www.Notesfree.in

GE 3451 - ENVIRONMENTAL SCIENCE & SUSTAINABILITY

UNIT I - ENVIRONMENT AND BIODIVERSITY

Defination, Scope & Importance of Environment - Need for Public awarness - Ecosystem and Energy flow - Ecological Succession, types of biodiversity - genetic, Species and ecosystem diversity - Values of biodiversity India as a mega diversity nation - hot spots of biodiversity - threats to biodiversity : habitat loss, Paaching of wildlife, man wildlife conflicts - Endangered and endemic Species of india - Conservation of biodiversity - Insitu and exsitu.

— x —

INTRODUCTION

The word environment is derived from the french word "Environ" meaning "Surroundings". Each and Everything around us is called as Environment.

Every organisms is Surrounded by materials and forces which consistute its Environment, from which it must derive it needs. Environment Creates favourable conditions for the existence & development of living organisms.

ENVIRONMENT

Environment is defined as, "the Sum of total of all the living and non-living things around us influencing one another".

www.Notesfree.in

www.Notesfree.in

Environmental Science

Environment Science is the Study of the environment, its biotic (ie, biological) and abiotic (ie., non-biological) Compoments and their interrelationship.

Environmental Engineering

Environmental Engineering is the application of Engineering Principles to the Protection & enhancement of the quality of the Environment and to the enhancement & Protection of Public health and welfare.

Environmental Studies (or) Enviromental Education

Environmental Studies are the Process of educating the People for Preserving quality Environment.

Scope of environment Studies

→ Environment Protection & Management, Environment laws, Environment Engineering are emerging as a new Carrier Opportunities.

→ Industries need Environment experts to Control Pollution and disposal of water.

→ Enviromental experts are needed in all developmental and Policy making Commitees

→ There is huge market all over the world for waste and Pollution Control technologies

→ There is a need for trained manpower at every level to deal with Environmental issues like Safe

www.Notesfree.in

www.Notesfree.in

and clean drinking water, clean and fresh air, fertile land, healthy food and Sustainable development

Importance of Environment Studies

→ Environmental education is important for the economy and welfare of human Society.

→ Environmental education help us to find ways and means to maintain the ecological balance.

→ Environmental education train us to conserve our fast depleting natural resources.

→ It helps to understand different food chains and the ecological balance in nature.

→ Environmental education demonstrates how man can drive benefits from the Environment without destroying it.

→ Environment has been a Source of happines for man and time has come to preserve this happiners for man by importing Environmental education

→ It also helps us in Careful handling of the issues like Pollution, over exploitation of natural resources and Sustainable environment.

→ Environmental Studies have a direct relation to the quality of life we have.

→ Environmental Studies develop a concern and respect for the environment

Types of Environment: i) Natural Environment ii) man-made Environment

Natural Environment: The environment that ~~contains~~ comes into existance without interface of man Eg: Air, Water, Soil etc.

Manmade Environment (or) Anthropogenic: The Environment which has been ~~identified~~ modified by human activities is called man-made Environment. Ex: Road, colleges etc.

www.Notesfree.in

www.Notesfree.in

Public awarness

Increasing Population, urbanisation and Poverty have generated Pressure on the natural resources and lead to degradation of the Environment. Humans are responsible for natural resources, degradation of air, water, Soil etc. To get rid of these Problems, Public awarness is necessary.

1) Awarness through education

Environmental education must be a Part of Curriculum even from Childhood in Schools

2) Awarness through Mass Media

Media like radio, Tv etc Can educate People through Cartoons, documentaries etc.

3) Training Programs

Orientation and training Programs can be Organized to Create awarness

4) By arranging Competition

Story writing, essay writing, drawing competition must be organised nation-wide for Students Officials as well as Public Can be awarded for the best efforts.

5) NGO's

They Can act as "action group" or "Pressure group" in organizing Public movement for the Protection of the environment.

6) use of Posters & Banners

Attractive Posters and Banners related to environment Can be Placed in Public Places like Parks, Bus Stops etc.

www.Notesfree.in

www.Notesfree.in

7) Celebration of important days by the government

World Environment day - June 5

Earth day - April 22

Ozone day - September 16

These days must be celebrated in schools, colleges & work places so that people know their importance.

Ecology

Defination Ecology is the study of interactions among organisms or group of organism with their environment. The environment consists of both biotic components (living organisms) & abiotic components (non-living organisms) (or) i.e Ecology is the study of ecosystem.

Ecosystem

Ecosystem is the basic functional unit of ecology. The term system is coined from a Greek word meaning study of home.

Defination

A group of organisms interacting among themselves and with environment is known as ecosystem. Thus, an ecosystem is a community of different species interacting with one another & with their non-living environment exchanging energy and matter

Examples Animals cannot synthesis their food directly but depend on the plants either directly or indirectly

www.Notesfree.in

www.Notesfree.in

Biome

The kind of organisms which can live in a particular ecosystem depends on their physical and metabolic adoptions to the environment of that place. On earth there are many sets of ecosystems which are exposed to same climatic conditions and having dominant species with similar life cycle, climatic adoptions and physical structure. This set of ecosystem is called a biome.

Thus the biome is a small ecosystem with in an ecosystem.

Types of ecosystem

- Ecosystem
  - Natural
    - Terrestial
    - Aquatic
      - Marine
      - Freshwater
        - Lotic (running water) — Eg: Spring, Stream, rivers etc.
        - Lentic (Standing water) — Eg: Lake, Pond, Pool, etc.
  - Artificial / man Engineered

1. Natural Ecosystem

Natural ecosystems operate themselves under natural condition

www.Notesfree.in

www.Notesfree.in

Based on habitat types, it further classified into three types

i) Terrestial Ecosystem

This ecosystem is related to land and types of vegetation

Ex: Grassland ecosystem, forest ecosystem, desert ecosystem etc.

ii) Aquatic ecosystem

This ecosystem is related to water, it is further sub classified into two types based on salt content

i) Fresh water ecosystem

a) Running water ecosystem

Ex: Rivers, streams

b) Standing water Ecosystems

Ex: Ponds, lake

ii) Marine ecosystem

Ex: Sea and Sea shores

2. Man-Made (or) Artifical Ecosystem

Artifical ecosystem is operated (or) maintained by man himself.

Ex: Croplands, gardens

www.Notesfree.in

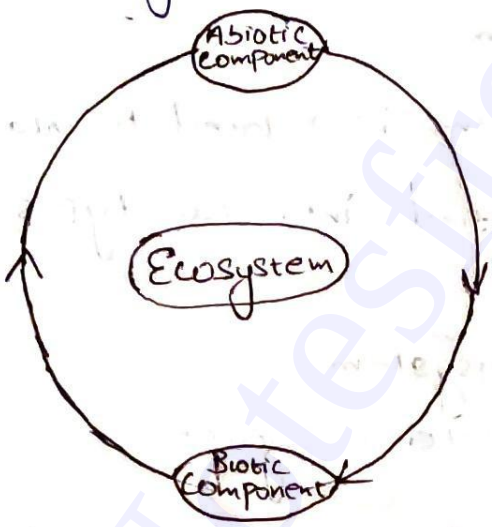
www.Notesfree.in

Structure (or) components of an Ecosystem

The term Structure refers to the various components. So the Structure of an ecosystem explains the relationship between the abiotic (non-living) & the biotic (living) components

An ecosystem has two major components

1. Abiotic (non-living) components
2. Biotic (living) components.



1) Abiotic (non-living) components

The non-living components (physical & chemical) of an ecosystem collectively form a community called abiotic components (or) abiotic components

Ex: Climate, Soil, water, air, Energy, nutrients etc

i) Physical components

They include the Energy, Climate, raw materials and living space that the biological community needs. They are useful for the growth and maintence of its member

Ex: Air, water, Soil, Sunlight etc.

www.Notesfree.in

www.Notesfree.in

ii) Chemical Components : They are the Sources of essential nutrients

Ex

i) Organic Substances: Proteins, lipids, Carbohydrates, etc.

ii) Inorganic Substances : All micro (Al, Co, Zn, Cu) and macro elements (C, H, O, P, N, P, K) and few other elements

2) Biotic Components

→ The living organisms in an ecosystem Collectively form its Community Called biotic Components

1. Autotrophic Components

The members of autotrophic Components are Producers, which are autotrops (Self-Nourshing organsims). They derive energy from Sunlight and make organic Compounds from inorganic Substances.

Ex: Green plants, algae, bacteria, etc.

2. Heterotrophic Components

The members of heterotrophic Components are Consumers & decomposers, which are heterotrophic (depend on others for food). They consume the autotrophs (producers)

The heterotrophs are

a) macro Consumers : They are herbivores, omnivores (or) Carnivores

b) Saprotrophs (micro Consumers): They are decomposers (bacteria, fungi, etc)

www.Notesfree.in

www.Notesfree.in

Classification of biotic Components

The members of biotic components of an ecosystem are group into three groups based on how do they get their food.

1. Producers (plants)
2. Consumers (animals)
3. Decomposers (Micro-organisms)

Producers (Autotrophs) Producers Synthesize their food themselves through Photosynthesis

Ex: All green Plants, trees

Photosynthesis

The green Pigments called Chlorophyll, Present in the leaves of Plants, converts CO_2 and H_2O in the Presence of Sunlight into Carbohydrates

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{h\nu} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

This Process is called Photosynthesis

Consumers (heterotrophs): Consumers are Organisms, which Cannot Prepare their own food & depend directly or indirectly on the Producers.

→ They Cannot make organic compounds, but Can transform one form organic Compounds into other form of organic Compounds.

Ex

Plant eating Species

Insects, rabbit, goat, deer, cow, etc.

www.Notesfree.in

www.Notesfree.in

Animals eating Species

Fish, lions, tiger, etc

Types of consumers

Consumers are the following types

i) Primary consumers (Herbivores) (plant eaters)

Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called Plant eaters.

Ex: Insects, rat, goat, deer, cow, horse etc.

ii) Secondary consumers (Primary consumers) (meat Eaters)

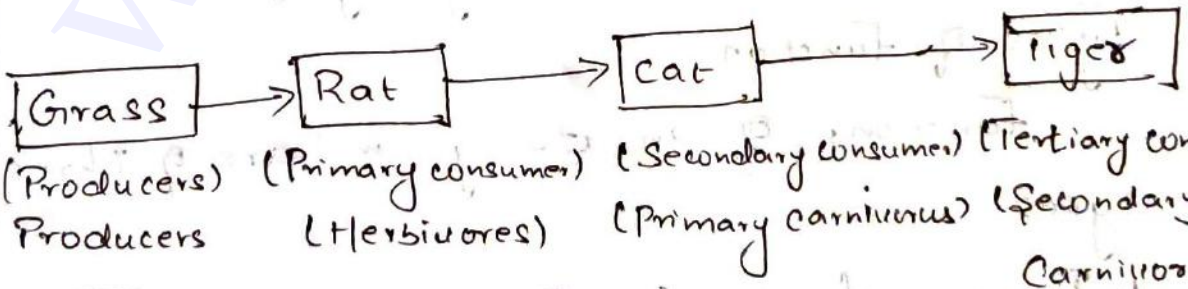
Secondary consumers are Primary Carnivores, they feed on Primary consumers. They directly depend on the herbivores for their food.

Ex: Frog, cat, Snakes, foxes etc.

iii) Tertiary consumers (Secondary Carnivores) (Meat Eaters)

Tertiary consumers are Secondary Carnivores, they feed on Secondary consumers. They depend directly on the Primary Carnivores for their food.

Ex: Tigers, lions, etc.



www.Notesfree.in

www.Notesfree.in

3. Decomposers - Decomposers are those Organisms which feed on organisms Plants & animals & decompose them into Simple Compounds. During the decomposition inorganic nutrients are ~~released~~ released. These inorganic nutrients together with other Substances are the utilized by the Producers for the Synthesis of their own food.

Ex: Microorganisms like bacteria & fungi

Meanings

i) Herbivores: Animals that eat only Plants are called herbivores (vegetarian)

ii) Carnivores: Animals that eat other animals are called Carnivores (non-vegetarian)

iii) Omnivores: Animals that eat both animals & Plants (vegetarian & non-vegetarian)

Function of an ecosystem

To understand clearly the nature of the ecosystem, its functioning should be thoroughly understood. The function of an ecosystem is to allow flow of energy & cycling of nutrients.

Types of function

Functions of an ecosystem are of three types

1. Primary function (or) Primary Production: The Primary function of all ecosystem is manufacture of Starch

www.Notesfree.in

www.Notesfree.in

(Photosynthesis).

ii) Secondary function (or) Secondary Production

The Secondary function of all ecosystem is distributing energy in the form of food to Consumers (or) the energy stored by the consumer

iii) Tertiary function : All living System die at a Particular Stage. These dead Systems are decomposed to initiate the third function of ecosystems namely "Cycling"

The function of an ecosystem may be understood by Studying the following terms.

a) Energy & material flow
b) Food Chain
c) Food webs
d) Food Pyramids.

Energy flow in the Ecosystems

Energy is the most essential requirement for all living organisms. Solar energy ~~ith~~ is the only Source to out Planent earth. Solar Energy is transformed to chemical energy in Photosynthesis by the plants (called as Primary Producers). Though a lot of Sunlight falls on green Plants, only 1.1. of it utilized for Photosynthesis This is the most essential help to Provide energy for all other living organisms in the ecosystem.

www.Notesfree.in

www.Notesfree.in

Some amount of Chemical energy is used by the Plants for their growth & the remaining is transferred to consumers by the Process of eating.

Thus the energy enters the ecosystem through Photosynthesis & Passes through the different tropic levels (feeding levels).

Energy flow through atmosphere to an ecosystem

Sun is the ultimate Source of energy the atmosphere absorbs 50% of the radiation & allow the remainings to reach the earth Surface. of the Solar radiation, ~~reached~~ that earth Surface reaches over, Some of which is utilised by Producers to Prepare its own food Photosynthesis.

Photosynthetic Equation

$$CO_2 + 2H_2O \rightarrow CH_2O + O_2 + H_2O$$

The Plants are used by herbivores and herbivores used by Carnivores as their food. In this way energy is transferred one Organism to another & So on. The Conversion of Solar energy governed by law of thermodynamics.

1st law of thermodynamics

It States that "Energy can neither be Created nor destroyed, but it can be Converted from one form to another"

illustration: Energy for an ecosystem comes from the Sun. It is absorbed by Plants, wherein it is

www.Notesfree.in

www.Notesfree.in

Converted into Stored chemical Energy
i.e., Solar Energy is converted into Chemical Energy
Solar energy → Chemical energy (Plants).

2. IInd law of thermodynamics

It states that, "whenever energy is transformed, there is a loss energy through the release of heat".

illustration : This occurs when energy is ~~transformed~~ transferred between tropic levels. There will be a loss of Energy (about 80-90%) in the form of heat as it moves from one tropic level to another tropic level. The loss of energy takes Place through respiration, running, hunting etc.

Respiration Equation

$$CH_2O + O_2 \longrightarrow CO_2 + H_2O$$

Carbohydrate oxygen carbondioxide water

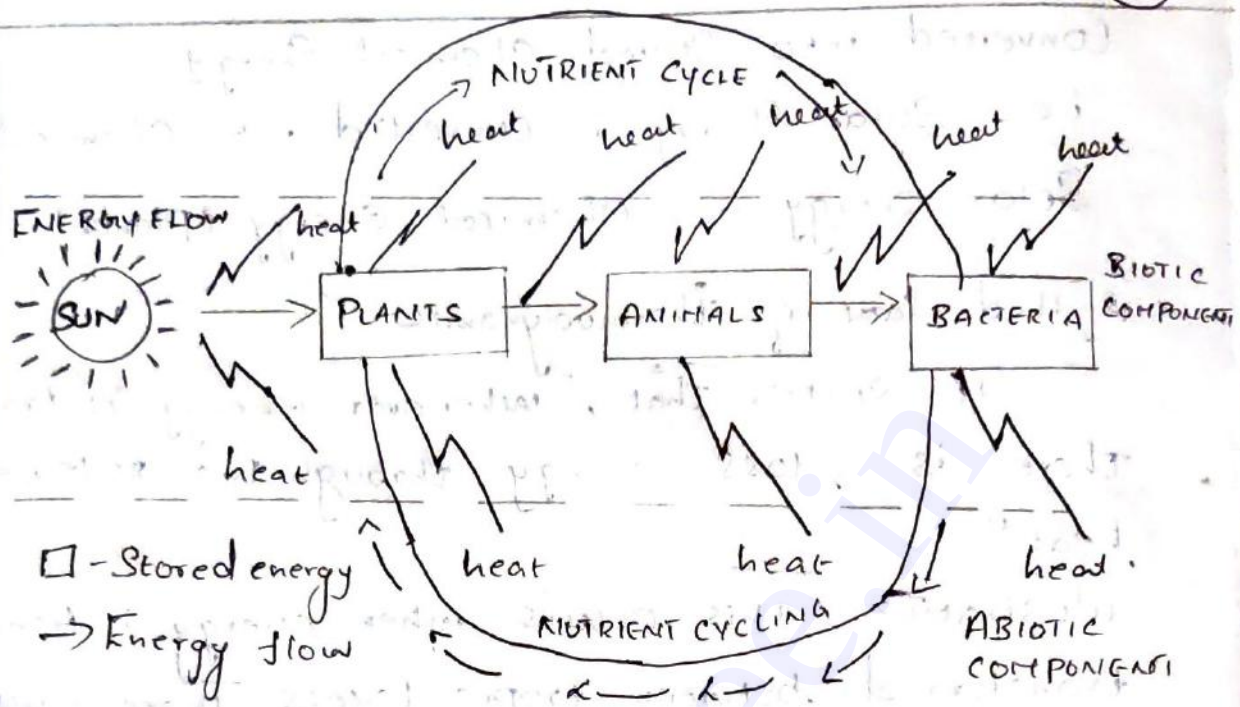
The net Production of biomass is only about 0.5% of the total incident radition (3000 K.cal/(m²)/day) & 1.0% of Energy absorbed & the remaining gets wasted.

Relation between Structure & function (flow model)

The biotic components & abiotic components are linked together through energy flow and nutrient cycle.

www.Notesfree.in

www.Notesfree.in



Food chain The Sequence of eating & being eaten in an ecosystem is known as food chain

Types of food chain

Depending on the Starting Point food chains can be of the following types

Grazing food chain

Grazing food chain Starts from green plants (Producers), go through herbivorus and end in Carnivores (Eg) Grassland, Pond Ecosystem

Grass → grasshopper → frog → Snake.

Detrius food Chain

Detrius food Chain Starts from organic wastes & dead organism (detrius) go through detrivores and end in inorganic Compounds.

Ex: Mangroove leats detritus food chain

Dead organic matter → Detritivores

$CO_2 + H_2O$ of Plants/animals

www.Notesfree.in

www.Notesfree.in

Community It is the group of Plants or animals living in an area.

Types of Ecological Succession

Ecologists recognize two types of ecological Succession, based on the Conditions Present at the beginning of the Process.

1. Primary Succession It involves the gradual establishment of biotic communities on a lifeless ground.

a) Hydrarch (or) Hydrosere: Establishment Starts in a watery area like Pond & lake.

b) Xerarch (or) Xerosere: Establishment Starts in a dry area like, desert and rock.

2. Secondary Succession: It involves the establishment of biotic Communities in an area, where Some type of biotic community is already Present.

Process of Ecological Succession

The Process of Ecological Succession can be explained in the following Steps.

1. Nudation: It is the development of a bare area without any life form.

2 Invasion: It is the establishment of one or more Species on a bare area through migration followed by establishment.

a) Migration : Migration of Seeds is brought about by wind, water or birds.

b) Establishment: The Seeds then germinate and grow on the land & establishes their Pioneer communities

www.Notesfree.in

www.Notesfree.in

3 Competition: As the number of individual Species grows, there is a Competition with Same Species and between different Species for Space, water and nutrients.

4 Reaction: The living organisms, take water, nutrients & grow & modify the environment is known as reaction. The modification becomes unsuitable for the existing Species & favour Some new Species, which replace the existing Species. This leads to Seral Communities

5. Stabilizations: It leads to Stable Community, which is in Equilibrium with the Environment.

Characteristics of Ecological Succession

i) It is unidirectional in nature
ii) It increase biomass in nature
iii) It involves various development of Stages
iv) Succession of Plant and animal Communities occur Side by side.

Causes of Ecological Succession

1) Climate Change/cause: long ~~vibration~~ variation in climate may lead Succession as Species cannot with Stand huge Climate Changes.

2) Physical Changes: The Physical changes like Soil erosion due to water, wind & gravity may lead to Changes in Environment where Species exist.

3) Human factor. The Size & Severity of the disturbance can have Profound influence on Plant and animal community.

www.Notesfree.in

www.Notesfree.in

Biodiversity : Bio means 'life' & diversity means 'variety', hence, biodiversity refers wide variety of life on earth

→ Our Planet - earth (biosphere) contains more than 20 million species of organisms. But of which only 1.4 million species have been identified so far. These species differ widely from one another. This variation in living organisms is called biodiversity.

Biodiversity

Biodiversity is defined as "the variety and variability among all groups of living organisms and the ecosystem in which they occur".

Significance (or) importance of biodiversity

1. Biodiversity is very important for human life, as we depend on plants, micro organisms, earth's animal for our food, medicine and industrial products.

2. Biodiversity protects the fresh air, clean water & productive land.

3. It is also important for forestry, fisheries & agriculture, which depend on rich variety of various biological resources available in nature.

4. Loss of biodiversity has serious economic & social costs for any country.

Impact of biodiversity loss

1. The farmers prefer hybrid seeds, as a result, many plant species become extinct.

2. For the production of drugs the pharmaceutical companies collect wild plants, so several medicinal plants now become extinct.

www.Notesfree.in

www.Notesfree.in

2. For the Production of drugs the Pharamaceutical Companies collect wild Plants, So Several medicinal Plants now become extinct.

3. Tropical forests is the main Sources of world's medicine. Every year these forests are disappering due to agriculture, mining, logging

Ex: Taxus baccate, a tree growing in Sub-himalayan regions

Classification (or) levels of Biodiversity

Biodiversity is generally classified into three types

1. Genetic diversity
2. Species diversity
3. Community (or) Ecosystem diversity

Genetic diversity

A Species with different genetic Characteristic is known as Sub-Species or "genera".

Genetic diversity is the diversity within Species ie., variation of genes within the Species.

Within individual Species, there are number of varieties, which are Slightly different from one another. These differences are due to difference in the Combination of genes. Genes are the basic units of hereditary information transmitted from one generation to other.

Examples

1. Rice varieties: All rice varieties belong to the Species "Oryzasativa". But there are thousands of rice varieties which Show variation at the genetic

www.Notesfree.in

www.Notesfree.in

level differ in their Size, Shape, colour and nutrient content.

2. Teak wood varieties: There are number of teak wood varieties found available.

Ex: Indian teak, burma teak, malasian teak etc.

Species diversity

Species : A discrete group of organisms of the Same kind is known as Species.

Species diversity is the diversity between different Species. The Sum of varieties of all living organisms at the Species level is known as Species diversity.

The biotic component is composed of a large number of Species of Plants, animals & micro organisms, which interact with each other & with the abiotic component of the environment.

Ex: 1. The total number of living Species in the earth are more than 20 million. But, of which only about 1.5 million living organisms are found and given Scientific names.

2. Plant Species: Apple, Mango, grapes, wheat, rice etc

3. Animal Species: Lion, tiger, elephant, deer, etc.

Community (or) Ecosystem Diversity

Ecosystem It is a Set of biotic Components (Plants, animals & micro organisms) interacting with one another & with biotic Components (soil, air, water etc)

The diversity at the ecological or habitat level is known as ecosystem diversity. A large

www.Notesfree.in

www.Notesfree.in

region with different ecosystems can be considered as ecosystem diversity.

Example River Ecosystem

The river which include the fish, aquatic insects, mussels & variety of Plants that have adopted.

Values of biodiversity

Biosphere is a life Supporting System to the human beings. It is the Combination of different organisms. Each organisms in the biosphere has its own Significance. Biodiversity is vital for healthy biosphere. Biodiversity is must for the Stability and Proper functioning of the biosphere.

1) Consumptive use value: These are direct use values, where the biodiversity Products are harvested & Consumed directly.

Ex: Food, drug, fuel etc.

a) Food: A large number of wild Plants are Consumed by human beings as food. Nearly 80-90% of our food crops have been domesticated only from the tropical wild Path.

Ex: Codanopin's in himalayan region
Cius microphyllum is Kashmir.

b) Drugs: Around 70% of modern medicines are derived from plant & Plant extracts. 20,000 Plants Species are believed to be used medicinally Particularly in the traditional System of unani, Ayurveda and Sidha.

www.Notesfree.in

www.Notesfree.in

Ex: India uses 3000 Species of Plants in Ayurveda, Homeopathy & unani System of medicine.

→ According to latest ~~medicinal~~ medical Sciences, bee-Sting venom is used for treating arthitis.

c) Fuel: Firewoods are directly consumed by villagers tribels. The fossil fuels like coal, Petroleum & natural gas are also the Products of fossilized biodiversity

Product	Source	use
Penicillin	Fungus	Antibiotic
Quinine	Cinchona Bark	malaria treatment
Tetra cycline	Bacterium	Antibiotic

Medicinal Products from natural resources

2) Productive use values

Biodiversity Products have obtained a commercial value. These Products are marketed & Sold. These Products may be derived from animals & Plants.

Animal Product

Animal Product	Animal
Silk	Silkworm
wood	Sheep
Musk	muskdeer
Tusk	Elephants

Plant & animal Product for various industry

Plant & animal Product	Industry
wood	Paper & Pulp Industry
Cotton	Textile Industry
leather	leather Industry
Fruits & Vegetable	Food Industry

Ex: Rice accounts for 22.1. of the Cropped area & Cerals, accounts for 39.1. of cropped area.

→ Oil Seed Production also helped in Saving large amount of foreign exchange Spent on importing edible oils.

www.Notesfree.in

www.Notesfree.in

3) Social values Social values of the biodiversity refers to the manner in which the bio resources are used to the Society. The values are associated with Social life, religion & Spiritual aspects of the People.

Ex: Holy Plants → Tulsi, Peepal, lotus etc.

Holy Animals → many animals are considered as holy animals in our country. Cow, Snake, rat etc.

4) Ethical values (or) Existence values

It involves ethical issues like "all life must be Preserved". The ethical values mean that a Species may (or) may not be used, but its existance in nature give us Pleasure.

Ex: The river ganga is considered as holy river we are not driving anything from Kangaroo, Zebra (or) Giraffee, but we feel that they Should exist in nature.

5) Aesthetic value: The beautiful nature of Plants & animals insist us to Protect the biodiversity.

Ex: Eco-tourism: People from far Place Spend a lot of time and money to visit the beautiful areas, where they Can Enjoy the aesthetic value of biodiversity. This type of tourism is known as eco-tourism.

6) Option value: The Option values are the Potential of biodiversity that are Presently unknown & read to be known. The Optional values of biodiversity Suggests that any Species may be Proved to be a valuable Species after Someday.

Ex: 1. The growing biotechnology field is Searching a Species causing the disease of Cancer & AIDS.

2. Medicinal Plants & herbs Play a very important role in our indian economic growth.

www.Notesfree.in

www.Notesfree.in

India as a Mega-diversity nation

There are nearly 170 Countries in the world & 12 of them Contain 70% of our Planet's biodiversity.

Mega Diversity regions

The following 12 Countries, Australia, Brazil, China, Colombia, Ecuador, the united States, India, Indonesia, madagascar, mexico, Peru & Democratic Republic of the Congo regions are known as Mega diversity regions. These Countries have the world's Selected few rich floral land & faunal Zone.

India as a Mega diversity nation

India is one among 12 mega-diversity Countries in the world. It has 89,450 animal Species accounting for 7.31% of the global faunal Species & 47,000 Plant Species which accounts for 10.8% of the world floral Species. The loss of biodiversity is about 33%.

Distribution of Species in Some groups of flora & fauna in india:

Groupwise Species Distribution

Plants	Number	Animals	Number
Fungi	23,600	Mollusca	5042
Bacteria	850	Birds	1228
Algae	2500	Reptiles	428
Bryophytes	2564	Mammals	372
Pteridophytes	1022	Arthopoda	57,525

Endemism (or) Endemic Species

The Species which are confined to a Particular area are called endemic Species. Our Country

www.Notesfree.in

www.Notesfree.in

has a rich endemic flora & fauna. About 33% of the flowering Plants, 53% of fresh water fishes, 60% amphibians, 36% reptiles & 10% mammalian are endemic Species.

1) Plant diversity - Nearly 5000 flowering Plants & 166 crop plant species have their origin in India.

2) Marine diversity - More than 340 coral species of the world are found here. Several species of mangrove Plants & Seagrasses are also found in our country.

3) Agro - biodiversity There are 167 crop species & wild relatives. India is considered to be the centre of origin 30,000 to 50,000 varieties of rice, mango, tumeric, ginger, Sugarcane etc.

4) Animal biodiversity There are 75,000 animal species including 5,000 insects. India is a home to about nearly 2,00,000 living organisms.

'RED' Data book (or) Red list

Red book is Catalogue of tara facing risk of extinction. The Purpose of Preparation of red list is to:

i) Provide awarness to the degree of threats to biodiversity.

ii) Provide global index on already decline of biodiversity

iii) Identification of Species at high risk of extinction.

iv) help in Conservation action

v) Information about international agreements.

www.Notesfree.in

www.Notesfree.in

India's biodiversity is threatened due to habitat destruction, degradation, fragmentation & over exploitation of resources.

According to 'RED' Data book 44 Plant Species are critically endangered, 54 endangered & 143 are vulnerable (exposed to damage)

India ranks 2nd interms of the no. of threatened mammals & 6th among the countries with the most threatened birds.

Ex:

1. Pitcher Plant has become endemic in Eastern himalayas

2. Taxus wallichina has come under red dad category due to its over exploitation.

Threats to biodiversity:

Any disturbance in an natural ecosystem tend to reduce its biodiversity. The waste generated due to increase in human population & industrilisation, spoils the environment and leads to more diversity in biological species.

Habitat loss: The loss of population of interbreeding organism is caused by habitat loss.

Factors influencing Habitat loss

1. Deforestation: The loss of habitat is mainly caused by deforestation activities. Forest & grasslands have been cleared for conversion into agricultural lands (or) settlement (or) developmental project.

2. Destruction of lands / wet lands

The wetlands, estuaries & mangroves are destroyed due to draining, filling & pollution which causes huge biodiversity loss.

www.Notesfree.in

www.Notesfree.in

3. Habitat fragmentation

Sometimes the habitat is divided into Small & Scattered Patches. This Phenomenon is known as Habitat fragmentation.

4. Raw material

For the Production of hybrid Seeds, the wild Plants are used as raw materials. As a result many Plant Species becomes extinct.

5. Production of drugs

Many Pharmaceutical Companies collect wild Plants for the Production of drugs. Therefore Several medicinal Plant Species are on the verge of extinction.

6. Illegal trade

Illegal trade on wildlife also reduces the biodiversity and leads to habitat loss.

Poaching of wildlife

Poaching means killing of Animals to sell their Products is called Commerical Poaching.

Factors influence Poaching

a) Human Population: Increased human Population in our Country has led to Pressure on forest resources, which ultimately causes degradation of wildlife habitats.

b) Commerical Activities: Though international ban on trading the Products of Endangered Species, Smuggling of wildlife Products continues.

Wildlife Products → ~~Furns~~ Furs, horns, tasks, live Specimens, herbal Products.

www.Notesfree.in

www.Notesfree.in

Wealth of wildlife → Asia, Latin, America & Africa have richest source of biodiversity

Example 1) Male gorilla - In Rwanda and Zaire, it is understand for body parts.

2) Blue morpho butterfly - In Brazil, it is poached for making attractive trays & other objects.

3) Snowy large egret - In U.S, its poached for its white plumes, so as to keep it in ladies hats.

4) Blubber - It is used to prepare lamp oils & lubricating oils

5) Baleen - It is used to prepare combs & other similar products / articles

6) Elephant feet - It is used to make Ash trays

7) Elephant - It is killed for ivory

→ (Cont) - - -

Subsistence Poaching - Killing animals to provide enough food for their survival called Subsistence Poaching

Commerical Poaching - Hunting & killing animals to sell their products is called commercial poaching.

Remedy measures

1. illegal hunting & trading of animals & animal products should be stopped immediately.

2. We should not purchase furcoat, purse or bag or items made of crocodile skin or python skin

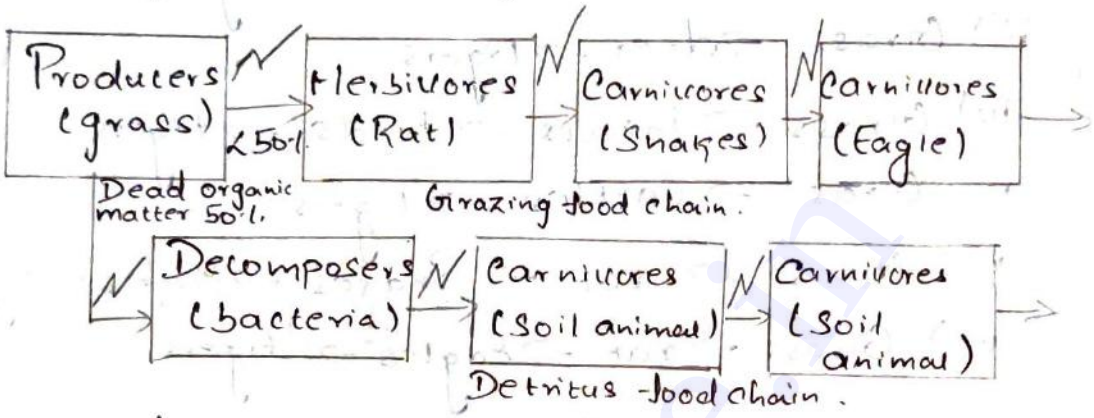
3. Biodiversity laws should be strengthened.

www.Notesfree.in

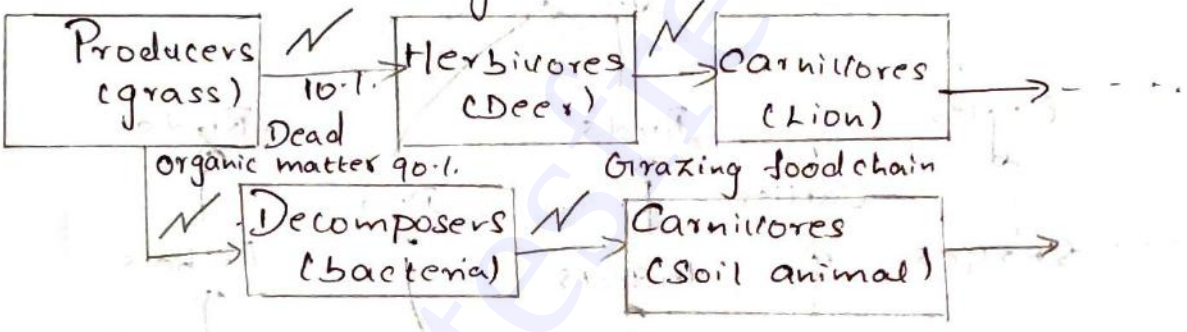
www.Notesfree.in

Energy flow diagram in food chain

1. In a grassland ecosystem



2. In a forest ecosystem



It is clear that grazing food chain gets energy basically from plant while the detritus food chain gets energy from dead plant biomass.

Food web

The interlocking pattern of various food chains in an ecosystem is known as food web.

In a food web many food chains are interconnected, where different types of organisms are connected at different trophic levels, so that there is a number of opportunities of eating and being eaten at each trophic level.

Energy flow in food web

The food web, is formed by interconnecting linear grazing food chain, which

www.Notesfree.in

www.Notesfree.in

in Sequence are

i) Grass → insects → fishes → birds → tigers

ii) Grass → insects → birds → tigers

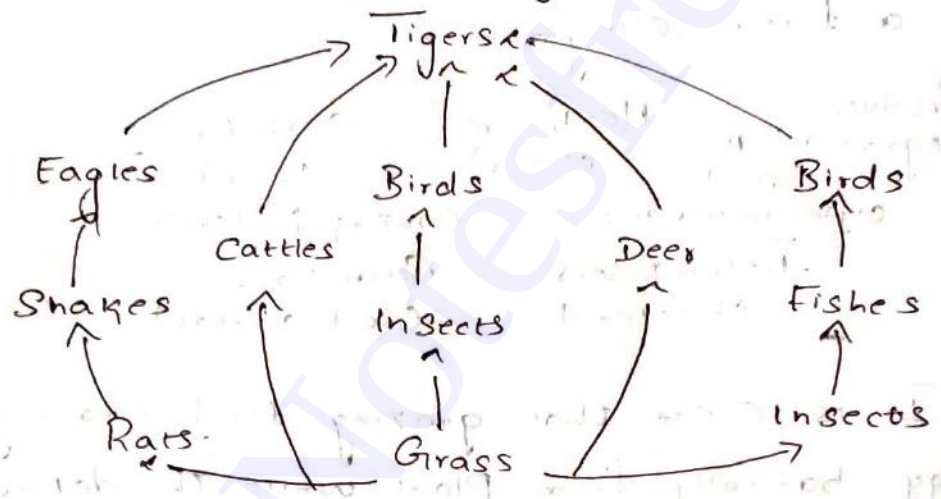
iii) Grass → deer → tigers

iv) Grass → insects → birds → tigers

v) Grass → Cattles → tigers

vi) Grass → rat → Snakes → Eagels → tigers

vii) Grass → rat → Eagles → tigers



Ecological Succession

The Progressive replacement of Community or by Series of Communities. Thus the Progressive replacement of one Community by another till the development of Stable Community in a Particular area is called Ecological Succession.

Stages of Ecological Sucession

1. Pioneer Community: The first group of organism, which established their community in the area is called 'Pioneer' community.

2. Seres (or) Seral Stage: The various developmental stages of community is called 'Seres'.

www.Notesfree.in

www.Notesfree.in

4: Adequate food, and water should be made available for the wild animals within forest zones.

5. The development & constructional work in & around forest region must be stopped.

Endangered & Endemic Species of India

According to international union of conservation of Nature & natural resources (IUCN) the species are classified into various types.

1. Extinct Species : A species is said to be extinct, when it is no longer found in the world.

2. Endangered Species: A species is said to be endangered when its number has been reduced to a critical level: unless it is protected & conserved, it is in immediate danger of extinction.

3. Vulnerable Species: A species is said to be vulnerable when its population is facing continous decline due to habitat destruction or over exploitation. Such a species is still abundant.

4. Rare Species: A species is said to be rare, when it is localized within restricted area (or) they are thinly scattered over a more extensive area. Such species are not endangered or vulnerable.

Endangered Species of India

A species is said to be endangered, when its number has been reduced to a critical level unless it is protected & conserved, it is in immediate danger of extinction.

→ India 450 plant species have been identified as endangered species. About 100

www.Notesfree.in

www.Notesfree.in

mammals & 150 birds are estimated to be endangered species. But India's biodiversity is threatened due to habitat destruction, degradation & over exploitation of resources.

Group of Threatened Species	Number of Threatened Species
Plants	250
Birds	70
Mammals	86
Reptiles	25
Amphibians	3
Fishes	3
Molluscs	2
Insects	50

Important Endangered Species

A few species of endangered reptiles, mammals, birds & plants.

1. Reptiles	Tortoise, green sea trutle, gharial, Python
2. Birds	Peacock, Siberian white crane, Pec
3. Mammals	Indian wolf, red fox, Sloth bear, tiger, Indian lion, golden cat, desert etc.
4. Primates	Hoolock gibon, lion-tailed macaque, capped monkey, golden monkey
5. Plants	A large no. of medicinal plants (like rauvol fos Serepentina), Sandal wood tree (like Santalum, Cycas bed donei)

RED-data book: RED-data book contains the list of endangered species of plants & animals. The RED. data gives the warning signal for those species which are endangered & if not protected they become extinct in near future.

www.Notesfree.in

www.Notesfree.in

Factors affecting Endangered Species

1. Pollution. Humans dispose their waste Products on nature. So, the land, river & air get Polluted Severly. These Pollutants enter our environment & travel through the food Chain & accumulate in the tissues of the living things, Finally it leads to death.

2. Over-exploitation: Over-exploitation of the natural resources & Poaching of wild animals also leads to extinct of wild animals

3. climate change: Climate change is brought about by the accumulation of greenhouse gases in the atmosphere. Climate change threatens Organisms & ecosystems, which Cannot accommodate the Change of environmental Studies.

Remedial measure

1. This treaty list Some 900 Species that Cannot be Commercially traded as live specimens or wildlife Products, because they are in danger of extinction.

2. The treaty also restricts international trade of 2900 Other Species, because they are endangered.

Drawbacks of this treaty

1. The badnews of this treaty is that effect of this treaty is limited because enforcement is difficult & convicted violators Often Pay Only Small fines.

2. Also, member Countries can exempt themselves from Protecting any listed Species.

www.Notesfree.in

www.Notesfree.in

Sustainable benefit to Present generation while maintaining its potential to meet the needs of future generation.

Factors affecting biodiversity

1) Poaching of wild animals, over exploitation of natural resources. degradation of habitats, affect biodiversity.

2) The marine ecosystems are also distributed due to oil Spills & discharge of effluents.

3) The climatic factors like global warming, Ozone depletion, acid rain also affect the biodiversity.

Advantages (or) need of biodiversity Conservation

1) It Provides immediate benefits to the Society Such as recreation & tourism.

2) It also Preserves the genetic diversity of Plants & animals.

3. Ensures the Sustainable utilization life Supporting System of earth.

4. It leads to Conservation of essential ecological diversity & life Supporting Systems.

Types (or) Strategy of biodiversity Conservation.

There are two types of biodiversity Conservation

1. In-Situ Conservation (within habitat)

2. Ex-Situ Conservation (outside habitat)

In-Situ Conservation

In-Situ Conservation involves Protection of fauna & flora within its natural habitat, where

www.Notesfree.in

www.Notesfree.in

the species normally occurs is called in-situ conservation.

The natural habitats or ecosystem maintained under in-situ conservation are called "protected areas"

Important In-situ Conservation: Biosphere reserves, National Parks, wildlife Sanctuaries, Gene Sanctuary etc.

Methods of in-situ conservation

Around 4.1. of the total geographical area of the country is used for in-situ conservation. The following methods are presently used for in-situ conservation. It is the best method for the long term protection of biodiversity

In-situ conservation	Number available
Biosphere reserve	7
National Parks	80
wild life Sanctuaries	420
Botanical gardens	120

1. Biosphere Reserves:

Biosphere reserves cover large area, more than 5000 sq.km. It is used to protect species for long time.

Name of Biosphere	State.
Nanda Devi	U.P
Nokrek	Meghalaya
Manas	Assam
Sunderbans	west bengal
Gulf of mannar	Tamilnadu
Nilgiri	Karnatka, Kerala, Tamilnadu
Great Nicobars & Similipal	Orissa.

www.Notesfree.in

www.Notesfree.in

for Conservation of Crop Varieties & the wild relatives of crops.

Role of Ex-Situ Conservation

1. It involves maintainence & breeding of Endangered Plants & Animal Species under Controlled Conditions

2. It identifies those Species which are at more risk of extinction.

3. It Prefers the Species, which are more important to man in near future among the Endangered Species

Important Ex-Situ Conservation

Botanical gardens, Seed banks, Microbial Culture Collections, tissue & Cell Cultures, museums, Zoological gardens.

Methods of Ex-Situ Conservation

The following important gene bank (or) Seed bank facilities are used in Ex-Situ Conservation.

i) National Bureau of Plant Genetic Resources (NBPGR):
It is located in New Delhi. It uses Cryo Preservation techniques to Preserve agricultural & horticultural crops.

Cryo Preservation technique.
It involves the Preservation of Seeds, Pollen of Some important agricultural & horticultural crops by using liquid nitrogen at a temperature as low as -196°c. varieties of rice, Pearl millet, Brassica, onion, carret have been Preserved Successfully in liquid nitrogen for Several years.

ii) National Bureau of Animal Genetic Resources (NBAGR)
It is located at Karnal, Haryana. It Preserves the Semen of domesticated bovine animals.

iii) National facility for Plant issue Culture Repository (NFPTCR)
It develops the facility for Conservation of varieties of crop Plants or trees by tissue Culture. This facility has been Created with the NBPGR.

www.Notesfree.in

www.Notesfree.in

3) The Site is under That

Reason for rich biodiversity in the tropics

1. The tropics have a more Stable climate

2. Warm temperatures & high humidity in the tropical areas Provide favorable Conditions

3. Among Plants, rate of out-crossing appear to be higher in tropics.

Area of hotspot

The hotspot area which cover less than 2.1. of the world's land & it contain 50,000 endemic Species.

According to myer setal an area is designated as a hotspot which it contain atleast 0.5.1. of the endemic plant Species.

In terrestial Plants, 40.1. Invertebrates, 25.1. Species are endemic.

The areas of high diversity, endemism are threatened by human activities.

Hotspots of biodiversity in India

Myers etal recognised 25 hotspots in the world two of which are found in India

1. Eastern himalayas → Indo-Barma Region

2. western ghats → Srilanka Region.

Eastern himalayas

Geographically, these are consist of Nepal, Bhutan & Neighbouring States of Northern India.

www.Notesfree.in

www.Notesfree.in

These are 35,000 Plant Species Present in the Himalayas out of which 30% are endemic. The Eastern himalayas are also contains rich wild Plants of ~~endemic~~ Economic Value.
Eg: Rice, banana, jute etc.

~~Eastern~~ western ghats

This area comprises maharastra, Karnataka, Tamil Nadu & Kerala. Nearly 1500 endemic Species are Present

In western ghats 62% of amphibians & 50% of lizards are endemic Species.

In this region only 6.8% of original forest are existing today while rest deforested.

Ex: Plants → Hypericum, Animals → Bluebird, lizard.

— x —

www.Notesfree.in

www.Notesfree.in

Role of biosphere reserves

1. It gives long-term Survival of evolving ecosystem.

2. It Protects endangered Species

3. It Serves as Site of recreation & tourism.

4. It is also useful for educational & research Purposes.

Restriction: No tourism & explosive activities are Permitted in the biosphere reserves.

2. National Park: A national Park is an area dedicated for the conservation of wildlife along with its Environment. It is usually a Small reserves Covering an area of about 100 to 500 Sq.kms. with in the biosphere reserves, one or more national Parks are also exists.

Name of National Park	State	Important wildlife
Kaziranga	Assam	One horned Rhino
Gir National Park	Gujarat	Indian lion
Bandipur	Karnataka	Elephant
Dachigam	J & K	Hangul
Corbett	UP	Tiger
Kanha	M.P	Tiger
Periyar	Kerala	Tiger, Elephant
Dudwa	U.P	Tiger
Sariska	Rajasthan	Tiger
Ranthambore	Rajasthan	Tiger

Role of national Park

1. It is used for Enjoyment through tourism, without affecting Environment.

2. It is used to Protect, Propagate & develop the wildlife.

www.Notesfree.in

www.Notesfree.in

GE3451 - ENVIRONMENTAL SCIENCE & SUSTAINABILITY

UNIT - II ENVIRONMENTAL POLLUTION

Causes, Effects and preventive measures of water, Soil, Air and Noise pollutions. Solid, Hazardous and E- Waste management. Case Studies on occupational Health and safety Management system (OHASMS). Environmental protection, Environmental protection acts.

ENVIRONMENTAL POLLUTION:

Introduction:

Environmental pollution may be defined as, "the Unfavorable alteration of our surroundings".
It changes the quality of air, water and land which interferes with the health of humans and other life on earth.

pollution are of different kinds depending on the nature of pollutant generated from different Sources.

Example, Industry, Automobiles, thermal power plants...

www.Notesfree.in

www.Notesfree.in

Water pollution:

Definition:

Water pollution may be defined as," the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on humans and aquatic life.

⇒ The pollutants include sewage, industrial chemicals and effluents, oil and other wastes.

⇒ Besides, chemicals from the air dissolved in rain water, and fertilizers, pesticides and herbicides leached from the land also pollute water.

Types of water pollution:

1. Infectious Agens:

Example: Bacteria, viruses, protozoa and parasitic worms.

2. Oxygen Demanding Wastes (Dissolved Oxygen)

Example: Organic wastes such as animal manure and plant debris that can be decomposed by aerobic (oxygen-requiring) bacteria.

www.Notesfree.in

www.Notesfree.in

3. Inorganic Chemical:

Examples: water soluble inorganic chemicals.

4. Organic Chemical

Examples: oil, gasoline, plastics, pesticides, cleaning solvents.

5. plant Nutrients:

Examples: water-soluble compounds containing nitrate, phosphate and ammonium, ions.

6. Sediment:

Examples: Soil, silt, etc...

7. Radioactive Materials:

Examples: Radioactive isotopes of iodine, radon, uranium, cesium, and thorium.

8. Heat (Thermal pollution)

Example: Excessive heat

9. point and Non-point sources of water pollution:

(i) Non-point sources → Ex: There are usually large land areas.

(ii) point sources.

Example of point sources → Includes factories, sewage treatment plants, abandoned underground mines and oil tankers.

www.Notesfree.in

www.Notesfree.in

CAUSES & EFFECTS OF WATER POLLUTION:

⇒ Disease causing agents: the micro-organism including bacteria, virus, protozoa, if present in drinking water causes disease. For Example,

⇒ Oxygen depleting waste: organic matters present in water are degarded by microorganism present in water which required oxygen. If large amount of organic matter present in waste water then large amount of oxgen is required by the microorganism is ~~reffered~~ to degrade the waste. Therefore oxygen content in water decrease. The amount of oxygen consumed by microorganism is reffered as Biological Oxygen Demand (BOD). High level of BOD means large amount of waste present in water.

⇒ Water soluble inorganic chemicals: the elements like lead, mercury, cadmium, arsenic adversely affect the human being and animals. For example, Cadinium causes Ilai-Itai disease, mercury causes Minamata disease.

⇒ Suspended solids: If suspended solid present in water bodies, then water become turbid and therefore proper sunlight does not reach to the

www.Notesfree.in

www.Notesfree.in

aquatic plant and animal which distrub the life of aquatic ecosystem.

Water Quality standards:

Water used for drinking should have certain quality. The following table summaries several quality criteria and their standards for drinking water.

Table Standards for drinking water

S. No.	Parameter	WHO Standard, odour-less in mgs/litre	ISI-standard in mgs/litre.
1.	Colour, odour and taste	Colourless, odourless and tasteless.	Colourless, odour-less and tasteless
2.	pH	6.9	6.9
3.	Total dissolved solids	1,500	—
4.	Dissolved oxygen	—	3.0
5.	chloride	250	600
6.	sulphate	400	1,000
7.	Nitrate	45	—
8.	cyanide	0.2	0.01
9.	Fluoride	1.5	3.0
10.	chromium	0.05	0.05
11.	Lead	0.05	0.1
12.	Arsenic	0.05	0.2

www.Notesfree.in

www.Notesfree.in

SOIL POLLUTION:

Definition:

Soil pollution is defined as, "the Contamination of Soil by human and natural activities which may Cause harmful effects on living beings."

Composition of Soil:

Components	%
Mineral matter (inorganic)	45
Organic matter	5
Soil water	25
Soil Air	25

Types of Soil pollution:

1. Industrial wastes:

Disposal of industrial wastes is the major problem for soil pollution.

2. Urban Wastes:

Urban wastes comprises both Commercial and domestic wastes consisting of dried sludge of sewage. All the urban solid wastes are Commonly referred to as refuse.

Constituents of urban refuse:

This refuge contains garbage and rubbish

www.Notesfree.in

www.Notesfree.in

materials like plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, abandoned.

3. Agricultural practices:

⇒ Modern agricultural practices pollute the soil to a large extent. Today with the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides, weedicides are added to increase the crop yield.

⇒ Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution.

4. Radioactive pollutants:

Radioactive substances resulting from explosions of nuclear dust and radioactive wastes.

Example:

Radio nuclides of radium, thorium, uranium, isotopes of potassium (K-40) and carbon (C-14) are very common in soil, rock, water and air.

Radioactive waste contains several radio nuclides such as strontium -90, iodine -129, cesium -137 and isotopes of iron which are most injurious.

www.Notesfree.in

www.Notesfree.in

5. Biological agents:

Soil gets large quantities of human, animal and bird's excreta which constitute the major source of land pollution by biological agents.

Examples:

⇒ Heavy application of manures and digested sludges could cause serious damage to plants within a few years. Because the sludges are containing more live viruses and viable intestinal worms.

⇒ In addition to these excreta, faulty sanitation, municipal garbage, waste water and wrong methods of agricultural practices also induce heavy soil pollution.

Control (or) preventives measures of soil pollution:

The pressure on intensification of farm activities increases for two reasons.

⇒ population growth

⇒ Decrease of the available farm land due to urbanisation.

1. Control of soil erosion:

Soil erosion can be controlled by a variety of foresty and farm practices.

www.Notesfree.in

www.Notesfree.in

Example:

⇒ Trees may be planted on barren slopes.

⇒ Contour cultivation and strip cropping may be practiced instead of shifting cultivation.

⇒ Terracing and building diversion channels may be undertaken.

2. proper dumping of unwanted materials:

⇒ Excess of waste products by man and animals cause chronic disposal problem. open dumping is most commonly practiced method.

⇒ Recently controlled tipping is followed for solid waste disposal. The surface so obtained then can be used for housing (or) sports field.

3. production of natural fertilizers:

⇒ Excessive use of chemical fertilizers and insecticides should be avoided. Biopesticides should be used in place of toxic chemical pesticides.

Example: organic wastes contained in animals dung can be used for preparing compost manure and biogas rather than throwing them wastefully polluting the soil.

www.Notesfree.in

www.Notesfree.in

4. Proper Hygienic Condition:

People should be trained regarding the sanitary habits.

Example: Lavatories should be equipped with quick and effective disposal methods.

5. Public Awareness:

Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental pollution.

Example: Mass Media, Educational institutions and voluntary agencies can achieve this.

6. Recycling and Reuse of wastes:

To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc... should be recycled and reused.

Example: Mass media, educational institutions and voluntary agencies.

Industrial wastes should be properly treated at source.

www.Notesfree.in

www.Notesfree.in

Integrated waste treatment method should be adopted.

7. Ban on Toxic chemicals:

Ban should be imposed on chemicals and pesticides like DDT, BHC etc... which are fatal to plants and animals. Nuclear explosions and the improper disposal of radioactive wastes should be banned.

www.Notesfree.in

www.Notesfree.in

Causes of soil pollution (or) degradation:

⇒ Soil erosion: removal or movement of top soil from one place to another place is known as soil erosion, it is a natural process. But the erosion enhances by human activities like mining, Construction, new land for agricultural practices, deforestation, overgrazing etc.

⇒ Due to erosion, soil become less fertile and erosion also reduce the soil water holding capacity.

⇒ Excess use of fertizers: Essential micro-nutrients like N, P, K are supplied by chemical fertilizer to increase the crop yield or productivity. The microorganism present in the soil converts nitrogen into nitrate ions; enter into food chain from soil distrubing the biochemical process.

⇒ Acid Rain: Acid rain increases the acidity of soil which reduces the crop yield.

www.Notesfree.in

www.Notesfree.in

⇒ Salinity of water : Due to excessive irrigation, concentration of soluble salt increase in soil, then productivity and quality of soil decrease. These salts increase in soil, deposit on the surface then diffusion of oxygen and drainage of water in soil does not occur therefore growth of plant is slow down.

⇒ Industrial waste : Various pollutants present in the environment from industrial waste. Discharge from chemical industries, fertilizer and pharmaceutical companies are highly polluting.

EFFECT OF SOIL POLLUTION:

(i) Salinity and water logging reduce the fertility of soil and crop yield.

(ii) Toxic chemical present in the soil also affect the plant growth and human life.

(iii) Soil pollution contaminated the underground water.

www.Notesfree.in

www.Notesfree.in

AIR POLLUTION:

Definition:

Air pollution may be defined as, "the presence of one (or) more contaminants like dust, smoke, mist and odur in the atmosphere which are injurious to human beings, plants and animals."

The rapid industrialization, fast urbanization, rapid growth in population, drastic increase in vehicles on the roads and other activities of human beings have distrubed the balance of natural atmosphere.

Composition of Atmospheric Air:

During several billion years of chemical and biological evolution, the composition of the earth's atmosphere has varied.

Composition of atmospheric Air:

Constituents	%
Nitrogen	78
Oxygen	21
Argon (Ar)	<1
CO_2	0.037
water vapour	Remaining
O_2 He, NH_2	Trace amount

www.Notesfree.in

www.Notesfree.in

Sources of air pollution:

The Sources of air pollution are of two types

1. Natural Sources:

Examples: volcanic eruptions, forest fires, biological decay, pollen grains, marshes, radioactive materials etc..

These pollutants are caused by the natural sources.

2. Man-made (anthropogenic) activities:

Examples: Thermal power plants, vehicular emissions, fossil fuel burning, agricultural activities etc...

Classification of air pollutants:

Depending upon the form of pollutants present in the environment, they are classified as.

1. primary air pollutants:

primary air pollutants are those emitted directly in the atmosphere in harmful form.

Example: CO, NO, SO_2, etc...

2. Secondary air pollutants:

Some of the primary air pollutants may react with one another (or) with the basic components of air to form new pollutants.

www.Notesfree.in

www.Notesfree.in

Secondary pollution. For Example, Carbonic acid, nitric acid, sulpuric acid etc...

Cause of Air pollution:

⇒ Urbanization
⇒ population
⇒ Deforestation
⇒ Industrialization
⇒ vehicle emission

Major Air pollutants and their effects:

1 ⇒ Carbon dioxide: The Concentration of CO_2 gas increase in atmosphere due to emission from vehicles, burning of fossil fuel, emission from volcano, industries, agricultural acitivity etc... it increase green house effect which causes global warming and climate change.

2 ⇒ Carbon monoxide: Carbon monoxide gas releases after incomplete Combustion of fossil fuel or other product.

www.Notesfree.in

www.Notesfree.in

The source of Co is vehicle emission, burning of Coal, biomass Combustion etc... CO causes headache, dizziness, heart failure (in blood CO Combines with oxygen which reduced the affinity of haemoglobin towards oxygens, etc...

3 ⇒ Sulphurdioxide : SO_2 releases from oil refineries, volcanic eruption and chemical industries etc... Sulphur dioxide react with moisture to from Secondary pollutant which Causes eye irritation. It Can Cause allergic reaction and asthma.

4 ⇒ Lead : Petra ethyl lead used as anti-knocking agents in petrol for smooth function vehicle. Lead particle Coming out from the exhaust of vehicle and mixed with air. It Causes injurious effect on kidney and liver.

www.Notesfree.in

www.Notesfree.in

Suspended particulate matter (SPM)

Description:

5 => It includes variety of particles and droplets (aerosols). They can be suspended in atmosphere for short periods to long periods.

6. Ozone (O_3)

6 => Highly reactive irritating gas with an unpleasant odour that forms in the troposphere. It is a major componant of photochemical smog.

Photochemical smog:

7 => The brownish smoke like appearance that frequently forms on clear, sunny days over large cities with significant amounts of automobile traffic.

Hydrocarbons (aromatic and aliphatic)

8 => Hydrocarbons especially lower hydrocarbons get accumulated due to the decay of vegetable matter.

Chromium (Cr)

9 => It is a solid toxic metal, emitted into the atmosphere as particulate matter.

www.Notesfree.in

www.Notesfree.in

Control (or) preventive measures of air pollution:

The atmosphere has several built-it self cleaning processes such as dispersion, gravitational setting, flocculation, absorption, rain washout and so on, to cleanse the atmosphere.

1. Source pollution:

Since we know the substances that causes air pollution, the first approach to its control will be through source reduction.

Some actions that can be taken in this regard are as follows:

⇒ Use only unleaded petrol.

⇒ Use petroleum products and other fuels that have low sulphur and ash content.

2. Control measures in industrial centre:

The emission rates should be restricted to permissible levels by each and every industry.

Incorporation of air pollution control equipments in the design of the plant layout must be mandatory.

Continuous monitoring of the atmosphere for the pollutants should be carried out of know the emission levels.

www.Notesfree.in

www.Notesfree.in

NOISE POLLUTION :

Definition :

Noise pollution is defined as, "the unwanted, unpleasant (or) disagreeable sound that causes discomfort for all living beings".

Types and sources (causes) of Noise :

It has been found that environmental noise is doubling every 10 years. Generally noise is described as,

1. Industrial Noise :

⇒ Highly intense sound (or) noise pollution is caused by many machines.

⇒ There exists a long list of sources of noise pollution including different machines of numerous factories, industries and mills.

⇒ Industrial noise, particularly from mechanical saws and pneumatic drill is unbearable and is a nuisance to public.

⇒ Recently, it has been observed by the institute of oto-rino laryngology, Chennai that enormously increasing industrial pollution has damaged the hearing of about 20% workers.

Example : In the steel industry.

www.Notesfree.in

www.Notesfree.in

2. Transport Noise:

⇒ The main Noise, Comes from transport. It mainly includes road traffic noise, rail traffic noise and air craft noise.

⇒ The number of road vehicles like motors, scooters, Cars, motor cycles, buses, trucks and particularly the diesel engine vehicles have increased enormously in recent years.

⇒ That is why, this form of pollution is gaining importance, especially in large and over crowded towns and cities.

⇒ According to experts, the noise level in most of the residental areas in metropolitan cities is already hovering on the border line because of vehicular noise pollution.

⇒ A Survey Conducted in metropolitan cities has shown that noise level in Delhi, Bombay and Culcutta is as high as 90 dB.

⇒ Inhabitants of cities are subjected to this most annoying form of transport noise which gradually deafen them.

www.Notesfree.in

www.Notesfree.in

5. Neighbourhood Noise:

⇒ This type of noise includes distrubance from household gadgets and Community.

⇒ Common noise makers are musical instruments, TV, VCR, radios, transistors, telephones and loudspeakers etc...

⇒ Ever since the industrial revolution, noise in environment has been doubling every ten years.

Effects of Noise pollution:

⇒ Noise pollution affects human health, Comfort and efficiency.

⇒ It Causes Contraction of blood vessels, makes the skin pale, leads to excessive secretion of adrenalin hormone into blood stream which is responsible for high blood pressure.

⇒ Blasing sounds have known to Cause mental distress, heart attacks neurological problems.

⇒ It Causes muscles to contract leading to nervous breakdown, tension etc...

⇒ These adverse reactions are coupled with a change in hormone content of blood, which in turn increase the rate of heartbeat, Contraction of blood vessels, and dilation of pupil of eye.

www.Notesfree.in

www.Notesfree.in

⇒ High intensity sound emitted by industrial plants, bottling machines, supersonic aircrafts, when continued for long periods of time not only distrubs but also permanently damages hearing.

⇒ Offices, industries and crowded places where constant noise prevails can produce temper tantrums, headaches, fatigue and nausea.

⇒ Loud and sudden noise affect the brain. Intermittent noise leads higher incidence of psychiatric illness and also a danger to health of preganant mothers and small infants.

⇒ Noise has harmful effects on non-living materials too, e.g. cracks develop under the stress of explosive sound.

Control of Noice pollution:

Following methods can control noise pollution:

⇒ Limited use of loudspeakers and amplifiers.

www.Notesfree.in

www.Notesfree.in

⇒ Excursing Control over noise producing vehicles.

⇒ Industrial workers should be provided with ear plugs.

⇒ Delocalisation of noisy industries far away from dwelling units.

⇒ Within a radius of 10 miles of airport, no buildings or factories should be allowed.

⇒ plants and trees should be planted all around the hospitals, libraries and schools and Colleges.

⇒ Personal protection against noise can be taken by using, Cotton plugs in the ear.

1. Source Control:

This may include Sourse modification such as acoustic treatment to machine surface, design changes, limiting the operational timings and so on.

www.Notesfree.in

www.Notesfree.in

2. Transmission path intervention:

This may include Containing the source inside a sound insulating enclosure, Construction of a noise barrier or provision of sound absorbing materials along the path.

3. Receptor Control:

This includes protection of the receiver by altering the work schedule or provision of personal protection devices such as ear plugs for operating noisy machinary.

4. Oiling:

proper oiling will reduce the noise ~~the~~ from the machines.

5. planting trees around houses can also act as effective noise barriors.

6. Different types of absorptive materials can be used to Control interior noise.

www.Notesfree.in

www.Notesfree.in

Solid waste Management

⇒ Rapid population growth and urbanization in developing Countries have led to the generations of enormous quantities of solid wastes and consequential environmental degradation.

⇒ An estimated 7.6 million tonnes of municipal solid waste is produced per day in developing Countries.

⇒ These wastes are disposed in open dumps Creating Considerable nuisance and environmental problems.

Definition:

Solid waste management is the process of Collecting, treating and disposing of solid waste.

Types of and sources of solid wastes:

Depending upon the nature, Solid wastes Can be broadly Classified into three types.

I Source of urban (Municipal) wastes:

Urban (or) municipal wastes include the following wastes.

(a) Domestic wastes:

It Contains a variety of materials thrown out from the homes.

www.Notesfree.in

www.Notesfree.in

Examples: food waste, cloth, waste paper, glass bottles, polythene bags, waste metals etc...

(b) Commercial wastes:

It includes the wastes coming out from the shops, markets, hotels, offices, institutions, etc...

Examples: waste paper, packing material, cans, bottle, polythene bags, etc...

(c) Construction wastes:

It includes the wastes of construction materials.

Examples: wood concrete, debris etc...

(d) Biological wastes:

It includes mostly the waste organic materials.

Examples: Anatomical wastes, infectious wastes etc...

Effect of Solid wastes:

Due to improper disposel of ~~munici~~ municipal solid wastes on the road side and their immediate sorroundings, biodegradable materials undergo decomposition. This produces foul smell and breeds various types of insects, which spoil the land value.

Toxic substances may percolate into the ground and contaminate the ground water.

www.Notesfree.in

www.Notesfree.in

Burning of some of the industrial wastes, domestic wastes, produce furans, dioxins and polychlorinated biphenyls, which are harmful to human beings.

Process of solid waste Manggement:

Solid waste management includes, the waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

Flow Chart:

Solid waste Generation

Collection of waste ⇒ Collection of waste from various sources.

Transportation ⇒ To transfer the collected wastes to the destination point.

storage ⇒ To store the collected wastes meanwhile time of the disposal.

segregation of wastes ⇒ Home separation for recycling.

Disposal methods

(a) Landfill (b) incineration (c) Composting

Steps involved in solid waste management:

Two impostant steps of solid waste management is reduce, refuse and recycle, before destruction and safe storage of wastes.

www.Notesfree.in

www.Notesfree.in

Hazardous waste management :

Definition:

It is the Collection, treatment and disposal of waste materials that can cause substantial harm to human health (or) to the environment.

⇒ Improper hazardous-waste storage (or) disposal Contaminates surface water and ground water supplies as harmful water pollution and land pollution.

⇒ people living in homes, built near waste disposal sites, may be in a vulnerable position.

⇒ The best remedy for this problem is to regulate the practice of hazardous-waste management.

Various steps of hazardous waste management :

Hazardous waste management involves the following 4 steps.

Step 1: Analysis :

physical and chemical properties of hazardous waste must be analysed before collection and recovery of useful components.

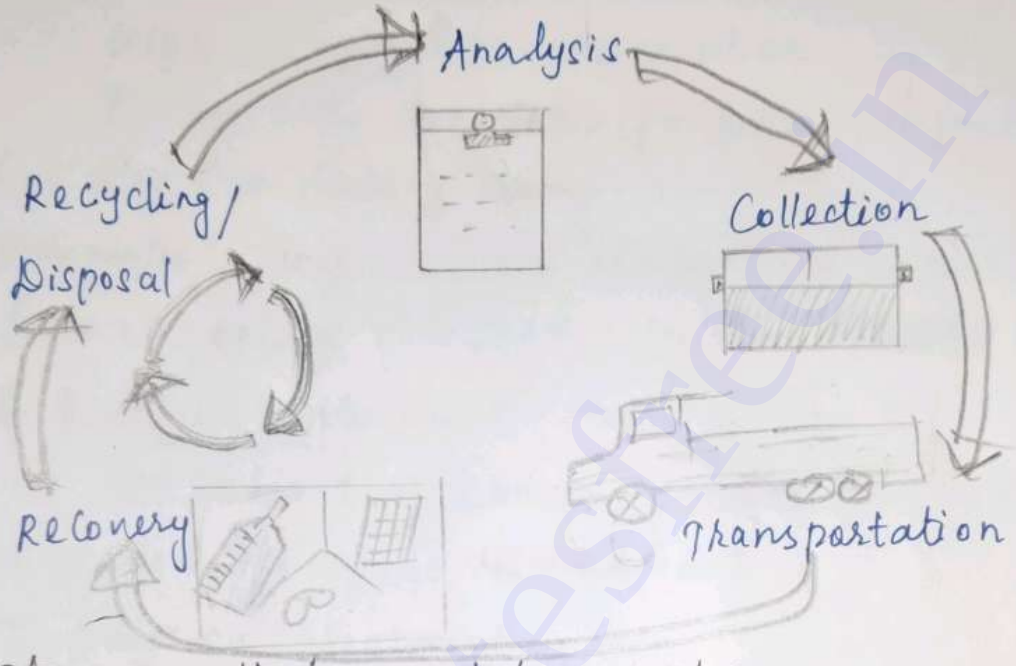
It is essential because it can be used as a fertilizer, soil management.

www.Notesfree.in

www.Notesfree.in

Various steps of hazardous waste management : (30)

Hazardous waste management involves the following 4 steps.



Step 2: Collection and transport :

⇒ Hazardous waste, generated at a particular place, is generally collected and transported by truck over public highways.

⇒ It can also be shipped in tank trucks, made of steel aluminium alloy, with capacities upto about 34,000 litres.

Step 3: Treatment (or) Recovery :

Hazardous waste can be treated (or) recovered by

www.Notesfree.in

www.Notesfree.in

1. Chemical method:

It includes ion-exchange, precipitation, oxidation and reduction and neutralization.

2. Thermal method:

High temperature incineration

It not only can detoxify certain organic wastes but also can destroy them.

Examples: Fluidized-bed incinerator, multiple hearth furnace, rotary kiln and liquid-injection incinerator

3. Biological treatment:

Microbes that can metabolize the waste may be added along with nutrients.

4. physical treatment:

Examples: Evaporation, Sedimentation, Solidification flotation and filtration.

Step 4 Storage and disposal:

Hazardous wastes that are not destroyed by incineration (or) other chemical processes need to be disposed properly.

www.Notesfree.in

www.Notesfree.in

E- waste management :

Definition :

E- waste management is defined as a holistic method of cutting down e-waste from the earth to prevent its harmful toxic to deteriorate earth.

Management of e- waste should begin at the point of generation.

This can be done by waste minimisation techniques and by sustainable product design.

Some e- waste management techniques :

waste management in industries involves adopting,
inventory management,
production process modification,
Sustainable product design,
use of renewable raw materials

Inventory management :

proper control over the materials, used in the manufacturing process, is an important way to reduce waste genaration.

By reducing the quantity of hazardous materials, used in the process, e-waste could be reduced.

www.Notesfree.in

www.Notesfree.in

2. Production process modification:

By changing the production process e-waste generation can be minimised.

3. Sustainable product design:

Efforts should be made to design a product with less amount of hazardous material.

Examples: New computer designs that are lighter and more integrated.

4. Use of renewable materials:

⇒ Bio ~~bad~~ based plastics are plastics made with plant based chemistry (or) plant producted polymers.

⇒ Most e-waste have non-degradable polymers in them.

⇒ By using these bio polymers we can reduce 'e'-wastes.

⇒ Like wise bio based toners, glues and inks are new development e-wastes.

www.Notesfree.in

www.Notesfree.in

Occupational Health and Safety Management System (OHASMS)

An Occupational health and safety management system (OHASMS) is a fundamental of an organization's risk management strategy. It enables an organization to product its work force and others under its Control.

Importance:

It reduced risk (or) accidents (or) injuries by identifying and mitigating hazards.

Case studies on OHASMS:

1. A Footwear manufacturing industry in Ambur, Tamil Nadu:

Objective:

The main objective of this case study is to assess the status of occupational health and safety of a footwear manufacturing industry with respect to the social Compliance.

Observation:

We have visited Azim leather and footwear industries, Ampur, Tamil Nadu.

Overall Occupational health and safety management practice in Azim leather and footwear industries was found to be good.

www.Notesfree.in

www.Notesfree.in

Production process:

⇒ production process of Azim industries starts after collecting the raw materials, cutting them, assembling, joining the insole and outsole to the shoe, finishing and packing.

⇒ Lots of people engaged during this production process.

⇒ About 70% of total workers are female.

⇒ In every section, Azim industries have employed experts to look after the work of the worker and improve the efficiency.

Some of the encouraging approaches observed in Azim industry.

⇒ positive attitude of owner towards of the workers.

⇒ Dedicated work force

⇒ Experienced and professional management team.

⇒ Disbursment of salary and wages to workers.

⇒ First aid box is found in all floors according to requirments of indian labour rules.

⇒ Factory has own health Centre to provide primary treatment.

www.Notesfree.in

www.Notesfree.in

⇒ Certified physician and nurse were available during the visit.

⇒ Factory has its Child Care Centre.

⇒ Factory has well maintained hygienic Canteen.

⇒ Factory is Conducting fire drill regularly.

Deficiency observed in Axim industry and Solution:

⇒ According to environmental Conversation rules, labour rules of indian Government and international guide lines, below findings are observed during factory visit and discussed the solutions with management.

⇒ Management should maintain Cleanliness of the area.

⇒ Management should place temperature and humidity measuring device in workplace because excessive heat and humidity are injurious for workers health.

⇒ Management should monitor and maintain sufficient and suitable lightings.

⇒ Factory must display material Safety data sheet at all Chemical storage areas.

www.Notesfree.in

www.Notesfree.in

Report (or) Conclusion:

⇒ Overall Occupational health and safety management practice in Azim industries was found good.

⇒ Though some deficiency were found during this visit, but Commitment of top management towards occupational health and safety was impressive.

2. Fire work industry in sivakasi, Tamil Nadu:

⇒ Safety and well-being is very essential for firework employees because in fireworks they are handling dangerous materials every day.

⇒ So they safety measures are most important in the firework industry.

⇒ They are handling Chemicals which will affect their health too.

⇒ According to the factories Act, safety and well-being is very necessary.

Objective of this study:

The main objective of this study is to analize the industrial safety and well-being

www.Notesfree.in

www.Notesfree.in

is very of firework employees in "kumaran fireworks" in sivakasi.

⇒ We have visited "kumaran fireworks" and analyzed overall occupational health and safety management practices of 257 employees and selected 30 respondents and Conducted survey question regarding safety measures of the employees.

Some of the encouraging approaches observed in kumaran fireworks:

⇒ 100% of respondent feels that adequate safety measures are taken during fire accidents.

⇒ 93.3% of respondent said limited safety materials are provided during the work.

⇒ 100% of respondent said the air circulation is perfect in the industry.

⇒ 90% of respondent said first aid box is available all the time.

⇒ 80.5% of respondent felt the work place is always clean and neat.

⇒ 85% of respondent said the building and machines are maintained in proper way.

www.Notesfree.in

www.Notesfree.in

Deficiency observed in kumaran fireworks and Solution:

⇒ Management Should Conduct material Camp once in 6 months, in the industry.

⇒ Management must provide separate toilet facilities for men and women.

⇒ proper rest room must be provided to the workers for taking rest in the break time.

⇒ Enough safety materials like gloves, face mask must be provided while they are working near Chemicals ~~for taking rest in the break time.~~ and machines in the factory.

⇒ More safety guards around the machines must be provided.

Report (or) Conclusion:

Overall Occupational health and safety management practice in "kumaran fireworks" was found good.

Though some deficiency were found during this visit, Commitment of top management towards occupational health and safety was impressive.

www.Notesfree.in

www.Notesfree.in

Environmental production:

Definition:

Environmental production is the practice of producting the natural environment by individuals, organisations and governments.

Objectives:

Its objectives are,

⇒ to Conserve natural resources,

⇒ to Conserve the existing natural environment,

⇒ to repair damage and reverse trends.

⇒ Due to the pressures of over consumption, population growth and technology, the biophysical environment is being degraded. This has been recognized and governments have begun placing restraints on activities that cause environmental degradation.

Importance (Or) Goal of environmental production:

⇒ To reduce air, water and land pollution.

⇒ To facilitate the Conservation of natural resources for our future generations.

⇒ To ensure the protection of biodiversity.

⇒ To implement sustainable development.

www.Notesfree.in

www.Notesfree.in

⇒ To restore the ecological balance.

⇒ To save our planet from harmful effects of global warming.

Environment (production) Act, 1986:

⇒ This is a general legislation law in order to rectify the gaps and laps in the above Acts.

⇒ This act empowers the Central government to fix the standards for quality of air, water, soil and noise and to formulate procedures and safe guards for handling of hazard substances.

Objectives of environmental Act:

⇒ to product and improvement of the environment.

⇒ to prevent hazards to all living creatures and property,

⇒ to maintain harmonious relationship between humans and their environment.

Important features of Environment Act:

The Act further empowers the Government to lay down procedures and safe guards for the prevention of accidents which cause pollution and remedial measures if an accident occurs.

www.Notesfree.in

www.Notesfree.in

⇒ The Act fixes the liability of the offence punishable under Act on the person who is directly in charge. Whether he/she is the director (or) manager (or) Secretary (or) any other officer, Unless he/she proves that it was Committed without his/her Knowledge (or) Consent.

⇒ The Environment (production) Act is the most Comprehensive legislation with powers for the central government to directly act, avoiding many regulatory authorities (or) agencies.

Water (prevention and Control of pollution) Act, 1974.

This act provides for maintaining and restoring the sources of water. It also provides for preventing and Controlling water pollution.

Objectives of the water act:

⇒ prevention and Control of water pollution,

⇒ Maintainging (or) restoring the wholesomeness of water,

⇒ Establishing Central and state boards for the prevention and Control of water pollution.

www.Notesfree.in

www.Notesfree.in

Important features of water Act:

⇒ This act aims at, to product the water from all kinds of pollution and to preserve the quality of water in all aquifers.

⇒ The act further provides for the establishment of Central Board and state Boards for prevention of water pollution.

⇒ Any Contravention of the guidelines (or) standards would attract penal action including prison Sentence ranging from three months to six years.

⇒ The amentment act of 1988 requires permission to set up an industry which may discharge effluent.

State pollution Control Board:

The Consent of the state pollution control board is needed to take Steps to establish any industry (or) any treatment and disposal System (or) any extension (or) addition there to, which is likely to discharge (or) trade effluent into a stream (or) well (or) river (or) on land.

use any new (or) altered outlet for the discharge of a sewage.

www.Notesfree.in

www.Notesfree.in

Air (prevention and Control of pollution) Act, 1981

⇒ This Act was enacted in the Conference held at stockholm in 1972.

⇒ It deals with the problems relating to air pollution.

⇒ It envisages the establishment of Central and state Control Boards endowed with absolute powers to monitor air quality and pollution Control.

Objectives of air act are:

⇒ to prevent, Control and abatement of air pollution

⇒ to maintain the quality of air

⇒ to establish a board for the prevention and Control of air pollution.

Important features of Air Act:

⇒ The Central Board may lay down the standards for the quality of air.

⇒ The Central Board Co-ordinates and settle disputes between state boards, in addition to providing technical assistance and guidance to state Boards.

www.Notesfree.in

www.Notesfree.in

⇒ The state Boards are empowered to lay down the standards for emissions of air pollutants from industrial units (or) automobiles (or) other sources.

⇒ The state Boards are to collect and disseminate information related to air pollution and also to function as inspectorates of air pollution.

⇒ The state Boards can advise the state Government to declare certain heavily polluted areas as pollution control areas and can advice to avoid the burning of waste products which cause air pollution in such areas.

⇒ The state Boards are to examine the manufacturing processes and the control of equipment to varify whether they meet the standards prescribed.

⇒ The directions of the Central Board are mandatory on state Boards.

⇒ The operation of an industrial unit is prohibited in a heavily polluted areas without the consent of the Central Board.

www.Notesfree.in

www.Notesfree.in

⇒ Violation of law is punishable with imprisonment for a term which many extend to three months (or) fine up to Rupees ten thousand (or) both.

⇒ This Act applies to all pollution industries.

⇒ The Air Act, like water Act, Confers wide powers on state Boards to order closure of any industrial unit (or) stoppage (or) regulation of supply of water, electricity (or) other services, if it is highly polluting.

Forest (Conservation (or) preservative) Act, 1980:

⇒ This act provides Conservation of forests and ~~related~~ related aspects.

⇒ This act is enacted in 1980.

⇒ It aims at to arrest deforestation.

Objectives of forest act:

⇒ To product and Conserve the forest,

⇒ To ensure judicious use of forest products.

www.Notesfree.in

www.Notesfree.in

Important features of Forest Act:

⇒ The reserved forests shall not be diverted (or) dereserved without the prior permission of the Central Government.

⇒ The land that has been notified (or) registered (or) forest land may not be used for non-forest purposes.

⇒ Any illegal non-forest activity within a forest area can be immediately stopped under act.

Important features of Amentment Act of 1988:

⇒ Forest departments are forbidden to assign any forest land by way of lease (or) otherwise to any private person (or) non-government body for re-afforestation.

⇒ Clearance of any forest land of naturally grown trees for the purpose of re-afforestation is forbidden.

⇒ The diversion of forest land for non-forest uses is cognisable offence and any one

www.Notesfree.in

www.Notesfree.in

who violates the law is punishable.

Wildlife (protection) Act, 1972 Amended in 1983, 1986 and 1991.

⇒ This act is aimed to product and preserve wildlife.

⇒ wild life refers to all animals and plants that are not domesticated.

⇒ It has 350 species of mammals, 1200 Species of birds and about 20,000 known species of insects.

⇒ Some of them are listed as 'endangered species' in the wildlife (protection) Act.

⇒ wildlife is an integral part of our Ecology and plays an essential role in its functioning.

⇒ The wildlife is declining due to human actions, the wildlife products - skins, furs, feathers, ivory etc..., have decimated the populations of many species.

www.Notesfree.in

www.Notesfree.in

⇒ wildlife populations are regularly monitored and management stratagies formulated to product them.

Objectives of the wildlife act:

⇒ To maintain essential ecological processes and lifesupporting systems.

⇒ To preserve biodiversity.

⇒ To ensure a continuous use of species.

Important features:

⇒ The act covers the rights and non-rights of forest dwellers.

⇒ It provides restricted grazing in sanctuaries but prohibits in national parks.

⇒ It also prohibits the collection of non-timber forest.

www.Notesfree.in

www.Notesfree.in

Energy management:

Energy management is planning and operation of energy production and energy consumption units as well as energy distribution and storage.

Objectives of energy management:

(i) Resource conservation.
(ii) climate protection.
(iii) cost savings / minimize waste.
(iv) Minimize environmental effects.

Principles of energy management:

1. It controls the costs of energy function and not buy of energy.

2. The second principle is to control energy function as a product cost.

3. The third principle is to control and meter only the main functions, which accounts

www.Notesfree.in

www.Notesfree.in

for only 20% functions which make up 80% of the costs.

4. The last principle states that the major effort of an energy management program should be put into installing controls and acheiving results.

Steps involved in process of energy management:

St 1: collecting + analyzing the continuous data

St 2: Identify optimizations in equipment schedules, set points and flow rates to improve energy efficiency.

St 3: calculate return on investments. units of energy saved can be metered and calculated just like units of energy delivered.

St 4: Execute energy optimization solutions.

www.Notesfree.in

www.Notesfree.in

Energy conservation :

Energy conservation is the practice of using less energy inorder to lower the costs and reduce environmental impacts.

This can be acheived by,

i) Energy more efficiently.

ii) By reducing the amount of service used.

Objectives :

i) To reduce overall energy demand.

ii) To Lower energy cost.

iii) To reduce energy consumption.

iv) To lower the overall green house gas emission.

Law of Conservation of Energy :

The principle of energy of conservation states that energy can neither be created nor destroyed but it can be transformed from one to another.

www.Notesfree.in

www.Notesfree.in

Importance of energy ~~consumption~~ conservation:

1. It insists us to replace the energy, used with an alternate energy source.

2. When we conserve energy more efficiently, it directly reduce the amount of green house gas emissions entering the earth's atmosphere.

3. It reduces our usage of non-renewable energy resources. (like fossil fuels).

New Energy Sources:

Solar energy:

Solar energy is derived by capturing ~~sol~~ radiant energy from sunlight and converting it into heat, electricity or hot water.

Significance:

(i) Solar cells are noise & pollution free.

(ii) It can also be used in remote, isolated areas, forests etc.

www.Notesfree.in

www.Notesfree.in

Wind energy:

Moving air is called wind. Energy recovered from the force of wind is called wind energy. The energy possessed by wind is because of its high speed. The wind energy is harnessed by making use of wind mills.

Significance:

(i) The generation period of wind energy is low and power generation starts from commissioning.

(ii) It is recommended to broaden the nation's energy options for new energy sources.

Bio-mass energy:

Biomass is the organic matter, produced by plants or animals used as sources of energy. Most of biomass is burned directly for heating, cooling and industrial purposes.

www.Notesfree.in

www.Notesfree.in

Significance :

1) Biomass consumes more CO_2 than is released during combustion of biomass.

2) It provides a stored form of energy and in many cases in a form suitable for vehicle propulsion.

AI in energy sector :

* Artificial Intelligence is used to forecast demand and manage the distribution of resources, to ensure that power is available at time and place its needed with a minimum of waste.

* AI plays an essential role in world's transition to clean energy.

Photo voltaics :

Solar companies are integrating pv systems to minimize the need for additional land usage. As a result of integrated pv, floatovoltaics + agrivoltaics are logical shift in trends.

www.Notesfree.in

www.Notesfree.in

Now thin fill pv cells are being developed to make solar panels flexibile, cost-effective, light weight and environment friendly.

Grid integration:

Grid integration is the practice of developing efficient ways to deliver variable renewable energy to grid.

Distributed energy storage systems (DESS)

A (DESS) is a packaged solution that stores energy for used at a later time. The system is provided with two main components.

(i) DC charged batteries.

(ii) Bi-directional inverter.

Space technologies:

(i) Harresting H_2 from moon to power fuel cell onboard.

(ii) Orbitting solar rays that absorb around the clock direct sunlight and send the energy

www.Notesfree.in

www.Notesfree.in

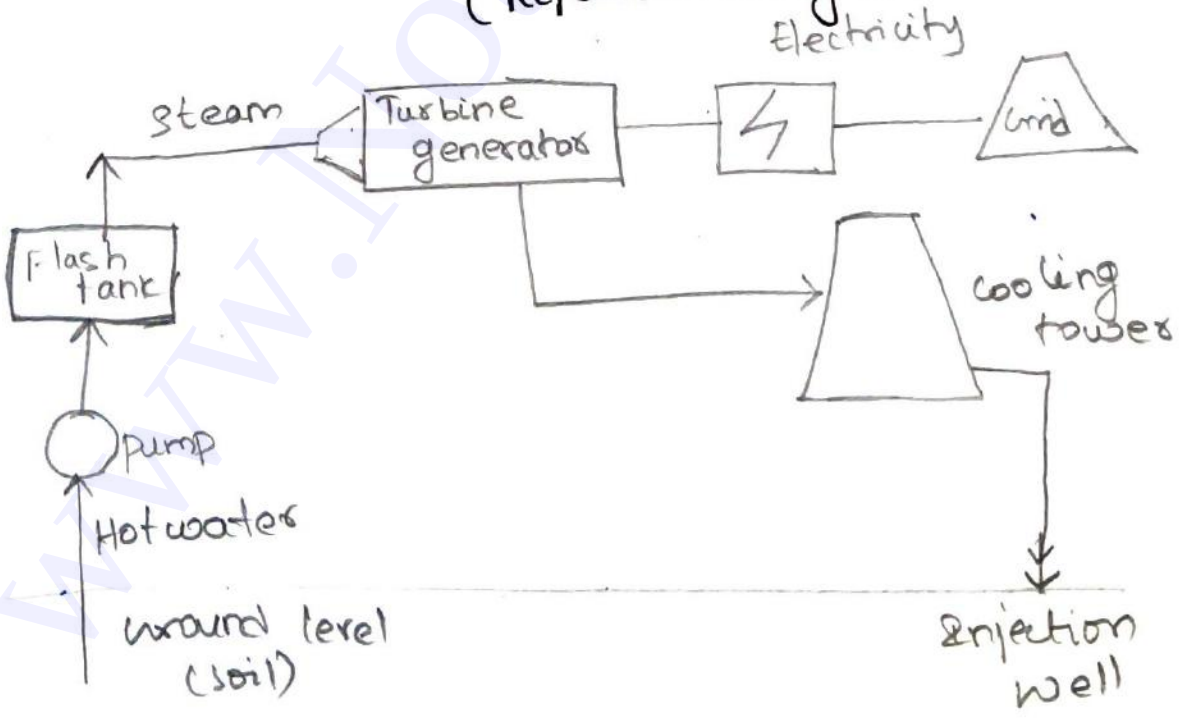
back down to stations on ground via radios or microwaves.

Norwegian crystals:

(i) Low carbon mono crystalline silicon ingots, is a type of crystal, used for high performance photovoltaic devices.

(ii) Gallium-doped ingots, that increases the lifetime of solar cells.

Geothermal power plant
(Reference diagram).



www.Notesfree.in

www.Notesfree.in

* Energy audit is a systematic approach to analyze the use of energy for decision-making in the area of energy management.

Energy Conservation :

* Energy conservation implies reduction in energy consumption without compromising on quality or lowering the quantity of production.

* This means that by reducing losses and wastages, as well as by increasing the efficiency, it is possible to increase the production from a given amount of energy input.

New Energy Sources :

"Energy can be defined as the capacity to do some work. Energy is one of the most important building blocks for human life on earth and economic development of the country."

www.Notesfree.in

www.Notesfree.in

Types of Energy Sources :

There are 2 different types of energy resources

(i) Renewable Energy resources.

(ii) Non-renewable energy resources.

Renewable Energy resources :

* These energy resources are also known as non conventional energy resource, which can be regenerated continuously

* It can be used again and again due to the adequate availability of resources in large amount.

eg : Solar energy
wind energy
Bio-fuels

www.Notesfree.in

www.Notesfree.in

Non Renewable resources :

* These energy resources are also known as conventional energy resources.

* It cannot be regenerated when these sources are exhausted because these resources are present in limited amount and take a long period of time to resynthesize.

eg : Nuclear energy
coal
petroleum etc.

Need of new Energy Sources :

The demand of energy resources are increasing day by day in the development of industries, transportation and agricultural activities.

* Development in different sectors relies largely upon energy.

* Agriculture, industry, mining, transportation, lighting, cooling and heating in buildings all need energy.

www.Notesfree.in

www.Notesfree.in

* with the demands of growing population, the world is facing further energy deficit.

* In developed countries like USA & canada an average person consumes 300 GJ per year.

Applications of Hydrogen Energy:

* Hydrogen is a non-polluting and easily transportable fuel. Hydrogen does not produce pollutants on combustion unlike conventional fuels.

* The gas can be easily transported by rail or road to long distances without much loss or cost. It can be easily converted into power using IC Engines or fuel cells at consuming points.

* Hydrogen can be easily produced from fossil fuels or electrolysis of water.

www.Notesfree.in

www.Notesfree.in

Production of Hydrogen:

The various methods of production of hydrogen are,

1. Electrolysis of water.
2. Thermochemical or steam reforming of methane.
3. Thermal decomposition or thermolysis of water.
4. Biophotolysis.

1. Electrolysis of water:

* It is the simplest method which consists of two electrodes immersed in an aqueous conduction solution called electrolyte.

* When a direct current is passed through the cell, it decomposes water into hydrogen and oxygen.

* Oxygen is formed at anode while hydrogen is formed at cathode.

www.Notesfree.in

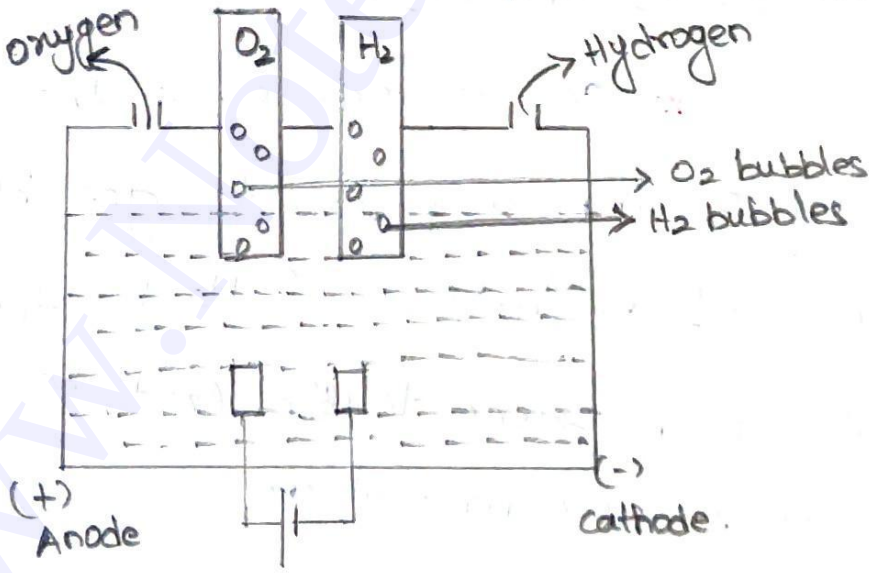
www.Notesfree.in

* Metal or carbon plates are used as electrodes. The aqueous KOH solution is used as the electrolyte.

* A decomposition voltage of 2V is applied. The chemical reactions of decomposition of water are,

$$4H_2O + 4\bar{e} \longrightarrow 2H_2\uparrow + 4OH \text{ (cathode)}$$

$$4OH \longrightarrow O_2\uparrow + 2H_2O + 4\bar{e} \text{ (anode)}$$



Electrolysis of water.

www.Notesfree.in

www.Notesfree.in

2. Thermochemical Method :

* This method consists of steam reforming of natural gas to produce hydrogen. It is most efficient, cost-effective and commercialized technology available.

* The natural gas consisting of methane and carbon monoxide is reformed with the help of steam at 900°c to produce a mixture of H_2 and CO_2.

* CO_2 is removed at the later stage by scrubbing process to get hydrogen. The cost of production of H_2 by this method is very much same to the cost to produce electricity using natural gas.

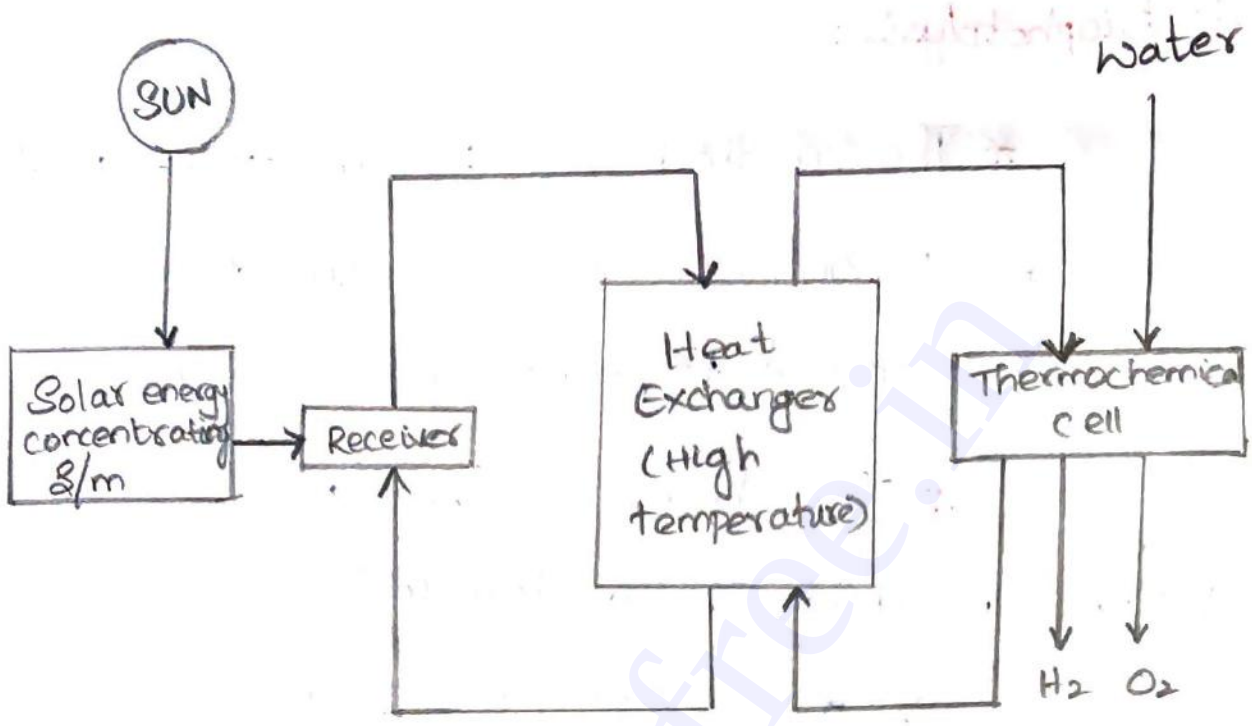
The reactions of reforming of natural gas with steam are as follows.

$$CH_4 + 2H_2O = CO_2 + H_2$$

$$CO + H_2O = CO_2 + H_2 .$$

www.Notesfree.in

www.Notesfree.in



Thermochemical process.

3. Thermolysis of water

* It is the process of producing hydrogen by splitting water directly using heat energy.

* The splitting of water is similar to electrolysis in which electricity is used for splitting and this is called thermolysis.

* The thermolysis requires a high temperature of about 2500°c.

* To carry out thermolysis at lower temperature of about 850°c, the process is carried out in different stages, using chemical materials.

www.Notesfree.in

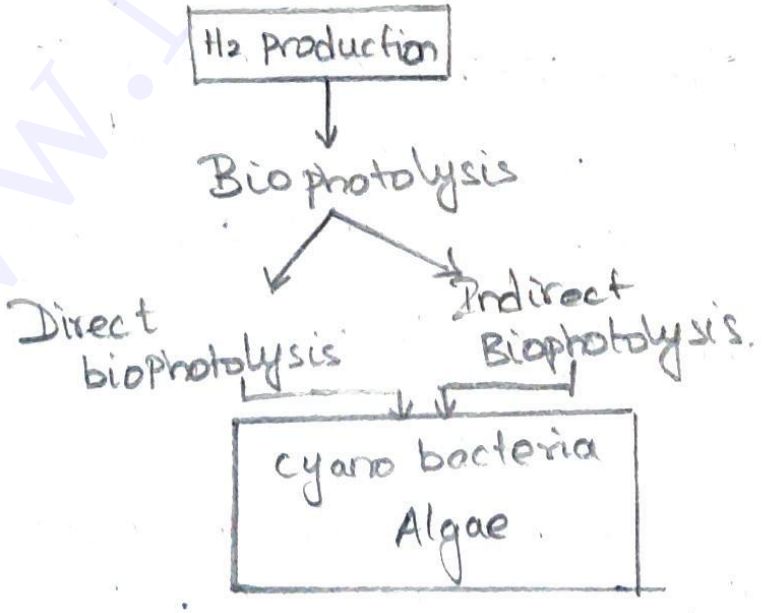
www.Notesfree.in

4. Biophotolysis :

* The method uses the ability of plants such algae to generate hydrogen gas when these plants are exposed to water and sunlight.

* The hydrogen gas can be produced by this method at a low cost.

* Since this process is essentially a decomposition of water using photons of solar energy in presence of biological catalysts of plants, the reaction is called biophotolysis of water.



Biophotolysis of water.

www.Notesfree.in

www.Notesfree.in

Hydrogen Powered Vehicles and Storage:

* Hydrogen is an explosive gas and a safe way of storing it using proper particle way is under research which can help the researchers to develop hydrogen powered vehicles.

* Researchers have developed ways to use "carbon nanotube" (CNTs) to store hydrogen. The hydrogen storage system consists of parallel graphite sheets with added lithium ions to increase the storage capacity.

* The storage capacity is 41g of H_2 per litre as against the specified target by department of Energy (DOE) of 45g per litre.

Hydrogen storage

Material storage	physical storage.
↳ chemical H_2	↳ Liquid H_2
↳ Liquid organic	↳ cold compressed
↳ Absorbent	↳ compressed gas.
↳ Complex hydride	

www.Notesfree.in

www.Notesfree.in

* A sponge like nano material with a record high surface are for holding hydrogen gas has been developed.

* The silicon nano tubes are more efficient in storing H_2 gas than that of carbon nano-tubes.

* Ammonia borane storage is attractive as it can store hydrogen up to 20% of its weight, which can help hydrogen fuelled vehicles to cover mor than 300 miles on a single tank.

* The only drawback is that no efficient method to recycle ammonia borane has been developed.

* Liquid hydrogen is used in air transportation at it is possible to provide certain arrangement in it to keep the gas in liquid form, that is, highly insulated storage cylinders with cooling devices.

www.Notesfree.in

www.Notesfree.in

Applications of Hydrogen:

The applications of hydrogen are as follows,

* Hydrogen is used as fuel in various types of fuel cells to generate electric power.
* Hydrogen is used as aviation fuel as it has high energy density.
* It is used for hydrogenation of vegetable oils.
* It is used for manufacturing ammonia.
* It is used for manufacturing tungsten filaments of lamps.

The first phase of green hydrogen plant commissioned at L&T's Hazira complex in Gujarat by Indian oil corporation.

Ocean Energy resources:

* Ocean energy refers to all forms of renewable energy derived from the sea, There are three main types of ocean technology: wave, tidal & ocean thermal

www.Notesfree.in

www.Notesfree.in

* Wave Energy remains more costly than the other ocean technologies. Ocean thermal energy is created by solar energy when ocean water absorbs solar radiations.

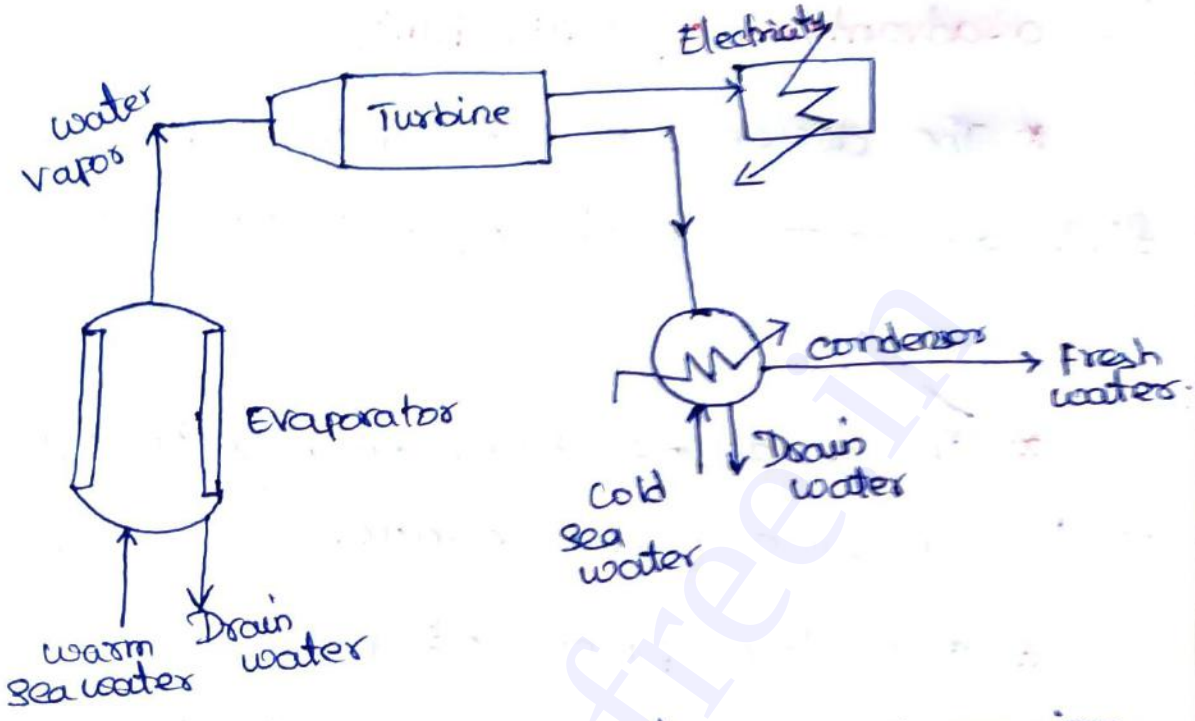
* The absorption of solar radiation causes a moderate temperature gradient to develop in water from the top surface to the bottom of the ocean.

* This temperature gradient can be utilized using a heat engine to generate power. This process of conversion is called ocean thermal energy conversion (OTEC).

* The surface water acts as the heat source and the deep-water acts as the heat sink and heat engine can operate between these source and sink.

www.Notesfree.in

www.Notesfree.in



Ocean thermal energy conversion.

The advantages of OTEC,

* The plant can supply steady power without any fluctuation in all the vagaries of weather.

* The power o/p does not vary from season to season.

* The plant can be constructed on shoreline or an floating platform.

* The plant of any size or capacity can be constructed at a suitable site.

www.Notesfree.in

www.Notesfree.in

The disadvantages of OTEC Plant,

* The design operation and maintenance of flash evaporator in the open system are problematic.

* The design of steam turbine to operate at low pressure is problematic.

* The development of pumps suitable for handling large amounts of water is problematic

* Long distance cable to transmit power to shore is required.

The current OTEC project is being set up to power a desalination plant. The power expected to be generated is under 200KW.

The National institute of ocean technology, an autonomous institute under the union ministry of earth sciences is establishing OTEC plant with a capacity of 65 kilowatt in Kavaratti (Lakshadweep).

www.Notesfree.in

www.Notesfree.in

Tidal Energy conversion :

* Tides are periodic rise and fall of the water level which are produced by gravitational attraction of moon and the sun acting on the rotating earth.

* The difference in the level between the high and low tide is called the tidal range of 5-15m can be easily used to drive turbine coupled with generator to generate electric power.

* The tidal energy is harnessed by constructing a tidal barrage; during high tide, the water flows into the reservoir of the barrage and turns the turbine, which inturn produces electricity by rotating the generator.

* During low tide, when the sea-level is low, the sea water stored in the barrage reservoir flows out into the sea and again turns the turbines.

www.Notesfree.in

www.Notesfree.in

Components of tidal power plant :

The components of a tidal power plant are,

I Dam & Dyke :

* The function of dam or dyke is to form a barrier between the sea and the reservoir.

* Dam is also built between basins in case the plant has more than one basin.

II Sluice ways or movable gates :

* Sluice ways are provided in the dam so that water can enter into basin during high tides.

* These may also be provided to empty the basin during low tides. Sluice ways are controlled through gates.

III power house :

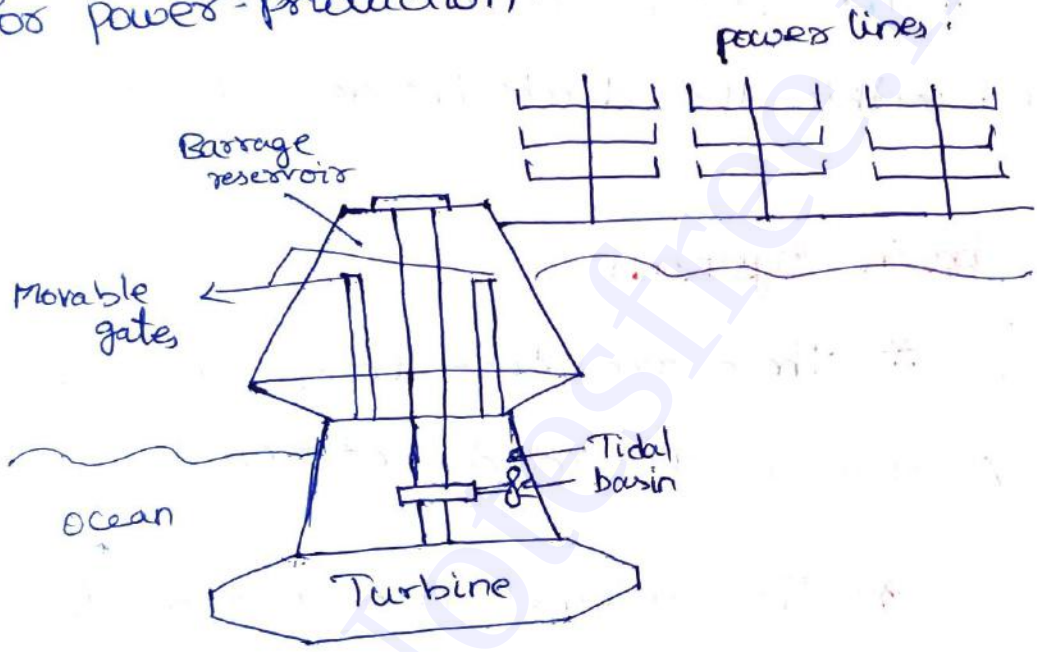
* A powerhouse consists of turbines,

www.Notesfree.in

www.Notesfree.in

electric generators and other auxilliary equipment.

* The water with high potential energy is made to run through turbines to generators for power-production.



Tidal power plant.

Classification of tidal plants:

The tidal plants are classified on the basis of basins used as,

Single basin S/ms :

* This is the simplest system of generating tidal power. The single basin scheme has only one basin.

www.Notesfree.in

www.Notesfree.in

* The basin is separated from the sea by a dam. The sluice way is opened during high tide to fill the basin.

* The turbine-generator units are mounted within the ducts inside the barrage.

Double basin system:

* There are two basins at different levels. A dam is provided between two basins.

* The turbines are located in the dam. The sluice gates are provided in the dam.

* one basin is called the upper basin, the water level is maintained above that in the other, the low basin.

* The high level basin gates are called the inlet gates and low level gates as outlet gates. The upper basin is filled with water

www.Notesfree.in

www.Notesfree.in

* Two basin schemes have the advantages over normal schemes is that generation time can be adjusted with high flexibility.

Concept, Origin and power plants of Geothermal Energy:

* Geothermal Energy is the thermal Energy present in the interior of the earth.

* Volcanoes, geysers, hot springs are visible signs of the large amounts of heat lying in earth's interior.

* It is impossible to extract heat when it is lying at the great depth from the surface.

* The centre of earth is estimated to have high temperature 10,000 K. The heat is generated within the earth due to decaying process of radioactive isotopes.

www.Notesfree.in

www.Notesfree.in

* The molten rock within the earth is called magma, which is nearest to earth's surface with the temperature about 3000°c.

Advantages and disadvantages of Geothermal Energy.

The main advantages are,

* Reliable source of Energy.
* It is in continuous supply.
* Least polluting.
* Versatile in use.
* Cheaper than any other sources.

The main disadvantages are,

* Drilling & blasting of wells may cause instability of land structure & may develop risk of earthquake.
* Geothermal fluids also bring dissolved gases and solute, which lead to air & land pollution.
* It cannot be transported over long distances.

www.Notesfree.in

www.Notesfree.in

UNIT - IV - SUSTAINABILITY AND MANAGEMENT

Development, GDP, Sustainability - Concept, needs and challenges - Economic, Social and aspects of sustainability - from unsustainability to sustainability - millennium development goals and protocols. Sustainable Development Goals - targets, indicators and intervention areas. Climate change - Global, Regional and local environmental issues and possible solutions - case studies. Concept of carbon Credit, Carbon Footprint. Environmental management in industry - A case study.

www.Notesfree.in

4. Sustainability and Management

Development:

Definition:

The process that creates growth progress, positive change in economic, environmental and social component without damaging the resources of the environment.

Types of development:

1) National development
2) Major development
3) Local development

1) National development:

It starts from the national planning frame work. The developments that would make a significant contributions to overall success (or) international role.

www.Notesfree.in

2) Major development:

Major development improve economic power of the country. It includes fish farms, offices, storage and distribution centres, housing estates, renewables, waste-management, mineral extraction sites, etc.,

3) Local development:

It is the most common form of development and comprises of small scale developments including house extension, conversions, small and medium housing, industrial development and small scale renewable developments.

principles of development:

1. Equitable use
2. Flexibility in use
3. Simple and intuitive use
4. Perceptible information
5. Tolerance for error
6. Low and physical effort.
7. Size and space for approach and use.

Characteristics of development:

* Continuous process
* predictable
* Both quantitative and qualitative

www.Notesfree.in

* It is the result of interaction of individual and environment.

* It follows a particular pattern like infancy, childhood, adolescence and maturity.

Effects of development:

1. It increases wealth (or) reduces poverty.

2. It improves standards of living, health, education, infrastructure and technology.

Factors affecting development:

The important economic factors affecting developments are

1. Natural resources
2. Power and energy resources
3. Capital accumulation
4. Technological resources
5. Available labour force
6. Transportation and communications
7. Education and training

1. Natural resources:

It help countries to develop by creating jobs and increasing their wealth through the sales.

Example:

Tree, soil, water, minerals, coal, oil, etc,...

2. Power and energy resources:

Being natural, can be mined and sold quickly. It is important for producing power and energy within the country.

Example:

oil, gas, coal and water.

3. Capital accumulation:

If a country has more capital, it can creates more job. Low capital countries may have a low living wage and high unemployment.

4. Technological resources:

It refers ability to use advanced technologies within a country. It increases business capabilities and economic development of the country.

Example:

computer, cellphones, etc..

5. Available labour force:

Number of skilled labours within the country increases the development.

www.Notesfree.in
www.Notesfree.in

Advantages of development:

* Increased job satisfaction and morable among employees.
* Increased employee motivation.
* Increased efficiencies in processes, resulting in financial gain.
* Increased capacity to adopt new technologies and methods.

Disadvantages of development:

* population growth
* weak governance and rapid urbanization.
* poverty
* Pollution like smog, acid rain, green house effect, depletion of ozone layer, sewage and garbage.

GROSS DOMESTIC PRODUCT (GDP):

GDP is the total market value of the goods and services, produced within a country, during the specified period of time.

Types of GDP:

1. Normal GDP
2. Real GDP
3. Actual GDP

1. Normal GDP:

It is the total value of all goods and services produced at current market prices.

2. Real GDP:

It is the sum of all goods and services produced at constant prices.

3. Actual GDP:

It is the real-time measurement of all outputs at any interval (or) any given time

Significance of GDP:

* It identifies the present state of economy.
* It is used to compare the economies between countries.
* GDP is objective of policy formulation.
* GDP is the root cause.
* It gives information about the size of economy and how an economy is performing.
* It is used to determine the development and performance of the economy.

Calculation of GDP:

There are three different ways of calculating GDP.

The value added approach.
The income approach
Expenditure approach

www.Notesfree.in
www.Notesfree.in

Expenditure approach:

Calculates the GDP by calculating the sum of all the services and goods produced in an economy.

GDP = { Private consumption + (Gross private investment + Government investment) + Government spending + (Exports − Imports) }

$$Y = C + I + G + (X - M)$$

Y = Gross Domestic product
C = Consumption
I = Investment
G = Government spending
X = Exports
M = Imports

Advantages of GDP:

* GDP is a broad indicators of development.
* It is easy to measure growth in percentage.
* GDP is cheap to collect.
* It is the very good way for government to know whether economic policies have been successful.

Disadvantages of GDP:

* It does not include non-market transactions.
* GDP does not account inequality.
* It doesn't include the activity of informal sector (black market)
* Production process could be immoral.

SUSTAINABILITY:

Sustainability is defined as "meeting our own needs without compromising the ability of future generations to meet their own needs."

Need of sustainability:

1. It protect biodiversity
2. It improves public health
3. It helps to reduce pollution and conserve resource.
4. It reduces and reuses the resources.
5. It minimizes waste.
6. It is used for life-cycle analysis.

www.Notesfree.in
www.Notesfree.in

Concept (or) Approaches (or) Significance of sustainability.

To build up the sustainability development, the following methods are proposed.

1. Developing appropriate technology:

It is the one, which is locally adaptable, eco-friendly, resource-efficient and culturally suitable. It uses local labours, less resources, and produces minimum waste.

2. Reduce, Reuse, Recycle approach:

It insists optimum use of natural resources, using it again and again instead of throwing it on the land or water and recycling the material into further products. It reduces pressure on the natural resources and reduces waste generation and pollution.

3. Providing environmental education and awareness:

Proving environmental education and awareness, the thinking and attitude of people towards on earth and the environment can be changed.

4. Consumption of Renewable Resources:

It is very important to consume the natural resources in such a way that the consumption should not exceed regeneration capacity.

5. Conservation of non renewable resources:

Non-renewable resources should be conserved by recycling and reusing.

6. Population Control:

By controlling population growth, we can make very good sustainability development.

Economic and social challenges of Sustainability:

1. Economic sustainability:

The organisation's which has the ability to manage its resources and responsibly generate profits in the long term is called economic sustainability.

Example:

1. A company uniliver

A strategy to achieve a balance between sustainability and the company's economic performance. So, it implemented several measures like increasing package recycling, promoting the use of recycled materials and responsible consumption awareness campaigns.

2. A company suez:

It reduced its emissions, related to electricity consumption, by 95% by using renewable energy and conservation of natural habitats.

www.Notesfree.in
www.Notesfree.in

Economic challenges:

1. High rates of poverty and low growth.
2. High rates of unemployment (or) under employment.
3. Lack of quality jobs.
4. Volatile growth dependent on one source.
5. Low productivity due to poor human capital development.

2. Social Sustainability:

Social sustainability is strengthening the cohension and stability of specific social group.

Example:

1. A company CEMEX

It is working to contribute to the social development of communities. Thus, it offers decent housing through self-building programmes and loans with favourable access conditions.

2. A Gigante group:

It contributes funds and resources to a range of social causes like school materials for collaborators and grants to improve visual health.

Social challenges:

* Human rights
* Fair labour practices

* Living conditions
* Health and safety
* Empowerment
* Wellness, diversity and equity.

Aspects of sustainability:

1. Environmental aspect:

It acknowledges the need to maintain the biophysical systems that sustain all the life on earth. It includes the structure and function of natural ecosystem.

2. Social aspect:

It acknowledges the need for equity.

i) within and between generations
ii) within and between ethnic and social group

3. Cultural aspect:

The need to nourish and share attitudes and values that represent diverse world views and the political need for all people to express their views freely and to participate in decision making.

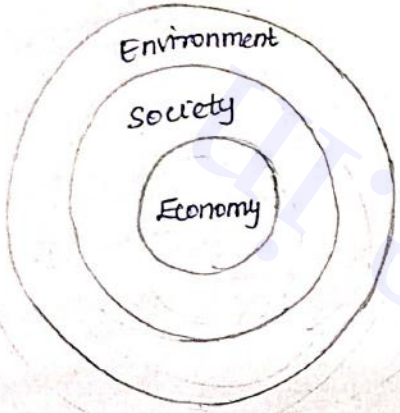
4. Economic aspect:

The interactions of human with the natural environment in using resources to create goods and services

www.Notesfree.in
www.Notesfree.in

which add value to their lives. The resource use and waste disposal must occur within the capacity of the planet.

Relationship between the aspects:



Unsustainability:

Unsustainability is a situation where exploitation of resources, practices or system is done in a manner. It occur when resources are used at a rate that exceeds their ability to replenish or when waste products are generated at a rate that exceeds the environment's ability to absorb or neutralize them.

Characteristics of Unsustainability:

* Unsustainability is one in which we forget our responsibility towards the environment.
* It not at all cares about the needs of future generations.
* Unsystematic planning can lead to damage to natural as well as human-made resources.
* It leads to extreme degradation of the environment as well as the living organism.

Causes for unsustainability:

* Developing countries are responsible for the degradation.
* The rate of increase of National pollution. In this regard, developed countries contribute much more than developing countries.
* Raising population
* We create a lot of chemical compounds, which break down in the environment and becomes problematic.
* We cut trees at a faster rate than they can grow, which causes global warming.
* Purchasing and using polythene bags contribute to growth of pollution.

www.Notesfree.in
www.Notesfree.in

Characteristics of sustainability:

* It reduces emission of green-house gases, which will reduce global-warming and helps in preserving the environment.

* It uses natural and biodegradable materials for reducing the impact on the environment.

* It follows non-polluting construction practices.

* It protect the natural habitats.

* It improves the quality of human life.

* It minimises the depletion of natural resources.

Differences between sustainability and unsustainability.

Sustainability	Unsustainability
Prevention of natural resources.	Exploitation of natural resources is faster than the planet can handle and replenish.
Long-term economic growth without negatively impacting our environment (or) soc^ty.	Not quantifying ecosystem services and increased vulnerability to crises.
Equality, diversity, social cohesion and democracy.	Labour laws, human rights, gender-inequality and poor treatment of indigenous people.

Sustainable development:

Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Aim of true sustainable development:

It aims at optimum use of natural resources with high degree of sustainability, minimum wastage, least generation of toxic by-products and maximum productivity.

1. Inter-generational equity:

It states that we should hand over a safe, healthy and resourceful environment to our future generations.

2. Intra-generational equity:

It states that the technological development of rich countries should support the economic growth of the poor countries and help in narrowing the wealth gap and lead to sustainability.

3. Place more emphasis on pollution prevention and waste reduction.

4. Recycle and reuse as many of our waste products and resources possible.

5. Sustain earth biodiversity.

www.Notesfree.in

*Earth degarding activities should be discouraged.

*Reduce poverty and rate of population growth.

*Don't use high quality energy to do a job.

Goals of sustainable Development:

*End poverty everywhere, in all its forms.

*End hunger, achieve food security and improved nutrition.

*Ensuring good health and promote the well-being of all age groups.

*Ensuring inclusive and equitable quality education.

*Achieving gender quality and empowering all women and children.

*Promoting sustainable economic growth.

*Reducing inequality within and among countries.

*Ensuring sustainable consumption and production patterns.

*Taking urgent action to combat climate change and its impacts.

www.Notesfree.in

Sustainable development targets:

* Reduce at least by half the proportion of men, women and children of all ages living in poverty.

* Implement nationally appropriate social protection systems and measures for all including floors.

* Eradicate extreme poverty for all the people everywhere.

* Double the agricultural productivity and income of small scale food producers.

* Maintain the genetic diversity of seeds, cultivated plants and farmed animals.

* Reduce the global maternal mortality ratio to less than 70 per 1,00,000 live births.

* End preventable deaths of new-borns and children under 5 years of age

* End of epidemics of AIDS, tuberculosis, malaria, hepatities, water-borne diseases.

* Adopt measures to ensure the proper functioning of food commodity markets.

Sustainable development indicators:

* Proportion of the population living below the international poverty line by sex, age, employment status.

* Proportion of the population living below the national poverty line by sex and age.

www.Notesfree.in

* Proportion of population covered by social protection floors.
* Prevalence of under nourishment.
* Proportion of total government spending on essential services.
* Prevalence of stunting and mal-nutrition among children and 5 years of age and prevalence of anaemia in women aged 15 to 49 years.
* Average income of small-scale food producers.
* Proportion of agricultural area under productive and sustainable agricultural practices.
* Agricultural export subsidies.
* Indicator of food price anomalies.
~~Maternal of food price~~
* Maternal mortality ratio.
* Under-5 mortality rate.
* Proportion of women of reproductive age, who have their need for family planning.

Intervention areas of sustainable development goals:

1. Climate change
2. Use of natural resources
3. Waste production
4. Water pollution
5. Deforestation.
6. Over fishing
7. Poverty
8. Ocean acidification
9. Air pollution

www.Notesfree.in

Climate change:

Climate change refers to the long-term shifts in temperature and weather pattern. These changes may be natural or artifical.

Causes of climate change:

* Presence of green house gases in the atmosphere increases the global temperature.
* Depletion of ozone layer also increases the global temperature.
* Uneven distribution of rainfall.
* Rotation of earth on its axis.
* Seasonal changes.

Effect (or) Issues of climate change:

* Climate change may upset the hydrological cycle, results in floods and droughts in different regions of the world.
* Global pattern of winds and ocean current also gets disturbed by climate.
* More frequent and intense drought.
* Sea level gets raised.
* Melting glaciers and warming oceans can directly harm animals and destroy
* Higher temperature increases heat related illnesses and make working outdoors more difficult.
* If conditions are hot wild fires start more easily and spread more rapidly.

www.Notesfree.in

Possible solution to climate change:

* Burning of fossil fuels like coal, oil and gas must be avoided.

* Renewable energy sources like solar, wind, tidal and geothermal power must be used instead of fossil fuels.

* Reducing petrol and diesel vehicles, planes and ships and switching to electric vehicles stop climate change.

* planting more trees in the right place will absorb more carbon from the emissions.

* Oceans also absorb large amounts of CO_2 from the atmosphere, which helps to keep our climate stable.

* Protect forests, which fight against climate change.

* Avoid of using plastics.

* Provide financial support to developing countries, so people and nature can successfully adapt.

www.Notesfree.in

Case studies

Climate change on chennai, East Coast Road (ECR) and Old Mahabalipuram Road (OMR)

ECR and OMR are today's landmark will receive the highest climate impact. Due to chennai's land use patterns, population stress and abuse of natural resources, climate has changed drastically in the last few years. Climate induced impacts like drought, flood, heavy rains and winds are becoming increasingly evident in the city.

Reason for flood in chennai

Increasing population and building land use pattern have changed the natural hydrology of the city. The water which needs to naturally drain into the sea via the regional watershed are now blocked by buildings and artificial man-made structures.

Remedy:

Researches predicts that chennai's climate is more unpredictable and aggressive. climate change will affect people and the environment. People need to take action to reduce the emission of green house gases that is the root cause for climate change.

www.Notesfree.in

Climate change on Chennai, Ennore

Ennore thermal power station (ETPS), a 660 MW coal-fired thermal power plant in Ennore at north Chennai, CPCL's oil refinery, Madras Fertilizers Ltd, Tamil Nadu Petroproducts Ltd and Madras Petrochemical Ltd. These six factories were, operating in violation of prescribed air pollution norms for nearly 60% responsible for drastic climate change.

More than 56 lakh tonnes of coal ash is spread over the river bed with flyash deposits ranging in depth from 1 ft to 8ft.

Issues (or) effects:

* Ground-level SO_2 and NO_2 pollution exceeded the carrying capacity of the area.

* Natural drainage pattern have been considerably altered due to fly ash pond construction and ash contamination. This will have an impact on local hydrology and flooding.

* In Ennore, children and women are particularly affected and gynecological problems were particularly reported by repondents.

* More than 120 million litres of hot waste water is discharged daily, from Ennore power plant, into the ocean. Such discharge in an already warming Ocean will create localised marine deserts.

Carbon credit:

A carbon credit is a tradable permit that represents the right to emit a set amount of CO_2 the equivalent amount of green house gas.

Types of carbon credit:

1. Voluntary emissions reduction (VER)
2. Certified emissions reduction (CER)

1. Voluntary emission reduction (VER):

A carbon offset that is exchanged in the over-the-counter (or) voluntary market for credits.

2. Certified emissions reduction (CER):

It relies on emission credits created through a regulatory frame work with the purpose of off-setting a project's emissions.

www.Notesfree.in

Advantages of Carbon Credit:

Each carbon credit corresponds to one ton of carbon that was not emitted into the atmosphere.

The purchase of carbon credits by companies that are environmentally conscious is favorable for their image.

It enable companies to support decarbonization beyond their own carbon footprint.

Disadvantages of carbon credit:

Some institutions and countries can accommodate themselves in the exchange market to continue emitting their greenhouse gases.

Companies do not invest in action emissions because they are able to buy unlimited credits.

The reduction of 1 ton of carbon that is 1 credit, will never be enough.

Main focus of carbon credit is to reduce green house gas emission, but it is not possible to stop the negative impacts caused by the global warming.

Carbon Footprint:

The total amount of green house gases (including CO_2 and CH_4) that are generated by our direct and indirect activities.

Individual carbon footprint:

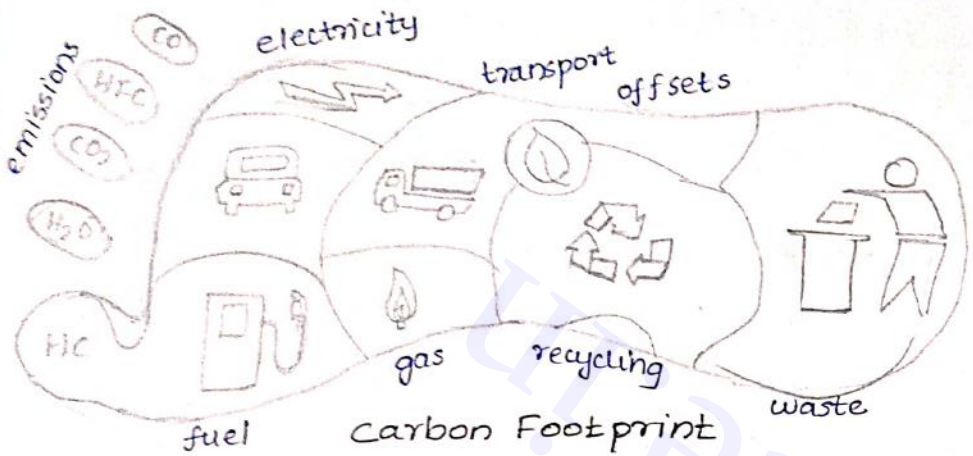
The sum total of their direct and indirect carbon emissions over the course of a year.

i.e., Smaller your carbon footprint : better for future

Bigger your carbon footprint : Have bigger negative impact in environment.

The average carbon footprint for a person in united state is 16 tons. Globally, the average is closer to 4 tones. To avoid 2°C rise in global temperatures, the average global carbon footprint per year needs to drop under 2 tons by 2050

www.Notesfree.in
www.Notesfree.in



Sources of carbon footprint:

* Climate change
* Natural process like volcanos
* Green house gases emitted from human activities.
* Industrial activities 22%
* Electricity generated accounted for about 28%.

Causes of a carbon footprint:

The major contributors to carbon footprints are

i) food (especially meat (beef))
ii) consumption
iii) transportation
iv) house hold energy

Ways to reduce your carbon footprint:

* Calculate your carbon footprint
* Drive less
* Switch to an electric (or) hybrid car.
* Travel smart
* Switch to renewable energy
* Make your home more efficient.
* Get energy efficient appliances.
* Unplug electrical devices when not in use.
* Start a home garden
* Don't waste water
* Reduce, reuse and recycle.

Environmental Management:

Environmental management is a set of practices and processes that enable any organization, whether private or public, to reduce its environmental impacts and increasing its operating efficiency.

Objectives of Environmental Management:

* To protect environmental resources.
* To monitoring plan to enable evalution of success or failure of enviromental management measures.

www.Notesfree.in
www.Notesfree.in

* To improve the quality of human life.

* To identify new eco-friendly technologies for sustainable development.

* To carry out reorientation of the plan if found necessary.

* To implement the protective and enhancement measures by adopting suitable planning and design criteria for construction of the project.

* To protect the environment from the effects of manufacturing byproducts.

Principles of environmental management:

1. Polluter pays principle (PPP):

It states that firms discharge polluting effluent to the environment. If measures are adopted to reduce pollution, the cost should be paid by the polluters (firms).

2. The user pays principle (UPP):

It states that all resource user should pay the cost of the use of a resource and related services.

www.Notesfree.in

3. The precautionary principle (PP):

It states that a substance posing a threat to the environment, is prevented from adversely affecting the environment.

4. Principle of effectiveness and efficiency:

The efficiency of resource use may be accomplished by the use of policy instruments that create incentive to minimize wasteful use.

5. The principle of responsibility:

It is the responsibility of all persons, to use the environmental resources in an ecological sustainable, economically efficient and socially fair manner.

6. The principle of participation:

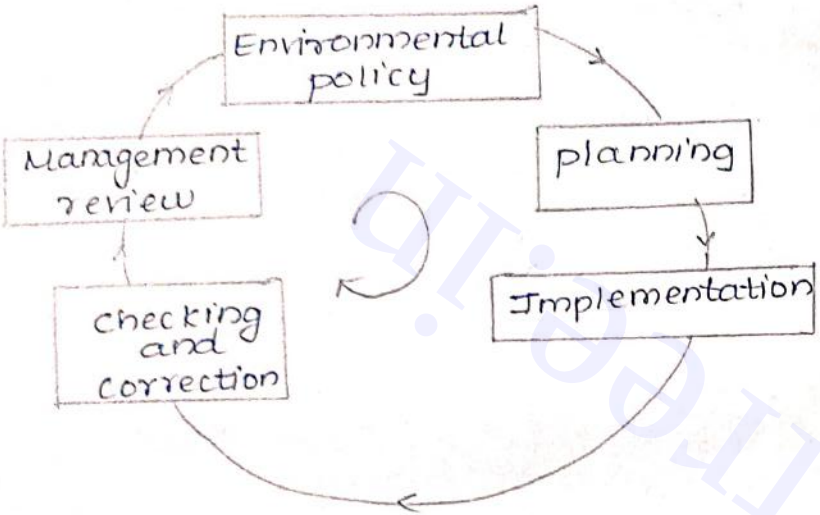
It is the duty of all the persons to participate in collectively environmental decision making activities.

7. The principle of proportionality:

It is based on the concept of balance. A balance is to maintain between the economic development on the one hand and environmental protection on the other hand.

www.Notesfree.in

Steps involved in environmental management.



1. Environmental policy:

It is the mission of an organization, which starts with establishing an environmental policy.

2. Planning:

It involves identifying the resources, processes, significant impacts and pollutions prevention opportunities. It also includes objectives and targets for improvements efforts.

3. Implementation:

Defining the structure, responsibilities and program. It also

develops and implements standard operating procedures and training.

4. Checking and correction:

It includes monitoring and measuring problems identification and corrective and preventive action implementation.

5. Management review:

It involves modification of environmental management system to ensure solutions on compliance. Based on the result of checking and correction, management must take corrective actions.

Characteristics of environmental management:

*It supports sustainable development.

*It demands the multidisciplinary approach.

*It has to integrate different development view points.

*It seeks to integrate natural and social science.

*It can extend from short-term to long-term and from local to global level.

*It deals with a world affected by humans.

www.Notesfree.in
www.Notesfree.in

Benefits of Environmental management:

* Improved environmental performance.
* Enhanced compliance
* pollution prevention
* Resource conservation
* Attracts new customers
* Increased efficiency
* Enhanced employee morale
* Enhanced image with public, regulators, lenders and investors.

Case studies:

Electronic waste (E-waste) Recycling, Dell company

Dell company, through its "legacy of good" programme, the technology giant has plan to cut waste, create more eco-friendly products. Its plan to use 50m pounds of recycled plastic and other sustainable materials, create 100% recytable packaging and recover 2 bn pounds of electronic waste. Dell sourced 4.5m kilos of recycled plastic to make monitors and desktops.

www.Notesfree.in

Dell eliminated 20m pounds of packaging waste and generating more than 18m in cost savings. Its intention to reduce packaging waste, replacing non-biodegradable oil-base material with organic alternatives such as bamboo and mushrooms.

As a part of its effort to encourage others to see waste as a valuable resource. Finally, the most appropriate environmental management strategy to control environmental pollution is cleaner production. So, according to environmental management principles, cleaner production is a proactive approach where companies take preventive measure to reduce waste production at source.

Biomedical waste management in Nepal:

Due to improper environment management techniques, Nepal has many problems with medical waste, which impact adversely the environment including human health. Nepal Health Resource council in collaboration with world health organization has developed national health care waste management guidelines and training manuals for medical professionals,

www.Notesfree.in

but it has not been functioning well. As a result, many hospital use small scale incinerations (or) open burn (or) dump the waste in their premises until the garbage pickers comes and dispose in the landfill.

Incinerator facilities, if properly implemented, not only reduce final disposal of waste, but also produce electricity/heat, saving resources. This situation in Nepal is much worsen because it was not properly built and there are residents who could directly be affected by emissions resulted from the smoke around the burning equipment.

Municipal solid waste management in Solapur city, Maharashtra, India.

Total waste generated in solapur corporation area is 420 MT/day, of which 50% is biodegradable, 25% is recyclable, 15.3% is green and 9.9% is debris and slit. About 51% of the total solid waste, collected from entire city, is biodegradable.

The waste is disposed daily to the landfill site located on Tuljapur road and Bhogaon. The disposal site is open and gives rise to contamination and the treatment process is not followed. The landfill sites

are not well maintained, which create the threat of groundwater contamination due to leachate percolation. Most of the waste remains lying down in open causing pollution with the odour and smell unless degrades naturally.

A treatment plant of anaerobic digestion is in progress to extract energy from organic waste generating the biogas.

www.Notesfree.in
www.Notesfree.in

www.Notesfree.in

UNIT - V

Sustainability Practices

ZERO WASTE

Definition

Zero waste is a set of principles, focused on waste prevention, that encourages redesigning resource life cycles, so that all products are reused.

Goal

1. The material should be reused until the optimum level of consumption is reached.
2. It provides guidelines for continually working towards eliminating waste.
3. To avoid sending trash to landfills, incinerators (or) the ocean.

Concept

The conservation of all the resources by means of responsible production, consumption, reuse and recovery of products, packaging and materials without burning and with no discharges to land, water (or) air that threaten the environment (or) human health.

www.Notesfree.in

www.Notesfree.in

Logo for zero waste

Examples of zero waste

(i) one - way recyclable glass bottles.

(ii) one - way milk bags.

(iii) one - way aseptic cartons.

(iv) one - way table - top paper board cartons.

Principles of zero waste

1. **Refuse what you don't need:**

   It prevents unwanted items from coming into your home.

2. **Reduce what you do use:**

   It is equal to less waste at the end.

3. Reuse whatever you can.

4. Recycle what you can't refuse (or) reduce.

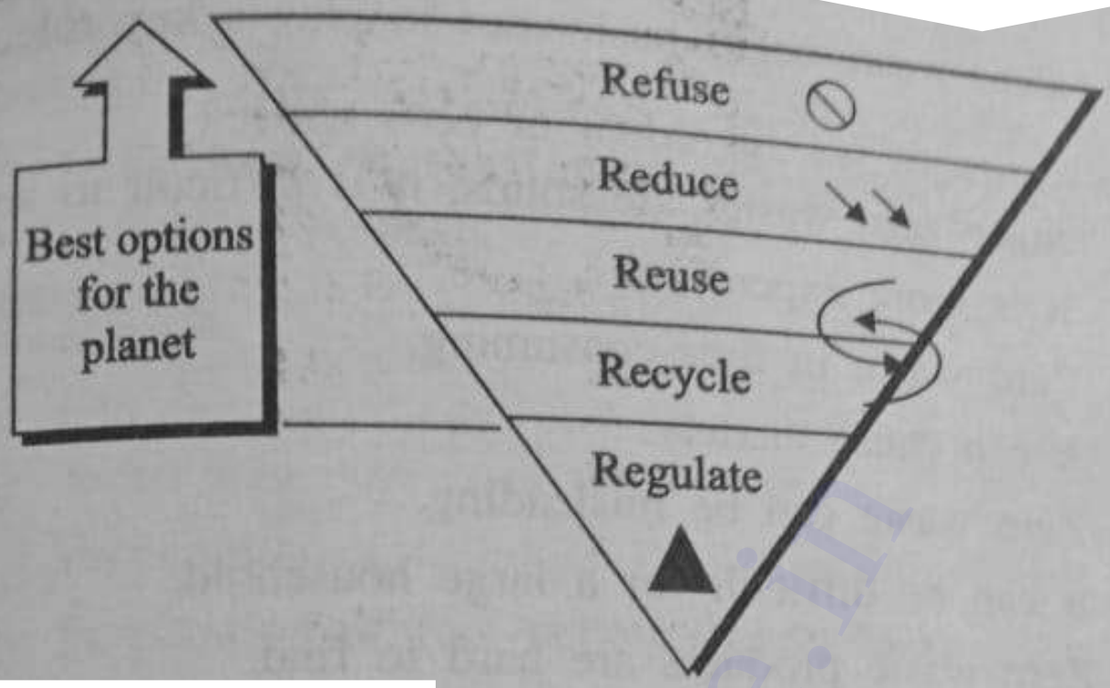
5. **Regulate of what's left over:**

   Composting food scraps, paper pieces and wooden (or) bamboo tooth brushes returns nutrients and fiber back to the earth.

www.Notesfree.in

www.Notesfree.in

Flow Chart



Zero waste Hierarchy

Steps to achieve zero waste

1. Identify the high waste areas of our life-style.
2. Know where to apply the principle of zero waste, if the waste cannot be removed (or) reduced.
3. Substitute single use plastic with eco-friendly zero waste options.
4. Buy zero waste (or) eco-friendly products.
5. Support eco-friendly businesses.
6. Put all your kitchen waste to good use (compositing).
7. Reuse, upcycle and re-purpose.

Advantages and Disadvantages of zero waste

Advantages (or) Benefits

(i) Zero waste reduces our climate impact.

(ii) It conserves resources and minimizes pollution.

(iii) It promotes social equity and builds community.

www.Notesfree.in

www.Notesfree.in

(iv) It supports a local circular economy and creates jobs.

(v) Zero waste needs businesses to play a key role.

Disadvantages (or) problem of zero waste

(i) Since zero wastes are solids, it is difficult to store.

(ii) It is more expensive.

(iii) Zero waste in time-consuming.

(iv) It can cause anxiety.

(v) Zero waste can be misleading.

(vi) It can be difficult for a large household.

(vii) Zero waste products are hard to find.

R CONCEPT (OR) 3R CONCEPT (REDUCE, REUSE AND RECYCLE)

Definition

The principle of reducing waste, reusing and recycling resources and products is often called 3Rs.

1. Reduce

Reducing means choosing to use things with care to reduce the amount of waste generated.

If the usage of raw materials are reduced, the generation of waste also gets reduced.

2. Reuse

Reusing involves the repeated use of items (or) parts of items which still have usable aspects.

(a) The refillable containers, which are discarded after use, can be reused.

(b) Rubber rings can be made from the discarded cycle tubes, which reduces the waste generation during manufacturing of rubber bands.

www.Notesfree.in

www.Notesfree.in

3. Recycle

Recycling means the use of waste itself as the resources.

It involves reprocessing of the discarded materials into new useful products.

Examples

(i) Old aluminium cans and glass bottles are melted and recast into new cans and bottles.

(ii) Preparation of cellulose insulation from paper.

(iii) Preparation of fuel pellets from kitchen waste.

(iv) Preparation of automobiles and construction materials from steel cans.

The above process saves money, energy, raw materials, and reduces pollution.

Concept of 3R

The concepts of 3R refers to reduce, reuse and recycle, particularly in the topic of production and consumption. It forces for an increase in the ratio of recyclable materials, further reusing of raw materials and manufacturing wastes and overall reduction in resources and energy used.

www.Notesfree.in

www.Notesfree.in

Principle

3R is the order of priority of actions to be taken to reduce the amount of waste generated and to improve overall waste management processes and programs.

Importance of 3 Rs

(i) The most effective way to reduce the garbage is reducing the amount of solid waste produced.

(ii) By reducing waste at the source, the resources like water and energy can be saved.

(iii) Like reducing, reusing avoids creating waste rather than trying to recycle it once it's already there.

(iv) Operating a well-run recycling program costs less than waste collection and land filling.

(v) Recycling helps families save money because they pay for less disposal costs.

(vi) recycling produces less air and water pollution than manufacturing with new materials.

(vii) By recycling less materials are sent to landfills, which will keep them for future.

(viii) Proper disposal and recycling will prevent water and soil contamination.

Advantages and disadvantages of 3 Rs

Advantages (or) Benefits of 3 Rs

(i) Reduce greenhouse gas emissions.

(ii) Saves energy.

(iii) Helps sustain the environment for future generations.

(iv) Reduces the amount of waste that will need to be recycled (or) sent to landfills and incinerators.

(v) Save money.

www.Notesfree.in

www.Notesfree.in

(vi) Prevent pollution.

Disadvantages of 3 Rs

1. High upfront capital cost.
2. Recycling sites are always unhygienic, unsafe and unsightly.
3. Products from recycled waste may not be durable.
4. Recycling might not be inexpensive.
5. 3R is more energy consumption and pollution.
6. 3R generates pollutants.
7. Processing cost is high.
8. Quality of resultant product is low.

CIRCULAR ECONOMY

Definition

Circular economy ***is a new production and consumption model that ensures sustainable growth over time. It reduces the consumption of raw materials and recover wastes by recycling (or) giving it a second life as a new product.***

Aim (or) Purpose

Aim of the circular economy is to make the most of the material resources available to us by applying three basic principles reduce, reuse and recycle.

In this way the life cycle of products is extended, waste is used and a more efficient and sustainable production model is established over time.

www.Notesfree.in

www.Notesfree.in

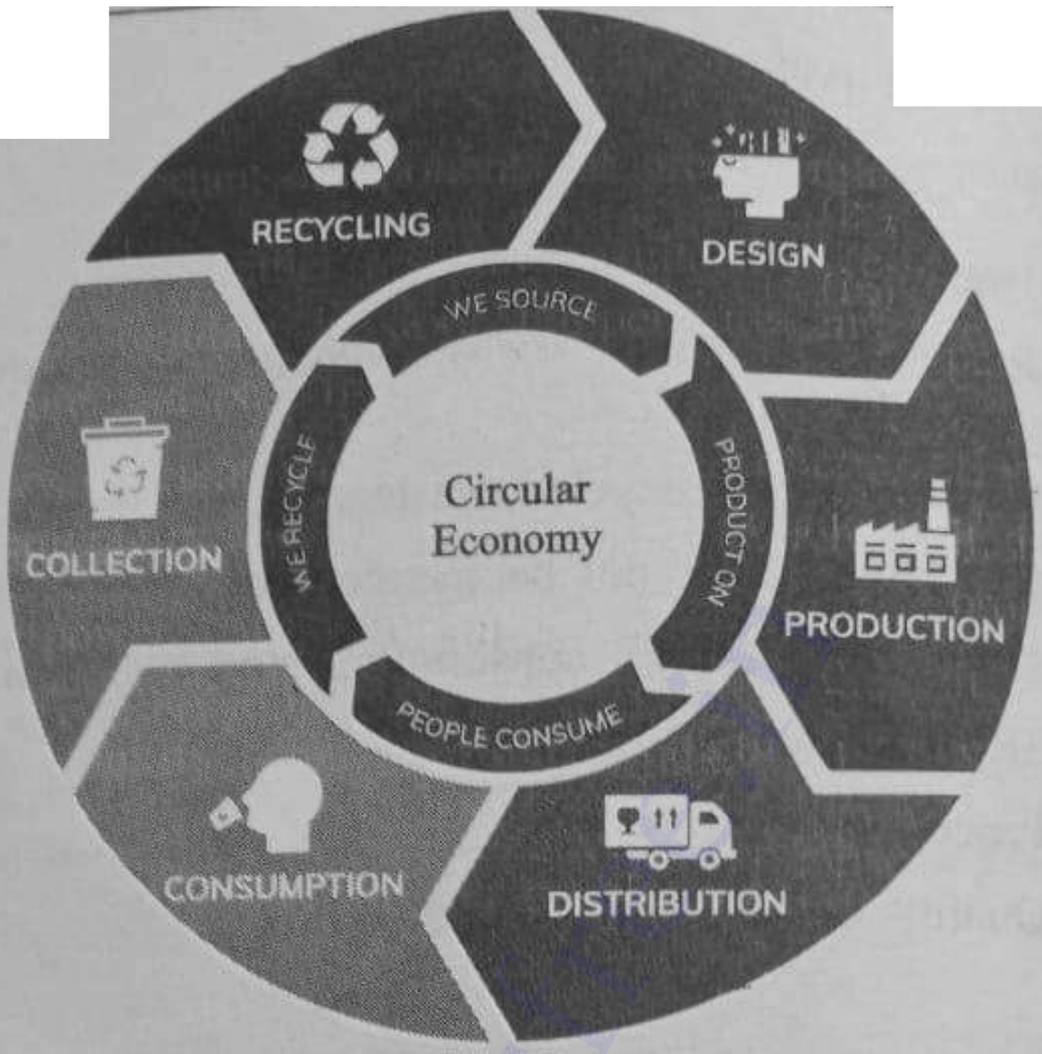


Fig. 5.4 Circular Economy

Benefits of circular economy

(i) It protects environment.

(ii) Circular economy benefits the local economy.

(iii) It drives employment growth.

(iv) It promotes resource independence.

Necessary steps (7Rs) to achieve a circular economy

1. Redesign

Redesigning process consumes fewer raw materials, extends their life cycle and generates less waste.

2. Reduce

If we reduce consumption, waste generation and use of raw materials, impact on the environment gets reduced.

www.Notesfree.in

www.Notesfree.in

3. Reuse

Reusing the products extends their life cycle.

4. Repair

Repairing avoids the use of new raw materials, saves energy and does not generate environmental waste.

5. Renovate

Update old objects, so that they can be reused.

6. Recycle

Waste product can be used as raw material to manufacture new products.

7. Recover

The products that are going to be discarded, can be used for new uses.

Example for Circular Economy

(i) Manufacturers design products to be reusable.

(ii) Electrical devices are designed in such a way that they are easier to repair. Products and raw materials are also reused as much as possible.

ISO 14000 SERIES

ISO

ISO is an International Organization for Standardization. It is composed of representatives from various national standard organizations. It provides standards and guidelines for a variety of businesses and purposes and publishes technical reports.

www.Notesfree.in

www.Notesfree.in

ISO 14000 series

It is a family of standards related to environmental management that exist to help organizations.

(a) minimize how their operations negatively affect the environment.

(b) comply with applicable laws, regulations and other environmentally oriented requirements.

(c) continually improve with above.

Objective of ISO14000 series

The primary objective of ISO14000 series of standard is to promote effective environmental management systems in organizations.

Logo of ISO

List of ISO 14000 Series Standards

It includes a catalogue of over 50 Environmental management and performance related standards. But some important ISO14000 series standards are listed here.

www.Notesfree.in

www.Notesfree.in

Standard	Title	Applications
ISO14001	Environmental management system.	Requirements with guidance for use.
ISO14004	Environmental management system.	General guidelines on implementation.
ISO14005	Environmental management system.	Guidelines for flexible approach to implementation.
ISO14015	Environmental management.	Environmental assessment of sites.
ISO14020 to 14025	Environmental management.	Environmental labels and declarations.
ISO14030	Green bonds.	Environmental performance of nominated projects and assets.
ISO14031	Environmental management.	Environmental performance evaluation & Guidelines.
ISO14040 to 14049	Environmental management.	Discusses pre-production planning.
ISO14050	Environmental management.	Vocabulary, terms and definitions.
ISO14062	Environmental management.	Product design and development.
ISO14063	Environmental management.	Guidelines and examples.

www.Notesfree.in

www.Notesfree.in

Standard	Title	Applications
ISO14064	Environmental management.	Reducing green house gas emissions.
ISO14090	Environmental management.	Adaptation of climate change.

Core elements of ISO 14000

It contains the following six key elements.

(i) Environmental policy.

(ii) Planning.

(iii) Implementation and operation.

(iv) Checking and corrective action.

(v) Management review.

(vi) Continuous improvement.

Advantages and disadvantages of ISO14000

Advantages (or) Benefits

The following five important benefits of quality management system

(i) It identifies risks and opportunities.

(ii) It prevents problems from reoccurring.

(iii) It boosts your marketing and sales efforts.

(iv) It improves employee performance.

(v) It improves your control over the business.

(vi) It lowers costs like energy bills, tax and insurance bills.

(vii) It helps to reduce waste.

www.Notesfree.in

www.Notesfree.in

(viii) It helps to minimize the carbon footprint of a company.

(ix) It is recognised internationally.

(ix) It gives immediate notice about the environmental performance of a company.

Disadvantages (or) limitations

1. It is extremely costly to implement if not done properly.
2. It requires a lot of administrative work.
3. No improvement in environmental performance.
4. Organizations face a lot of challenges while implementing this standards.

MATERIAL LIFE CYCLE ASSESSMENT

Definition

Life cycle assessment (LCA) ***is a process of evaluating the effects of a material on the environment over the entire period of its life, there by increasing resource use efficiency and decreasing liabilities.***

Generally LCA is used to study the environmental impact of a material. LCA is commonly referred to as a cradle-to-grave analysis.

Stages of a life cycle assessment

The followings are the 5 stages of a life cycle assessment

Step 1: Raw materials (Resources) extraction and processing.

Step 2: Manufacturing.

www.Notesfree.in

www.Notesfree.in

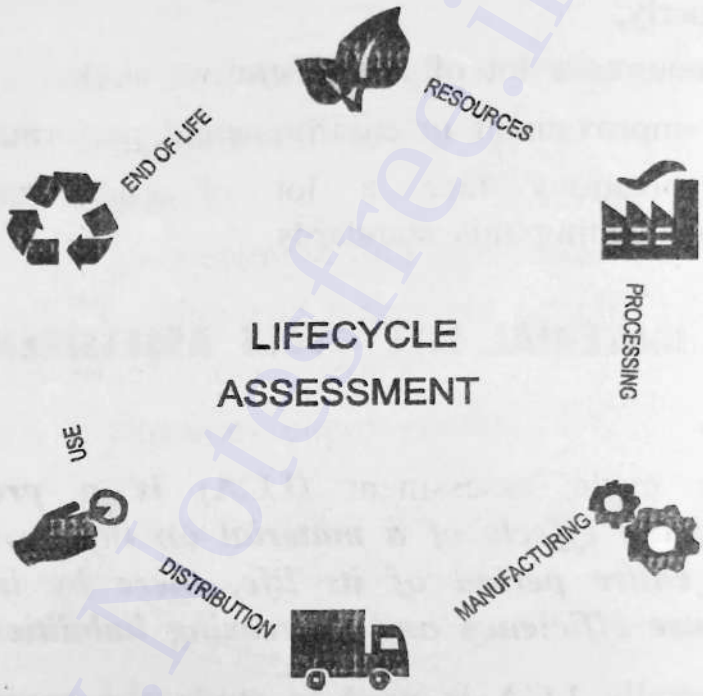
Step 3: Transportation.

Step 4: Distribution.

Step 5: Usage and retail.

Step 6: Waste disposal (end of life).

Flow Chart



Life cycle assessment

In the manufactured product, environmental impacts are assessed from raw material extraction and processing, through the product's manufacture, distribution and use, to the recycling (or) final disposal of the materials.

Benefits (or) Advantages of LCA

1. LCA is widely used to support sustainable development.

www.Notesfree.in

www.Notesfree.in

2. LCA allows decision makers to compare two products and to select the product that has lowest impact on the environment.
3. It is a modelling tool to assess environmental impacts of a product during its entire lifespan.
4. LCA provides a holistic view on the environmental impacts, to avoid optimizing one environmental indicator without considering the effects on the other indicators.
5. LCA identifies hotspots in the environmental impact.
6. LCA is purely based on internationally accepted standards.

Disadvantages (or) Limitations

1. LCA assesses the real world in a simplified model.
2. The assumptions, scenaries and scope may vary from one study to the other leading to different LCA results.
3. Variations in LCA approaches and results may be confusing especially for non-experts.
4. LCA study requires large amount of data.
5. If data collection is poor, the study will not lead to solid conclusions.
6. It is not easy to communicate the results of a LCA study.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

EIA is defined as a formal process of predicting the environmental consequences of any development projects. It is used to identify the environmental, social and economic impacts of the project prior to decision making.

www.Notesfree.in

www.Notesfree.in

Purpose (or) Aim of EIA

The main purpose of EIA is to determine the potential environmental, social and health effects of a proposed developmental projects.

Objectives of EIA

1. To identify the main issues and problem of the parties.
2. To identify who is the party.
3. To identify what are the problems of the parties.
4. To identify why are the problems arise.

Benefits of EIA

1. Cost and time of the project is reduced.
2. Performance of the project is improved.
3. Waste treatment and cleaning expenses are minimised.
4. Usages of resources are decreased.
5. Biodiversity is maintained.
6. Human health is improved.
7. It helps in preventing natural calamities like earthquake, cyclone, etc.,

Process of EIA (or) Key Elements of EIA

The key elements used in the process of EIA are

1. Scoping
2. Screening
3. Identifying and evaluating alternatives

www.Notesfree.in

www.Notesfree.in

4. Mitigating measures dealing with uncertainty

5. Issuing environmental statements

1. Scoping

It is used to identify the key issues of the concern in the planning process at an early stage. It is also used to aid site selection and identify any possible alternatives.

2. Screening

It is used to decide whether an EIA is required (or) not based on the information collected.

3. Identifying and evaluating alternatives

It involves knowing alternative sites and alternative techniques and their impacts.

4. Mitigating measures dealing with uncertainty

It reviews the action taken to prevent (or) minimize the adverse effects of a project.

5. Environmental statements

This is the final stage of the EIA process. It reports the findings of the EIA.

SUSTAINABLE HABITAT

Sustainable habitat means the maintenance of our natural home.

Definition

A sustainable habitat is an ecosystem that produces food and shelter for people and other organisms without resource depletion ie., no external waste is produced.

www.Notesfree.in

www.Notesfree.in

Features (or) Characteristics of sustainable habitat

(i) Proper waste management.

(ii) Affordable housing.

(iii) Waste water treatment and facility of recycling waste water.

(iv) Green transportation using green fuel like biodiesel.

Objectives of national mission on sustainable habitat

1. To reduce energy demand by promoting alternative technologies and energy conservation practices in both residential and commercial areas.
2. Better urban planning like
   (i) using better disaster management
   (ii) lesser use of private transport
   (iii) more usage of public transport
3. Encourage community involvement and participation of stake holders.
4. Conservation of natural resources such as clean air, water, flora and fauna.
5. Facilitate the growth of small and medium cities.
6. To create sustainable habitats, engineers and architects should not consider any element as a waste product.

How to maintain sustainable habitat

For maintaining our sustainable habitat, we should

(i) Promote energy efficiency.

(ii) Promote the use of eco-friendly fuels.

www.Notesfree.in

www.Notesfree.in

(iii) Better manage municipal solid waste.

(iv) Promote to public transport.

GREEN BUILDINGS

Definition

Green building is an efficient method of construction that produces healthier buildings, which have less impact on the environment and climate. It requires less cost to maintain.

Green buildings preserve previous natural resources and improve our quality of life.

Criteria for green building

1. Green builders are encouraged to build on previously developed land rather than developing new land.
2. It is also important to build near existing infrastructure like bus routes, market, libraries.
3. The building site should be smaller because there is less environmental foot print.
4. Sites must be sustainably landscaped and don't suffer from soil erosion (or) light pollution.
5. Water reduction is built in by design using low-flow toilets, grey water systems.
6. Green buildings are constructed using clean energy like geothermal, solar, wind energies.
7. Green builders reduce material usage wherever possible. Mainly they use natural, renewable sources.
8. Selecting low emitting materials and products not only improves human health but also protect the overall environment.

www.Notesfree.in

www.Notesfree.in

Features of green building

(i) Efficient use of energy, water and other resources.

(ii) Use of renewable energy such as solar energy.

(iii) Pollution and waste reduction measures ie., reuse and recycling.

(iv) Good indoor environmental air quality.

(v) Use of materials that are non-toxic, ethical and sustainable.

(vi) A design that enables adaptation to a changing environment.

(vii) Consideration of the quality of life of occupants in design, construction and operation.

(viii) Construction of the environment in design, construction and operation.

Thus, any building can be a green building whether it is a home, an office, a school, a hospital, a community centre provided it includes features listed above.

Principles of green building

The five principles of green building are

(i) Livable communities.

(ii) Energy efficiency.

(iii) Indoor air quality.

(iv) Resource conservation.

(v) Water conservation.

www.Notesfree.in

www.Notesfree.in

Components of green building

Seven important components of green buildings are

1. Aluminium weather resistant insulated access panel. It helps regulate in door temperature and prevent moisture and pest from entering.
2. Energy efficient windows.
3. Green roof.
4. Solar power.
5. Water conservation.
6. Recycling.
7. Landscaping.

Advantages and Disadvantages of green building

Advantages of green buildings

1. Green buildings are energy efficient.
2. Higher fraction of eco-friendly materials.
3. Water - efficient devices.
4. Reduction in waste.
5. Less air pollution.
6. Reduction in green house gas emissions.
7. Protection of our natural resources.
8. Indoor air quality is improved.
9. Use of recycled metal and other construction materials.
10. Emphasis on renewable energies.
11. Day lighting is utilized as best as possible.
12. Use of renewable plant materials.
13. Higher market value.

www.Notesfree.in

www.Notesfree.in

14. Rainwater collection and use of compost bins.
15. Overall health improvements.

Disadvantages of green building

1. High initial costs.
2. Energy supply may depend on weather condition.
3. Technology problems are more.
4. Maintenance may be difficult.
5. Indoor air temperature may greatly vary over time.
6. Experienced green construction workers may be rare.
7. Green construction is not suitable for all locations.
8. Availability of green construction materials.
9. Funding problems for green buildings.

GREEN MATERIALS

Definition

Green materials also called eco-friendly materials, building construction materials that have low impact on the environment. Due to the properties of non-toxic, organic and recycling, green materials are widely used in various industrial applications.

Examples Naturally occurring materials like wood, ceramics, glass, clay, sand, stone.

Criteria for green materials

Following criteria can be used to identify the green materials.

(i) Local availability of materials.

(ii) Embodied energy of materials.

(iii) % of recycled (or) waste materials used.

www.Notesfree.in

www.Notesfree.in

(iv) Rapidly renewable materials.

(v) Contribution in energy efficiency of building.

(vi) Recyclability of materials.

(vii) Durability.

(viii) Environmental impact.

Evolution of the material can be made using the mentioned criteria.

Characteristics of green materials

Common characteristics of green materials are

1. Green materials are energy efficient products, it uses less energy to do the same task.
2. It lowers energy cost and lessen pollution.
3. Green materials are mostly renewable, can be regenerated again and again.

Example Bamboo grows quickly while pine grows more slowly, but both are renewable.

4. Green materials are recyclable (or) made from recycled material. So, they save energy and reduce waste.
5. Green materials are non-toxic, they do not emit odors, irritants (or) hazardous compounds that affect human health.
6. They are durable and no need to upgrade (or) repair.
7. They preserve resources and energy.
8. They are cost-effective.
9. They can be locally sourced, so transport cost can be reduced.

www.Notesfree.in

www.Notesfree.in

Important green building materials

Green building is construction that primarily uses natural materials and renewable resources. These structures look really cool.

1. **Stone:** It is low maintenance and durable.

2. **Cob:** (mud mixture of natural ingredients like soil, sand, straw and lime). It is cheap and energy efficient.

3. **Bamboo**

   It is durable and light weight.

4. **Cork: (Cork canes from oak trees).**

   It is a very good thermal insulator and mold resistant

5. **Adobe brick: (brick made of clay and straw).**

   Natural noise protection and posses unique design (can be easily cut and transformed).

6. **Straw bale**

   Easily renewable and cheap.

7. **Cord wood**

   Affordable (cheap and easy construction), thermal efficiency.

8. **Earth bags (or) sand bags**

   Locally sourced and provide natural insulation.

9. **Mycelium (or) mushroom roots**

   Strong and light weight.

Examples of green materials

(i) Bamboo floorings.

(ii) LED lightings.

www.Notesfree.in

www.Notesfree.in

(iii) Reclaimed wood.

(iv) Energy efficient appliances.

(v) High-efficiency glass windows.

(vi) Solar panels.

(vii) Recycled steel.

(viii) Cork.

(ix) Precast concrete slabs.

(x) Low VOC paint.

ENERGY EFFICIENCY

Definition

Energy efficiency is the use of less energy to perform the same task (or) produce the same result. Energy efficient homes and buildings use less energy to heat, cool and run appliances and electronics.

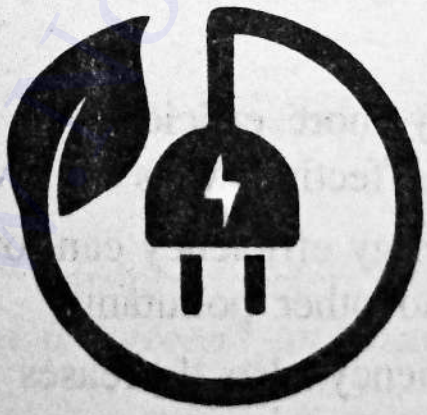


Fig. 5.7 Energy efficiency logo

Methods of achieving energy efficiency

Energy efficiency can be achieved by the following methods.

(i) Alternative waste treatment.

www.Notesfree.in

www.Notesfree.in

(ii) Avoided emissions from diverting legacy waste from landfill for process engineered fuel manufacture.

(iii) Avoided emissions from diverting legacy waste from landfill through a composting alternative waste technology.

(iv) Capture and combustion of landfill gas.

Calculation of energy efficiency

Energy efficiency can be calculated using the following relation.

$$\text{Energy efficiency} = \frac{\text{energy output}}{\text{energy input}} \times 100\%$$

$$\eta = \frac{w_{out}}{w_{in}} \times 100\%$$

Advantages (or) Benefits of energy efficiency

1. Using energy more efficiently is one of the fastest, most cost - effective ways to save money.
2. Increased energy efficiency can lower greenhouse gas emissions and other pollutants.
3. Energy efficiency also decreases water use.
4. It can lower individual utility bills, create jobs and help stabilize electricity prices.
5. It provides long-term benefits by lowering overall electricity demand, thus reducing the need to invest in new electricity generation and transmission infrastructure.
6. Energy efficient construction is environmentally - friendly as it does not emit harmful carbon dioxide into the atmosphere.

www.Notesfree.in

www.Notesfree.in

Example

Energy - efficient LED light bulbs are able to produce the same amount of light as incandescent light bulbs by using 75 to 80% less electricity.

Disadvantages (or) limitations of energy efficiency

1. Energy efficient construction is the high cost of enforcing ie., addition cost is required to build and plan such buildings.
2. Building materials are not always available.
3. Although energy efficient construction is environmentally friendly, it produces less carbon emissions and has slight unfavorable effects on the human health.
4. Indoor air is 3 to 7 times more polluted than outdoor air.

SUSTAINABLE TRANSPORT

Definition

Sustainable transport refers to ***any means of transportation that is "green" and has low impact on the environment.***

Examples

1. walking
2. cycling
3. transit
4. carpooling
5. car sharing
6. green vehicles

www.Notesfree.in

www.Notesfree.in

Sustainable transport can carry people for more efficiently than cars. Electric cars pollute less and reduce individual carbon foot prints.

Sustainable transport

Importance of sustainable transport

(i) Sustainable transport contributes to reduction in damaging CO_2 emission and therefore to a reduction in atmospheric pollution and improved air quality in cities.

(ii) The aim of this type of transport is to reduce the negative impacts on the environment.

Key elements of sustainable transport

1. Fuel economy

The better fuel economy gets the lower emissions go. By improving fuel economy we can get the same mileage while generating fewer emissions. It is achieved by

(i) making engines more efficient.

(ii) vehicles lighter and bodies more aerodynamic.

www.Notesfree.in

www.Notesfree.in

2. **Occupancy**

The cheapest and simplest way to lower the carbon intensity of a vehicle is to stick more people in the vehicle.

Example

Local bus has emissions 7 times higher than the school bus. The main difference is that the school bus has very high occupancy.

3. **Electrification**

Electrification is the most important pathway to low carbon transport.

4. **Pedal power**

Bicycles reduces the carbon emissions.

5. **Urbanization**

It is a huge opportunity for lowering both distance travelled per person and the carbon intensity of that travel.

How to Promote sustainable transport

Followings are steps for promoting sustainable transport.

1. ***Enhancing public transportation:***
   It is not only less polluting means of transportation, but also promoting HSE (Health, safety and environment) policy.
2. *Encouraging car pooling:* It reduces the volume of CO_2, emitted per inhabitant.
3. *Encouraging bicycle use:* It is reliable and non-polluting means of transportation.
4. *Teleworking:* It reduces employee travel and therefore their carbon food print.

www.Notesfree.in

www.Notesfree.in

5. *Improving the parking experience:* It can be done effectively with the help of a parking management software.

Advantages and Disadvantages of sustainable transport

Advantages (or) benefits

1. It creates job.
2. Provides safer transportation.
3. Emits less pollution.
4. Promotes health (sustainable transit reduces emissions and air pollution)
5. It saves energy.
6. Saves money.
7. *Decreases congestion:* When people choose sustainable transportation, over driving themselves, congestion also decreases.
8. *It conserves land.* It encourages compact development, fewer roadways in country areas results in less runoff, thereby protecting the land and the biodiversity.

Disadvantages (or) limitations

(i) Modifications to handling and transport facilities.

(ii) The initial purchase of reusable containers.

(iii) Additional costs of the tracking system e.g., software packages, reading equipments, electronic chips, barcode labelling, detector's etc.

www.Notesfree.in

www.Notesfree.in

SUSTAINABLE ENERGY

Definition

Sustainable energy is the energy which meets the needs of present without compromising the ability of future generations to meet their own needs.

It should be encouraged as it does not cause any harm to the environment and is available widely at free of cost.

Sources of sustainable energy

Followings are the sustainable enery sources as they are stable and available in plenty.

1. Wind energy.
2. Solar energy.
3. Ocean energy.
4. Hydro power.
5. Geothermal energy.

Advantages and disadvantages of sustainable energy

Advantages (or) Benefits

1. Improves public health

Burning of fossil fuels produces serious public health issues like neurological damage, cancer, heart attacks, breathing problems and premature death. However these problems can be eliminated by using sustainable energy sources, which emit no air (or) water pollutants.

www.Notesfree.in

www.Notesfree.in

2. Creates local jobs

Since most of the sustainable energy infrastructure is built locally (or) in the same country, it helps creates jobs and improves the economy.

3. Decrease your carbon footprint

Sustainable energy like wind and solar energy creates zero carbon emissions.

4. Cost saving

As it is easily available they are much more cost-effective than traditional energy resources, such as power plants

5. Energy security

It helps to conserve the planet's natural resources and reduce the pollution.

Disadvantages (or) limitations

1. Sustainable energy sources are not available round the clock.
2. The efficiency of sustainable energy technologies is low.
3. The initial cost of sustainable energy is high.
4. Sustainable energy sites require a lot of space.
5. Sustainable energy devices need recycling.

NON-CONVENTIONAL SOURCES (OR) RENEWABLE ENERGY SOURCES

Non-conventional sources are natural resources which can be regenerated continuously and are inexhaustible. They can be used again and again in an endless manner.

Examples *Wood, solar energy, wind energy, hydropower, tidal energy, etc.,*

www.Notesfree.in

www.Notesfree.in

Merits of Non-conventional energy resources

1. Unlimited supply.
2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralized energy production.

Solar energy

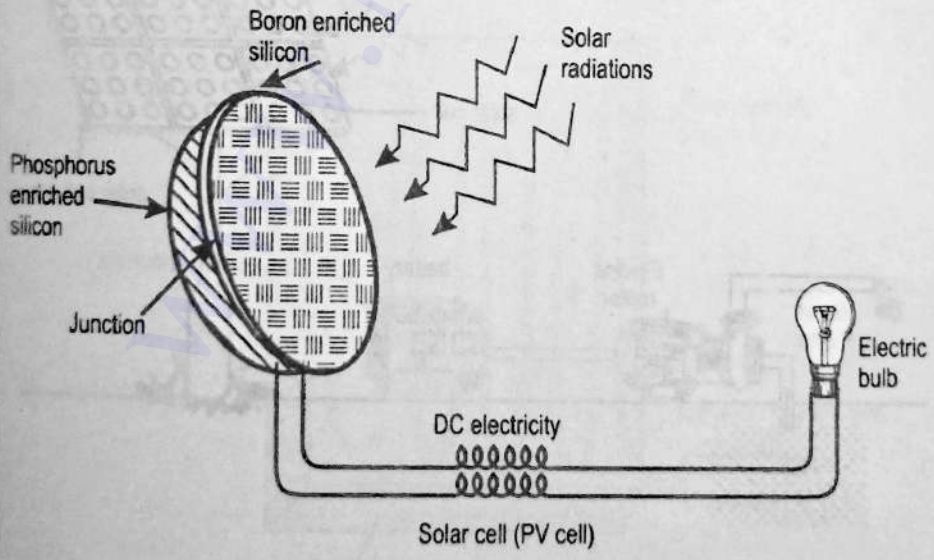
The energy that we get directly from the sun is called solar energy.

The nuclear fusion reactions occurring inside the sun release enormous amount of energy in the form of heat and light. Several techniques are available for collecting, converting and using solar energy.

Methods of Harvesting Solar Energy

Some important solar energy harvesting devices are given below.

1. Solar cells (or) photovoltaic cells (or) PV cells



Solar cell

www.Notesfree.in

www.Notesfree.in

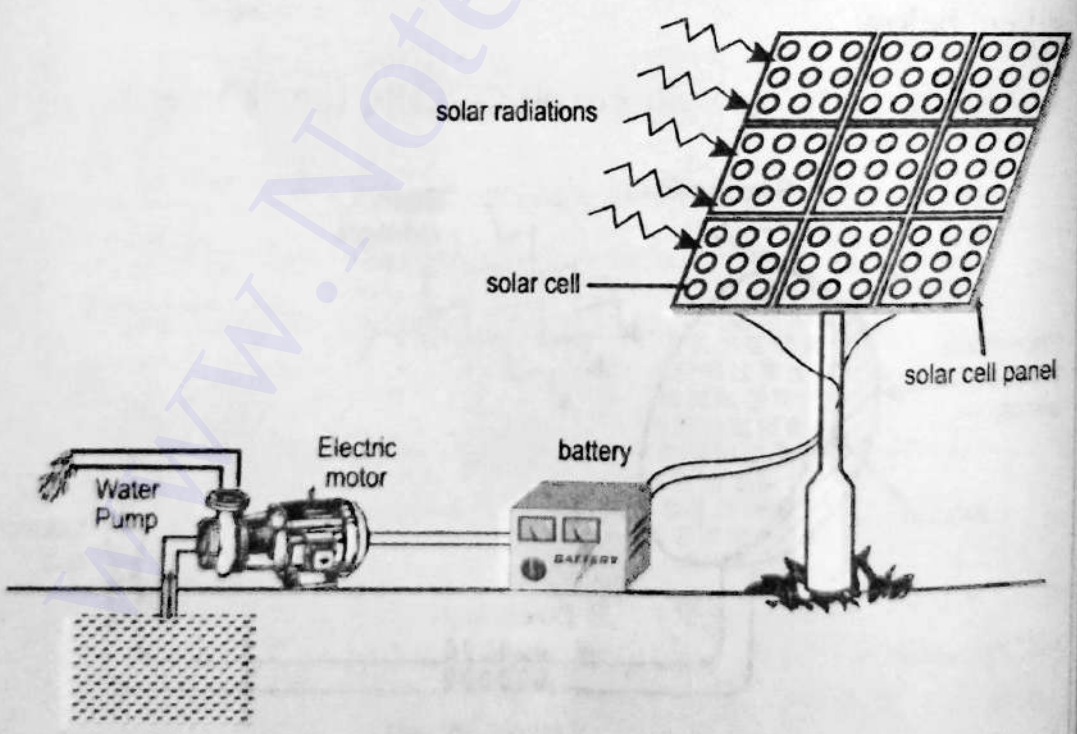
Solar cells consists of a p-type semiconductor (such as Si doped with B) and n-type semiconductor (such as Si doped with P). They are in close contact with each other. When the solar rays fall on the top layer of p-type semiconductor, the electrons from the valence band get promoted to the conduction band and cross the p-n junction into n-type semiconductor. There by potential difference between two layers is created, which causes flow of electrons (ie., an electric current).

Uses

Used in calculators, electronic watches, street lights, water pumps to run radios and TVs.

Solar Battery

When a large number of solar cells are connected in series it form a solar battery. Solar battery produce more electricity which is enough to run water pump, to run



Solar pump run by solar cells (Battery)

www.Notesfree.in

www.Notesfree.in

street-light, etc., They are used in remote areas where conventional electricity supply is a problem.

2. Solar heat collectors

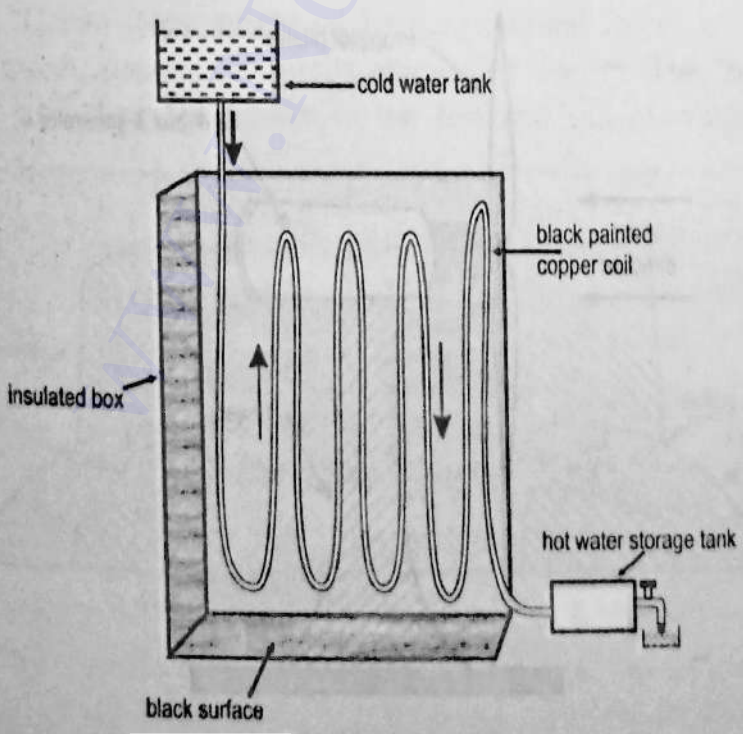
Solar heat collectors consist of natural materials like stones, bricks (or) materials like glass, which can absorb heat during the day time and release it slowly at night.

Uses

It is generally used in cold places, where houses are kept in hot condition using solar heat collectors.

3. Solar water heater

It consists of an insulated box inside of which is painted with black paint. It is also provided with a glass lid to receive and store solar heat. Inside the box it has black painted copper coil, through which cold water is



Solar water heater

www.Notesfree.in

www.Notesfree.in

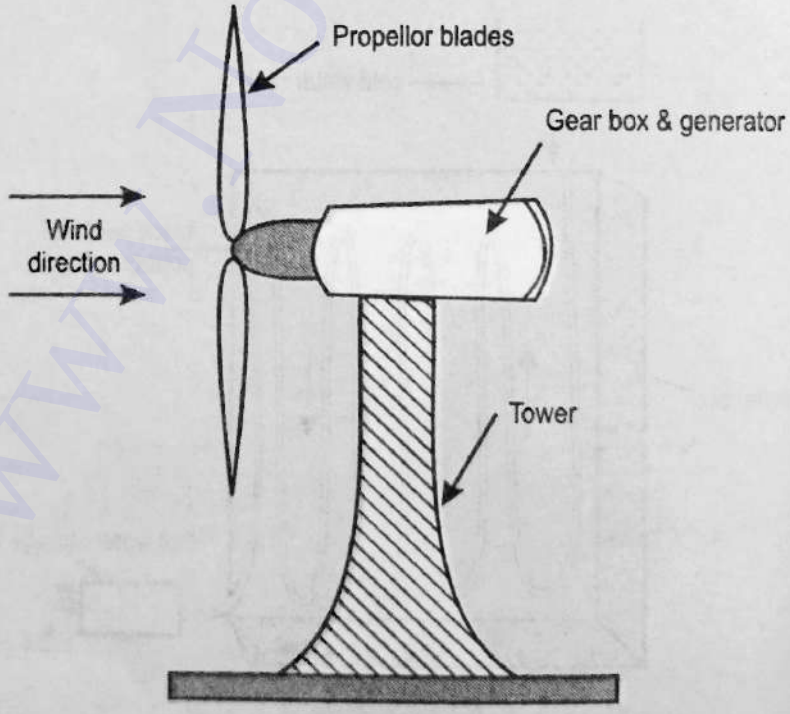
allowed to flow in, which gets heated up and flows out into a storage tank. From the storage tank water is then supplied through pipes.

Wind energy

Moving air is called wind. Energy recovered from the force of the wind is called wind energy. The energy possessed by wind is because of its high speed. The wind energy is harnessed by making use of wind mills.

1. Wind mills

The strike of blowing wind on the blades of the wind mill makes it rotating continuously. The rotational motion of the blade drives a number of machines like water pump, flour mills and electric generators.



Wind mill

www.Notesfree.in

www.Notesfree.in

2. Wind farms

When a large number of wind mills are installed and joined together in a definite pattern it forms a wind farm. The wind farms, produce a large amount of electricity.

Condition

The minimum speed required for satisfactory working of a wind generator is 15 km / hr.

Advantages

(i) It does not cause any air pollution.

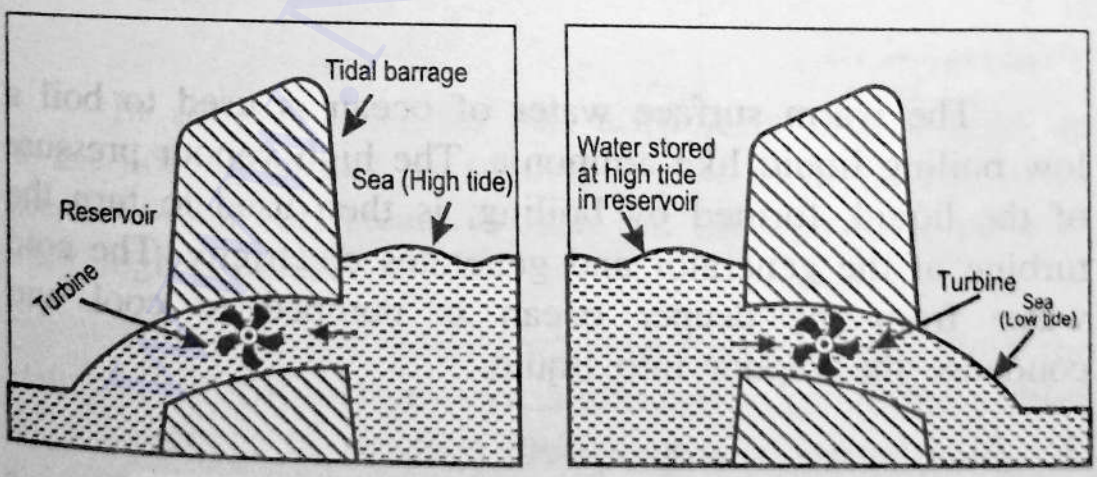
(ii) It is very cheap.

Ocean energy

Ocean can also be used for generating energy in the following ways.

1. Tidal energy (or) Tital power

Ocean tides, produced by gravitational forces of sun and moon, contain enormous amount of energy. The **'high tide'** and **'low tide'** refer to the rise and fall of water in



(a) (b)

(a) Water flows into the reservoir from sea.
(b) Water flows out from the reservoir to the sea.

www.Notesfree.in

www.Notesfree.in

the oceans. The tidal energy can be harnessed by constructing a tidal barrage.

(a) During high tide, the sea-water is allowed to flow into the reservoir of the barrage and rotates the turbine, which inturn produces electricity by rotating the generators.

(b) During low tide, when the sea level is low, the sea water stored in the barrage reservoir is allowed to flow into the sea and again rotates the turbine.

2. Ocean thermal energy (OTE)

There is often large temperature difference between the surface level and deeper level of the tropical oceans. This temperature difference can be utilized to generate electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.

Condition

The temperature difference should be of 20°C (or) more is required between surface water and deeper water.

Process

The warm surface water of ocean is used to boil a low boiling liquid like ammonia. The high vapour pressure of the liquid, formed by boiling, is then used to turn the turbine of the generator and generates electricity. The cold water from the deeper ocean is pumped to cool and condense the vapour into liquid.

3. Geo-thermal energy

Temperature of the earth increases at a rate of 20 – 75°C per km, when we move down the earth surface. High temperature and high pressure steam fields exist below the earth's surface in many places. The energy

www.Notesfree.in

www.Notesfree.in

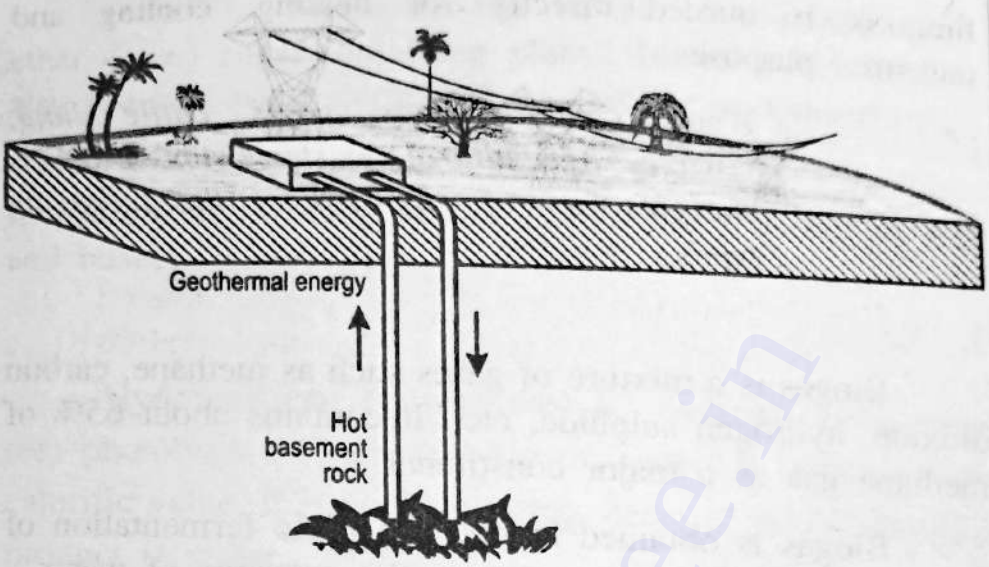


Fig. 5.14 Geo-thermal Energy

harnessed from the high temperature present inside the earth is called geothermal energy.

1. Natural geysers

In some places, the hot water (or) steam comes out of the ground through cracks naturally in the form of natural geysers.

2. Artificial geysers

In some places, we can artificially drill a hole up to the hot region and by sending a pipe in it, we can make the hot water (or) steam to rush out through the pipe with very high pressure.

Thus, the hot water (or) steam coming out from the natural (or) artificial geysers is allowed to rotate the turbine of a generator to produce electricity.

Biomass energy

Biomass is the organic matter, produced by plants (or) animals, used as sources of energy. Most of the

www.Notesfree.in

www.Notesfree.in

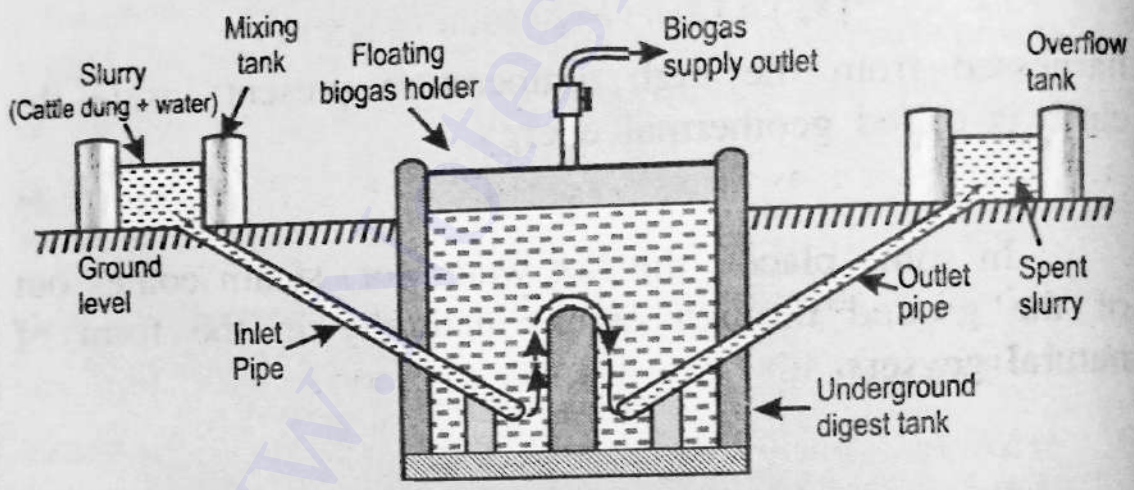
biomass is burned directly for heating, cooling and industrial purposes.

Examples *Wood, crop residues, seeds, cattle dung, sewage, agricultural wastes, etc., Biomass energies are of any one of the following types.*

1. Biogas

Biogas is a mixture of gases such as methane, carbon dioxide, hydrogen sulphide, etc., It contains about 65% of methane gas as a major constituent.

Biogas is obtained by the anaerobic fermentation of animal dung (or) plant wastes in the presence of water.



Biogas Plant

2. Biofuels

Biofuels are the fuels, obtained by the fermentation of biomass.

Example *Ethanol, methanol.*

(a) Ethanol: Ethanol can be produced from the sugarcane. Its calorific value is less when compared to petrol, and produces much less heat than petrol.

www.Notesfree.in

www.Notesfree.in

(b) Methanol: Methanol can be easily obtained from ethanol (or) sugar-containing plants. Its calorific value is also too low when compared to gasoline and diesel.

(c) Gasohol: Gasohol is a mixture of ethanol + gasoline. In India trial is being carried out to use Gasohol in cars and buses.

3. Hydrogen Fuel

Hydrogen can be produced by thermal dissociation (or) photolysis (or) electrolysis of water. It possess high calorific value. It is non -polluting, because the combustion product is water.

$$2H_2 + O_2 \longrightarrow 2H_2O + 150\ kJ$$

Disadvantages of hydrogen fuel

1. Hydrogen is highly inflammable and explosive in nature.
2. Safe handling is required.
3. It is difficult to store and transport.

ENERGY CYCLES

Energy cycle, is the interactions between energy sources within the Earth's environment.

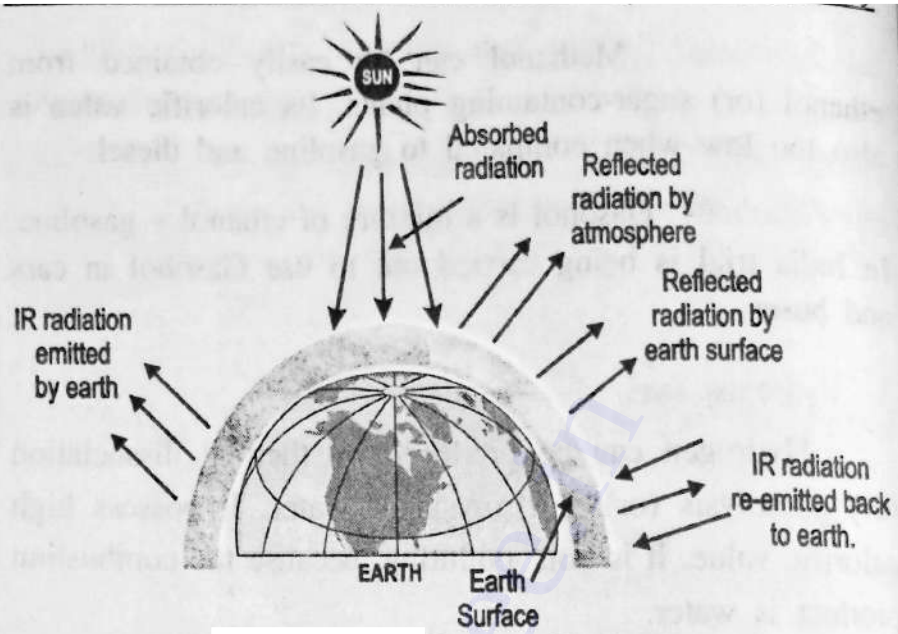
These interactions are very complex and even small changes in them can lead to significant changes in long-term climate behavior.

Illustration

A simple illustration of the major elements of the energy cycle is shown in the figure. 5.16

www.Notesfree.in

www.Notesfree.in



Energy Cycles

Soil moisture is an important factor in the absorption and reflection of the sun's energy by the earth's surface.

Important energy cycles

(i) Carbon cycle.

(ii) Nitrogen cycle.

(iii) Phosphorus cycle.

Carbon cycle

Definition

Carbon cycle is the movement of carbon (or) carbon compounds continuously from the atmosphere to the earth and then back into the atmosphere.

(Or)

Carbon cycle is the process where carbon compounds are interchanged among the biosphere, geosphere, hydrosphere and atmosphere of the earth.

www.Notesfree.in

www.Notesfree.in

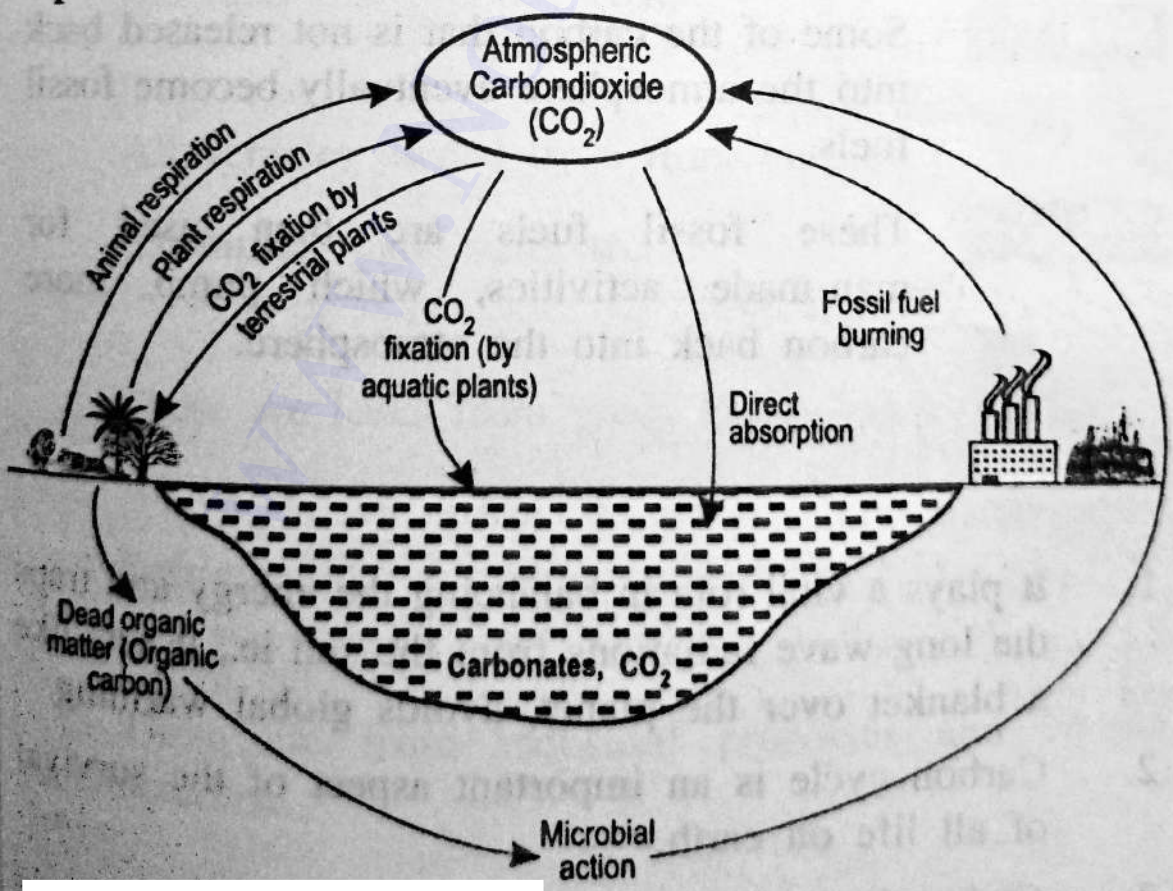
Carbon in the atmosphere is present in the form of carbon dioxide. Carbon enters the atmosphere through natural process such as respiration and industrial applications such as burning of fossil fuels

Sources of CO_2 in atmosphere

1. During respiration, plants and animals liberates CO_2 in the atmosphere.
2. Combustion of fuels also release CO_2.
3. Volcanic eruptions also release CO_2.

Various steps involved in carbon cycle

Carbon cycle involves the following 5 important steps.



Carbon cycle

www.Notesfree.in

www.Notesfree.in

Step I: Carbon present in the atmosphere is absorbed by plants by the processes photosynthesis, which involves the absorption of CO_2 by plants to produce carbohydrates (producers).

$$CO_2 + H_2O + \text{ energy} \longrightarrow (CH_2O)_n + O_2$$

Step II: These plants are then consumed by animals and carbon gets bioaccumulated into their bodies (consumers).

Step III: These animals and plants eventually die and decomposers eat the dead organism and return the carbon from their body back into the atmosphere (decomposers)

$$(CH_2O)_n + O_2 \longrightarrow CO_2 + H_2O + \text{ energy}$$

Step IV: Some of the carbon that is not released back into the atmosphere eventually become fossil fuels.

Step V: These fossil fuels are then used for man-made activities, which pump more carbon back into the atmosphere.

Importance (or) benefits of carbon cycle

1. It plays a vital role in balancing the energy and traps the long-wave radiations from the sun ie., it acts like a blanket over the planet, avoids global warming.
2. Carbon cycle is an important aspect of the survival of all life on earth.
3. Carbon is the building block of life and forms bonds with other elements necessary for life.

www.Notesfree.in

www.Notesfree.in

CARBON EMISSION AND SEQUESTRATION

Carbon emission

Carbon emission is the release of green house gases and their precursors into the atmosphere over a specified area and period of time.

Types of carbon emissions

Carbon (Green house gas) emissions are classified into two scopes.

I. Scope 1 emissions (or) Direct emissions

Scope 1 emissions are direct emissions from company. It is divided into 4 categories.

(a) Stationary combustion

All fuels that produce GHG.

(b) Mobile combustion

All vehicles owned by a firm, burning fuel.

Example: cars, vans, trucks.

(c) Fugitive emissions

These are leaks from green house gases (GHG).

Example

Refrigeration, air-conditioning units.

(d) Process emissions

These are from industrial processes and on-site manufacturing.

Example

Cement manufacturing, chemical manufacturing.

www.Notesfree.in

www.Notesfree.in

II. Scope 2 emissions (or) Indirect emissions

Scope 2 emissions are indirect emissions from the generation of purchased energy (purchased electricity steam, heat and cooling) from a utility provider (end user).

Sources (or) Causes of carbon emissions

1. Natural sources of CO_2 emission

It includes

(a) Decomposition of matter.

(b) Ocean release.

(c) Respiration.

(d) Most animals, which exhale CO_2 as a waste product.

(e) Carbonate rocks.

2. Human sources of CO_2 emission

It includes

(i) Burning of fossil fuels like coal, natural gas and oil.

(ii) Deforestation.

(iii) Industrial activities like cement manufacture, oil refineries and leather industries.

(iv) Transportation sector generates largest amount of CO_2 in the atmosphere.

Harmful effects of carbon emissions

1. Carbon emission, nothing but emission of green house gas, affects the planet significantly.
2. It causes global warming and affects climate change.

Reduction of carbon emission

There are many ways to reduce green house gas emissions like

www.Notesfree.in

www.Notesfree.in

1. energy efficiency.
2. fuel switching.
3. combined heat and power.
4. use of renewable energy.
5. more efficient use.
6. recycling of materials.
7. plant more trees.
8. reduce air travel.
9. driving more efficient.

Carbon sequestration

It is the process of capturing and storing atmospheric carbondioxide. It is one method of reducing the amount of CO_2 in the atmosphere. Goal of carbon sequestration is to reduce global climate change.

25% of our carbon emissions have been captured by earth's forests, farms and grassland. Scientists and land managers are working to keep landscapes vegetated and soil hydrated for plants to grow and sequester carbon.

30% of the carbon dioxide, we emit from burning fossil fuels, is absorbed by the upper layer of the ocean.

45% of carbon dioxide stays in the atmosphere the rest in sequestered naturally by the environment.

Concept (or) Aim of carbon sequestration

The concept of carbon sequestration is to stabilize carbon in solid and dissolved forms so that it doesn't cause the atmosphere to warm. The process shows tremendous promise for reducing the human "carbon foot print".

www.Notesfree.in

www.Notesfree.in

Methods (or) Types of carbon sequestration

There are three main types of carbon sequestration.

1. Biological carbon sequestration

It is the storage of CO_2 in vegetation like grassland, forests, soils and oceans.

2. Geological carbon sequestration

It is the process of storing CO_2 in underground geologic formations (or) rocks.

Typically, CO_2 is captured from an industrial sources like steel (or) cement production, power plant and injected into the porous rocks for long-term storage.

3. Technological carbon sequestration

Scientists are using innovative technologies to remove and store carbon from the atmosphere using innovative technologies.

Example *Graphene production*

The use of CO_2 as a raw material to produce graphene (a technological material). Graphene is used to create screens for smart phones and other technical devices. Graphene production is an example of how CO_2 can be used as a resource and a solution in reducing emissions from atmosphere.

Advantages and disadvantages of carbon sequestration

Advantages (or) merits

1. Carbon sequestration prevents the occurrence of climate change.

www.Notesfree.in

www.Notesfree.in

2. Deep injection of CO_2 improves the extraction of fuels like oil and methane from their reserves in addition to removing excess pollutants from the air.

3. Since the gas can be easily liquefied, it can be easily transmitted through pipelines.

4. No CO_2 leaking out from the injection site.

5. It lowers carbon emission by 80% to 85% while using fossil fuels.

Disadvantages (or) limitations

1. Due to carbon sequestration, in power plants, 40% additional coal is consumed and hence cost of energy gets increased by 1 to 5% per kilowatt hour.

2. CO_2 from power plant emissions must be captured and liquified, which uses a lot of electrical power.

3. It can be disastrous if the injected gas leaks due to structural flaws in the geological formation.

4. The ocean can become acidic due to the large amounts of carbon dioxide being injected into it, endangering aquatic life.

5. Planting trees, with the intention of storing and absorbing carbon, requires more time for the trees to mature.

6. There is no enough available geological resources to sequester carbon.

7. The concentration of CO_2, from power plant exhaust is too low for being effectively liquified.

www.Notesfree.in

www.Notesfree.in

GREEN ENGINEERING

Definition

Green engineering is the design, commercialization and use of processes and products that minimizes pollution, promotes sustainability and promotes human health without affecting environment.

Examples for green engineering

1. Biodegradable cups and straws.
2. Enhanced industrial emission filters.
3. Waste water treatment.
4. Radiant floors (heat homes efficiently by installing warming tubes under a floor).
5. Plant-based cooling (an alternate cooling solution using plants and trees installed around (or) on a building)

Goal of green engineering

1. Decrease in the amount of pollution that is generated by a construction.
2. Minimization of human population exposure to potential hazards (reducing toxicity).
3. Improved uses of matter and energy throughout the life cycle of the product.
4. Maintaining economic efficiency and viability.
5. Reduces energy and water consumption.
6. Reduces waste and our carbon footprint.
7. Improves business efficiency by lowering costs while improving the product design and creating new jobs.

www.Notesfree.in

www.Notesfree.in

Principles of green engineering

1. All materials and energy inputs and outputs are inherently non-hazardous as possible.
2. It is better to prevent waste that to treat (or) clean up waste after it is formed.
3. Separation and purification operations should be designed to minimize energy consumption and material use.
4. Products, processes and systems must be designed to maximize mass, energy, space and time efficiency.
5. Products, processes and system should be "output pulled" rather than "input pushed" through the use of energy and materials.
6. Complexity must be viewed as an investment when making design choices on recycle, reuse.
7. Durability rather than immortality should be a design goal.
8. Material diversity in multi-component products should be minimized.
9. Design of products, processes and system must include integration and inter-connectivity with available energy and materials flow.
10. Products should be designed for performance in a commercial "after life".
11. Material and energy inputs should be renewable rather than depleting.

Benefits of green engineering

1. This process enhances business practices by eliminating improper production methods.
2. It improves a company's reputation by showing consumers it cares about the environment.
3. It minimizes energy (or) production waste.

www.Notesfree.in

www.Notesfree.in

4. It provides tax incentives.
5. It helps the global environment.
6. It reduces air, water and soil pollutions.
7. It provides new business opportunities.

Limitations (or) disadvantages of green engineering

1. R & D costs, production and implementation costs are high.
2. Implementation will take many years.
3. Green technology is still quite immature.
4. Some companies may go out of business.
5. Job losses.
6. Sophisticated regulatory frame work needed.
7. Not everything that is labeled as green is actually green.

SUSTAINABLE URBANIZATION

Urbanization is the movement of human population from rural areas to urban areas for the want of better education, communication, health, employment, etc., without affecting the environment and needs of future generations.

Rules to develop a sustainable urbanization

1. Sustainable transportation.
2. Sustainable urban development.
3. Climate change mitigation and landscape architecture.
4. Resilient design (regarding natural hazards).
5. Applying ecological design.

www.Notesfree.in

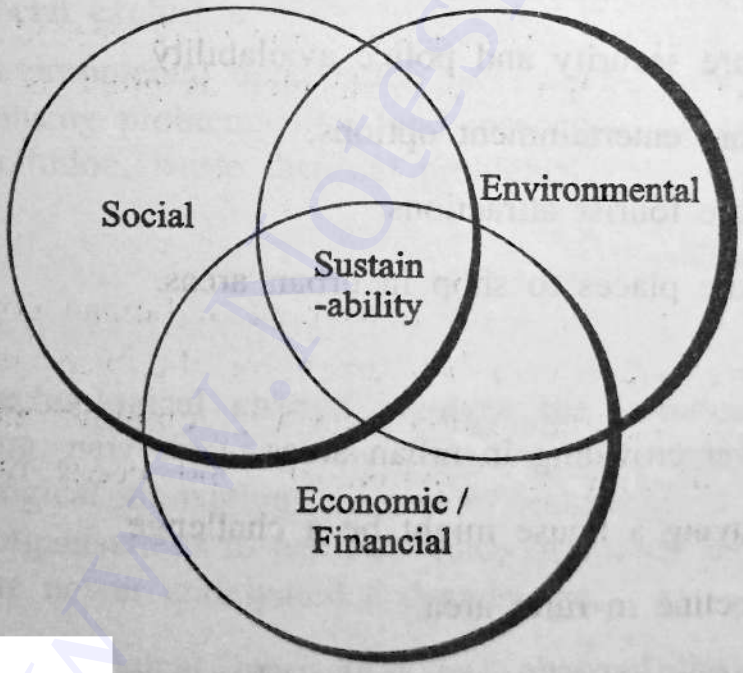
www.Notesfree.in

6. Improving water efficiency.
7. Increasing energy efficiency.
8. Using low-impact materials.

By following the above rules, urbanization can be made into sustainable.

Pillars of sustainable urbanization

Sustainability is based on three functional areas ie., social, environmental and financial/economical. These functional areas are interconnected and must be considered together. The place where these all meet and are balanced is the goal of sustainability.



Functional areas of urban sustainability

The goal of urban sustainability is to prevent resource availability issues for existing (or) future generations. It also minimizes an urban area's impact on its ecosystem.

www.Notesfree.in

www.Notesfree.in

Advantages and disadvantages of sustainable urbanization

Advantages

1. Urbanization creates convenience.
2. Urban economies can be better than rural ones.
3. Provides better education.
4. Get better housing.
5. Provides better social life.
6. Provides better healthcare services.
7. More security and police availability.
8. More entertainment options.
9. More tourist attractions.
10. More places to shop in urban areas.

Disadvantages

1. Over crowding in urban areas.
2. Buying a house might be a challenge.
3. Decline in rural area.
4. Too much crime occurs in urban area.
5. Unemployment problem is more.
6. Cost of living is higher.
7. No privacy.
8. Pollution problem is more.

www.Notesfree.in

www.Notesfree.in

SOCIO-ECONOMICAL CHANGE ON SUSTAINABLE URBANIZATION

Urbanization has many adverse effects on the structure of society because,

(i) gigantic concentrations of people compete for limited resources.

(ii) rapid housing construction leads to overcrowding.

(iii) slums, which experience major problems such as poverty, poor sanitation, unemployment.

(iv) it leads to higher crime rates and pollution.

(v) it also leads to increased levels of inequality and social exclusion.

(vi) environmental degradation is occurring very rapidly causing problems like land insecurity, excessive air pollution, waste disposal problems.

Technological change on sustainable urbanization

Technological change involves the introduction of something new (or) a new idea, method (or) device. Technological innovations, as part of technological change, allows organisations to test new ideas at speeds and prices that were newer anticipated a decade ago.

1. Technological innovation has changed the overall effectiveness and benevolence over time and with regard to sustainability.
2. Upgrading of industrial structure improves the sustainable urbanization.
3. Technological change and sustainability are closely related to each other.

www.Notesfree.in

www.Notesfree.in

4. Both factors form the innovation inorder to improve the effectiveness of environmental and social development and economic progress.

5. The combination of digital technology in the business model will establish and empower a city to be more sustainable.

PART B QUESTIONS

1. What is zero waste? Explain its concept and principles.
2. Explain the various steps to achieve zero waste? and advantages and disadvantages of zero waste.
3. What is *R* concept? Explain its concept and advantages and disadvantages of *R* concept.
4. What is circular economy? Explain various steps involved in achieving a circular economy.
5. What are ISO and ISO14000 series? List out any 5 ISO14000 series standards.
6. What are the core elements of ISO14000? Explain its merits and demerits.
7. What is life cycle assessment? Explain the various steps involved in life cycle assessment.
8. What is environmental impact assessment? Explain the objectives and benefits of EIA.
9. Explain the various elements of EIA.
10. What is sustainable habitat? Explain its characteristics and objectives of it.
11. What is green building? Explain its criteria and features.
12. Explain the principles, components, merits and demerits of green building.

www.Notesfree.in

www.Notesfree.in

13. What are green materials? Give examples. Explain important green building materials.
14. What is energy efficiency? Explain methods of achieving energy efficiency? How to calculate it.
15. Explain the advantages and disadvantages of energy efficiency.
16. What is sustainable transport? Explain the key elements of sustainable transport.
17. What is sustainable energy? Explain advantages and disadvantages of it.
18. Write notes on non-conventional sources of energy.
19. What is energy cycle? Explain the carbon cycle with a neat diagram.
20. What is carbon emission? Explain its types and remedy.
21. Define carbon sequestration. Explain the various types of carbon sequestration.
22. Explain the principle, goal and benefits of green engineering.
23. What is sustainable urbanization? Explain the rules to develop sustainable urbanization.
24. Write notes on socio-economical change on sustainable urbanization.

www.Notesfree.in