thermosphere :-** The layer beyond Mesosphere the temperature rises to 1500 k.

**Types of Air Pollutants**

These are of two types

1. Primary Pollutants :- Pollutants produced directly from sources and include :-

   (a) **Suspended Particulate Matter (SPM) :-** Dust, Soot (Carbon), Smoke, ash, asbestos, lead, chromium, arsenic, nitrate, sulphate.

   **(b) Inorganic gases**

   (i) $CO_x$ – Carbon dioxide ($CO_2$), Carbon monoxide (CO).

   (ii) $SO_x$ – Oxides of Sulphur i.e. Sulphur dioxide ($SO_2$).

   (iii) $NO_x$ – Oxides of Nitrogen i.e. Nitric oxide NO, Nitrogen dioxide $NO_2$.

   (iv) Ammonia ($NH_3$), Hydrogen Sulphide ($H_2S$).

(c) **Hydrocarbons :-** Methane ($CH_4$), Butane ($C_4H_{10}$), Ethylene ($C_2H_4$), benzene ($C_6H_6$).

(d) **Other Organic Compounds :-** Formaldehyde (HCHO), Chloroform ($CHCl_3$), Vinif Chloride ($C_2H_3Cl$), Carbon tetra chloride ($CCl_4$), Ethane Oxide ($C_2H_4O$)

(e) **Liquid Droplets :-** Sulphuric acid ($H_2SO_4$), Nitric acid ($HNO_3$) DDT, (Pesticide), Malathion.

(f) **Photochemical Oxidants & Volatile Organic Compounds (VOC):-** Ozone ($O_3$), Hydrogen peroxide ($H_2O_2$), PAN etc.

(g) **Chlorofluoro Carbon :-** CFC's

2. Secondary Pollutants :- Certain primary pollutants react with normal atmospheric constituents to form other types of pollutants through the process of oxidation and dissociation.

**Eg :-**

| Primary | | Secondary Pollutant |
|---|---|---|
| $SO_2$ | Oxidations → | $SO_3$ (Sulphur trioxide) |
| NO | Oxidation → | $NO_2$ (Nitrogen Dioxide) |
| $H_2S$ | Oxidation → | $SO_3 + H_2O$ (Vapour) |
| $NO_2$ | Dissociation → | No + [O] |
| $SO_2 + H_2O$ | → | $H_2So_3$ Sulphurous acid |

**TROPOSHERIC POLLUTANTS**

**Sources & Harmful Effects of Tropospheric Pollutants**

1. **Oxides of Carbon**

(i) **Carbon Monoxide (CO)**

Source – Incomplete combustion of wood (Carbon) and hydrocarbons

$$C + \frac{1}{2} O_2 \longrightarrow CO$$

$$CH_4 + \frac{3}{2} O_2 \longrightarrow CO + 2H_2O$$

**(ii) Carbon Dioxide (CO2)**

Source – Burning of wood, fuel, also absorbed by plants during photosynthesis liberating oxygen and maintaining the balance.

**Harmful effects –** Narcotic effects, stimulation of respiratory septum causing asphyxiation.

2. Oxides of Sulphur – Sulphur Dioxide ($SO_2$)

Source – Burning of S and Sulphur ores in industry.

$S + O_2 \longrightarrow SO_2$

$2FeS_2 + 3O_2 \longrightarrow 2FeO + 4SO_2$

$2ZnS + 2O_2 \longrightarrow 2ZnO + SO_2$

**Harmful effects :** Causes spasms of smooth muscles & bronchioles (lungs). Irritation of eyes (tears and redness)

3. **Oxides of Nitrogen –** Nitrogen monoxide (NO)

**Source :** Combination of atmospheric nitrogen and oxygen during lightning.

$N_2 + O_2 \xrightarrow[2000°C]{} 2\,NO$

Also liberated by combustion engines.

**Harmful effects** – Toxic to living tissues. When oxidised by air gives $NO_2$, harmful to textiles, metals and paints.

4. **Particulate Pollutants** – are of two types :-

(a) **Viable –** bacteria, algae, fungi dispersed in air causes diseases and allergies.

(b) **Non viable particulates –** in the form of must, fog, smoke, fumes, dust and soot, causes respiratory problems leading to pneumoconiosis, blocks sunrays reaching earths surface. Fog bads to poor visibility.

**5. Chlorofluoro Carbons CFC's**

**Sources -** Refrigerants and propellants, solvents and foaming agents. These are colourless odourless gases Eg. difluoro dichloro methane $CF_2Cl_2$.

**Harmful effects –** Deplete the ozone layer by reacting with it causing. Ozone hole causing harmful Ultra Violet radiate to reach the earth's surface.

**PHENOMENON DUE TO STRATOSPHERIC POLLUTANTS**

**1. GREEN HOUSE EFFECT & GLOBAL WARMING**

**Green House** – Plants of certain variety grow well in warm tropical climate. In colder regions the temperature is not sufficient and plants wither plants are made to survive by growing in special glass on plastic roofed structures (houses), where sunlight enters through glass or plastic the temperature increases, which is healthy for growing plants.

The infrared radiations having longer wavelengths cannot escape galls, thus keeping the green houses warm. Consequently plants remain green and healthy (hence the name green house).

**Green House Effect in Stratosphere :-**

Earth's surface behaves like a green house, about 75% of the solar energy is absorbed by earth's surface while rest 25% is reflected back into stratosphere and Troposphere.

Certain gases like $CO_2$, methane, Ozone ($O_3$) and chlorofluro carbon ($CF_2Cl_2$) and water vapours, have the capacity of absorbing the heat and retaining it. Thus they add to the heating of atmosphere. These gases are hence called green house gases and the effect of excessive heat is called green house effect.

Over the years the concentration of these gases are increasing due to environmental pollution and human activities, leading to average increase of temperature throughout the world, called global warming.

**Harmful Effects :-**

1. It leads of global warming, which results in

   (a) Melting of glaciers and increase in sea level, which enters rivers leading to severe floods.

   (b) Loss of habitat for aquatic life (fishes etc.)

   (c) Decrease in annual rainfall and hence result in decreased cultivation and droughts.

   (d) Increase the incidence of infections diseases like malaria, sleeping sickness, dengue, yellow fever etc.

**2. ACID RAIN**

Rain water is acidic (pH = 5.6) slightly due to dissolution of carbon dioxide in atmosphere which forms a weak acid, carbonic acid ($H_2CO_3$).

$$CO_2 + H_2O \longrightarrow H_2CO_3.$$

In industrial areas & emission from vehicles oxides of N and Sulphur NO2 and $SO_2$ are emitted into atmosphere which dissolve in rain water to form strong acids, nitric acid and sulphuric acid.

$$4NO_2 + O_2 + 2H_2O \longrightarrow 4\,HNO_3$$

$$SO_2 + \frac{1}{2}O_2 + H_2O \longrightarrow H_2SO_4$$

The oxidation is sped up in presence of carbon particles (soot) present in atmosphere. These acids dissolve in water further decreasing its pH to 4.5 to 3. Such rain containing high acidity is called Acid Rain.

Harmful effects –

(i) Toxic to vegetation and aquatic life.

(ii) Reacts with certain minerals of soil and is depleted of these minerals.

(iii) articles made of metals, gold and silver ornaments loose their lusture.

(iv) Damages the leaves of plants and retard their growth and growth of prests.

(v) Adverse effects on aquatic life. Metals like zinc, mercury, aluminium and lead dissolve on decan and sea beds and move into water which are toxic.

(vi) Structures of time stone ($CaCO_3$) are corroded by the acids to form salts which are washed off in the rains. It has done serious damage to the Taj Mahal in New Delhi.

**SMOG**

It is the air pollution caused in industrial cities due to smoke particles or and fog is called smoke SMOG.

It is of two types :-

**(a)** **Classical SMOG :-** It results in cold countries due to condensation of vapours (fog) and sulphur dioxide gas upon carbon particles of smoke produced by fuel combustion. It was first observed in London in 1952 which resulted in killing 4000 people and called London Smog.

In India smog is observed in Northern Indian cities in winter (December). It occurs due to the deposition of smoke (carbon) particles on husk of rice from rice harvesting.

**(b)** **Photo Chemical SMOG :-** It was first observed in Los Angeles (USA) and occurs in places where the climate is cold and dry. It results from the photo chemical decomposition of vapours of Nitrogen peroxide and hydrocarbons in presence of sunlight. The main constituents of photochemical smog are Nitric oxide (NO), Nitrogen Peroxide ($NO_2$), formed by combination of $N_2$ and $O_2$ in combustion of fuel.

$$NO_2 \xrightarrow[\text{Decomposition}]{\text{Photochemical}} NO + O$$

$$O + O_2 \xrightarrow[\text{Atmosphere}]{} O_3$$
Ozone

$$NO + O_3 \longrightarrow NO_2 + O_2$$

Both NO and $NO_2$ are oxidising agents and react with hydrocarbons present in air to form harmful products like formaldehyde, acrolein and peroxylacetyl nitrate (PAN).

The smog has brownish colour due to $NO_2$. It causes burning sensation in eyes and affects the respiratory system. It causes cough, bronchitis and irritation of respiratory system. Since rubber has a strong affinity for ozone it cracks.

**STRATOSPHERIC POLLUTION –**

**DEPLETION OF OZONE LAYER**

The presence of ozone blanket in upper atmosphere prevents harmful ultra- violet radiations from reaching our planet. U-V rays are harmful to humans and animals.

Ozone layer depleting substances like Freone chlorofloromethane, nitrogen oxides, carbon tetra chloride is constantly being released by industries flying gets and rockets. These convert ozone into oxygen by reacting with it.

$$Cl_2CF_2 \longrightarrow \underline{Cl + C\,Cl\,F_2}$$

Chlorofluoro methane

free radicals

$Cl + O_3 \longrightarrow ClO + O_2$

$ClO + O \longrightarrow Cl + O_2$

This creates ozone hole i.e decrease in concentration of $O_3$ in the ozone layer and UV rays from sun can penetrate the atmosphere.

Harmful effects of UV rays

1. It causes skin cancer.
2. Weakening and loss of eye sight and may cause blindness.
3. It suppresses the immune septum and hence lead to herpes and other diseases.

## WATER POLLUTION

The quality of drinking water is important for human welfare. Water is an universal solvent and can dissolve a wide range of organize and inorganic substances, prepuce of excess substance are toxic and called polluted water which may bad to several diseases in humans, animals and plants.

Water pollutions is defined as the continuation of water by excess foreign substances which changes its normal physical, chemical and biological properties.

**Causes of water pollution-**

**Major water pollutants :-**

1. **Microorganism move** into water bodies like rivers, lakes through domestic wastes.
2. **Organize wastes :-** from decaying plants and animals, animal wastes and discharge from food processing industries.
3. **Plant nutrients :-** Excess chemical fertilizers used for cultivation move from soil into the water bodies.
4. Toxic heavy metals like lead mercury & arsenic discharged into water by chemical industries as industrial wastes.
5. **Pesticides –** i.e. chemicals used for killing insects, fungi and weeds move into ground water which are toxic.
6. Sediments of soil erosion by agriculture and strip mining mix with ground water.
7. Radioactive substances from mining of uranium may move into water bodies which has severe harmful effects on humans and animals.
8. Acids from metallurgical operations and chemical industries and mining industry move into the water bodies and ground water thus polluting it
9. Bases (alkalis) from soap industries and aluminum extraction planted move into the surface water bodies.

Hazardous effects of water pollutants

1. Sewage water – causes typhoid and malaria fever
2. Heavy metals – these are poisonous and body do not excrete them.
3. Cadmium & Mercury – Causes kidney diseases

4. Detergents & fertilizers present in water reduces oxygen content in water and impedes development in higher life forms like fishes
5. Acid solution is deadly to aquatic life
6. Polychlorinated biphenyls cause skin disorders.

**Dissolved oxygen**

Solubility of $O_2$ is about 30 cm 3 in 11 water. This is sufficient to maintain and sustain marine & aquatic life and for destruction of organic wastes in water bodies.

It is also vital for support of aquatic life. Fish growth is inhibited if dissolved $O_2$ is less than 6 ppm. Lower the amount of dissolved oxygen more polluted the water sample.

**Sources of oxygen in water:-**

1. Surface water absorbs $O_2$ from atmosphere due to turbulent motion.
2. From photosynthesis of aquatic plants.

$O_2$ dissolved in water is consumed by

1. Oxidation of organic matter
2. Bio oxidation of nitrogenous material
3. Chemical & biochemical oxidation of reducing agents.

**Biological Oxygen Demand (BOD)**

It is the measure of dissolved oxygen that would be needed by micro organisms to oxidize these compounds

**Harmful effects of Biodegradable wastes in water and soil.**

1. Obnoxious/Odorous gases in environment called oxmogen taken in lungs cause lung problems, giddiness, nausea
2. Odorous exudates and secretions of plants, Animals Microorganisms and Humans release hydrocarbons in atmosphere.
3. Domestic and Industrial discharge contain $H_2S$, $NH_3$, alcohols, aldehyde, phenols, ethers chlorinated organic compounds couses breathing problems.
4. Microbial decay and decomposition of Organic matter
5. Generation of Plant Nutrients

   The decomposition of biodegradable pollutants, generate rich plant nutrients which threaten the existence of water bodies the phenomena is termed as eutrophication. Phosphates present in rocks are solubilized by microbial acuity. At this stage the aquatic septum gets hidey productive.
   Based on nutrient status there are three types of systems :-

(a) **Oligotropic –** Water with poor nutrient status

(b) Mesotropic – Water with intermediate nutrient status

(c) Eutrophic – Water with rich nutrient status

**Treatment of Biodegradable wastes**

1. **Liquid wastes –** Such as sewage waste and industrial waste waters contain suspended semi solid and solids in colloidal from.
2. **Primary Treatment –** Passing over a cascade septum and then passed through centre fugal separators whereby due to swirling motion heavy particles' settle. It is then subjected to froth floatation process by agitation and addition a chemical coagulants where by suraller particles form big lumps and settle. This particulate matter removed is
3. **Secondary treatment –** It is subjected to two treatments
   (a) **Aerobic treatment –** biodegradation in presence of oxygen (air) whereby microbes get oxidized
   (b) **Anaerobic treatment –** degradation of organic wastes in oxygen deficit environment.
4. **Tertiary treatment –** Phosphates, ammonium salts which are present after secondary treatment are removed by this method.

## MCQ's

Q1. The layer of atmosphere lying adjacent to earths surfaces is

(i) Mesosphere (ii) Ionosphere (iii) Troposphere
(iv) Stratosphere

Q2. The stratosphere lies between

(i) Mesosphere & Ionosphere (ii) Troposphere & Mesosphere

(iii) Ionosphere and Mesosphere (iv) Troposphere & Ionosphere

Q3. Which of the following is a primary pollutant:-

(i) $SO_2$ (ii) $NO_2$ (ii) $SO_3$ (iv) $H_2SO_3$

Q4. Which of the following is not a green house gas :-

(i) $NO_2$ (ii0 $CO_2$ (iii) $CF_2Cl_2$ (iv) $O_3$.

Q5. Green house effect is the capacity of a gas to

(i) reflecting heat (ii) absorbing and retaining heat
(iii) radiating heat (iv) transmitting heat.

Q6. The normal acidity of rain water is due to the dissolution of
(i) Nitrogen dioxide (ii) Sulphur dioxide
(iii) Carbon dioxide (iv) Nitric oxide

Q7. The gases which essentially cause acid rain are -
(i) $CO_2$ and $CH_4$ (ii) $NO_2$ and $SO_2$
(iii) CO and $CO_2$ (iv) $CH_4$ and NO.

Q8. The photochemical SMOG was first observed in
(i) North India (ii) London

(iii) Los Angeles (iv) Mexico

Q9. Classical smog is produced by :-

(i) Photochemical decomposition of $NO_2$

(ii) Condensation of $SO_2$ and vapors on Carbon (Smoke)

(iii) Photochemical decomposition of $SO_2$.

(iv) Condensation of $NO_2$ on smoke particles.

Q10. Ozone layer depletion is a phenomena observed in

(i) Stratosphere (ii) Troposphere (iii) Mesosphere

(iv) Ionosphere

Q11. The ozone layer is present in which atmospheric layer.

(i) Troposphere (ii) Stratosphere (iii) Mesosphere (iv) Ionosphere

Q12. One of the harmful effects of ultra violet rays entering due to ozone layer depletion is :

(i) Corrosion of lime stone

(ii) Skin cancer in humans

(iii) Cough and bronchitis

(iv) Burning sensation of respiratory tract.

Q13. Ozone layer depletion is due to conversion of

(i) CO to $CO_2$ (ii) $O_3$ to $O_2$

(iii) $O_2$ to $O_3$ (iv) $CO_2$ to CO.

Q14. Which of the following is a not a secondary pollutant

(i) $SO_3$ (ii) NO (iii) $NO_2$ (iv) $H_2SO_3$

Q15. Which of the following is a viable particulate pollutant

(i) fog (ii) smoke (iii) bacteria (iv) mist

Q16. Which of the following is not a viable particulate pollutant :-

(i) bacteria (ii) fungi (iii) algae (iv) smoke

Q17. In photochemical smog, the NO and $NO_2$ gases oxidise the hydrocarbons to give a harmful product

(i) Sulphurous acid (ii) Peroxy acetyl nitrate

(iii) Methane (iv) Sulphur Trioxide

Q18. Earth behaves as a green house. It absorbs about _____ of solar energy

(i) 50% (ii) 75% (iii) 25% (iv) 100%