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B.PHARM
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SUBJECT NAME: ENVIRONMENTAL SCIENCES

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CHAPTER 1:

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

TOPIC

The Multidisciplinary nature of environmental studies

- Natural Resources
- Renewable and non-renewable resources:
- Natural resources and associated problems
- Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

INTRODUCTION

- The word environment is derived from the French word '**environner**' which means to '**encircle or surround**'.
- Thus our environment can be defined as "**the Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants**"

SEGMENTS OF ENVIRONMENT

Environment consists of four segments.

1. Atmosphere- Blanket of gases surrounding the earth.
2. Hydrosphere- Various water bodies present on the earth.
3. Lithosphere- Contains various types of soils and rocks on the earth.
4. Biosphere- Composed of all living organisms and their interactions with the environment.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

- The Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc.
- It is the science of physical phenomena in the environment. It studies about the sources, reactions, transport, effect and fate of physical and biological species in the air, water, soil and the effect of from human activity upon these.

NATURAL RESOURCES

INTRODUCTION

- Natural resources can be defined as ‘variety of goods and services provided by nature which are necessary for our day-to-day lives’.
- Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or abiotic part).
- They are essential for the fulfillment of physiological, social, economical and cultural needs at the individual and community levels.

TYPES OF NATURAL RESOURCES

They are of two types of resources namely Renewable and Non-Renewable Resources.

- 1. Renewable resources:** The resources that can be replenished through rapid natural cycles are known as renewable resource. These resources are able to increase their abundance through reproduction and utilization of simple substances.

Ex: Plants, (crops and forests) and animals.

- Some examples of renewable resources though they do not have life cycle but can be recycled.

Ex: Wood and wood-products, pulp products, natural rubber, fibers (e.g. Cotton, jute animal wool, silk and synthetic fibers) and leather.

- In addition to these resources, water and soil are also classified as renewable resources.

- Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale.
- 2. Non renewable resources:** The resources that cannot be replenished through natural processes are known as non-renewable resources. These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.). Once a non-renewable resource is consumed, it is gone forever.

Non-renewable resources can further be divided into two categories, viz.

- A) Recyclable and
- B) Non-recyclable

A) Recyclable: These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in the earth's crust (Ex: Ores of aluminum, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. Phosphate rock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

B) Non-recyclable: These are non-renewable resources, which cannot be recycled in any way.

Ex: Fossil fuels and uranium, which provide 90 per cent of our energy requirements

NATURAL RESOURCES AND ASSOCIATED PROBLEMS:

- A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times

greater than in most developing countries.

FOREST RESOURCES

A forest can be defined as a biotic community predominant of trees, shrubs or any other woody vegetation usually in a closed canopy

FUNCTIONS OF FOREST

1. It performs very important function both to human and to nature.
2. They are habitats to millions of plants, animals and wild life.
3. They recycle rain water.
4. They remove pollutant from air.
5. They control water quality.
6. They moderate temperature and weather.
7. They influence soil condition and prevent soil erosion.

USES OF FOREST

1. Commercial uses
2. Ecological uses

1. Commercial uses:

- i. Wood – used as a fuel
- ii. Supply wood for various industries – Raw materials as pulp, paper, furniture timber etc.
- iii. Minor forest products – gum, dyes, resins
- iv. Many plants – Medicines
- v. Supply variety of animal products – honey, Ivory, horns etc.
- vi. Many forest lands are used for - Mining, grazing, for dams and recreation.

2. Ecological uses: Forest provides number of environmental services.

- i. **Production of oxygen:** Photosynthesis produces large amount of oxygen which is essential for life.
- ii. **Reducing global warming:** Carbon dioxide is one of the main green house gas. It is absorbed by plants for photosynthesis. Therefore the problem of global warming caused by CO₂ is reduced.
- iii. **Soil conservation:** Roots of trees bind the soil tightly and prevent soil erosion. They also act as wind breaks.
- iv. **Regulation of hydrological cycle:** Watershed in forest act like giant sponges and slowly release the water for recharge of spring.

- v. **Pollution moderators:** Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.
- vi. **Wild life habitat:** Forest is the home of millions of wild animals and plants.

REASON FOR DEFICIENCY OF FOREST:

In India the minimum area of forest required to maintain good ecological balance is about 33% of total area. But at present it is only about 12%. So over exploitation of forest material occurs.

OVER EXPLOITATION OF FOREST: Due to over population, there is an increased demand for medicine, shelter, wood and fuel. Hence exploitation of forest materials is going on increasing.

Cause of over exploitation:

1. Increasing agricultural production.
2. Increasing agricultural activities.
3. Increase in demand of wood resources.

DEFORESTATION: It is process of removal of forest resources due to natural or manmade activities (i.e.) destruction of forests.

Causes of deforestation:

4. **Developmental projects:** Developmental projects causes deforestation through two ways.
 - Through submergence of forest area.
 - Destruction of forest area.
Ex: big dams, hydro electric projects, road construction etc.
5. **Mining operations:** It reduces forest areas. Ex: Mica, coal, Manganese and lime stone.
6. **Raw materials for industries:** Wood is an important raw material for various purposes.
Ex: Making boxes, furniture and paper etc.
7. **Fuel requirement:** Wood is the important fuel for rural and tribal population.

8. **Shifting cultivation:** Replacement of natural forest ecosystem for mono specific tree plantation. Ex: Teak
9. **Forest fires:** Forest fire destructs thousands of acres of forest.
10. **Over grazing:** Over grazing by cattle reduces the cultivation land

PREVENTIVE MEASURES (OR) AVOID OF DEFORESTATION (OR) METHODS OF CONSERVATION OF FORESTS

- New plants of more or less of the same variety should be planted to replace the trees cut down for timber
- Use of wood for fuel should be discouraged.
- Forest pests can be controlled by spraying pesticides by using aero planes
- Forest fire must be controlled by modern techniques.
- Education and awareness programmes must be conducted.
- Strict implementation of law of Forest conservation Act.

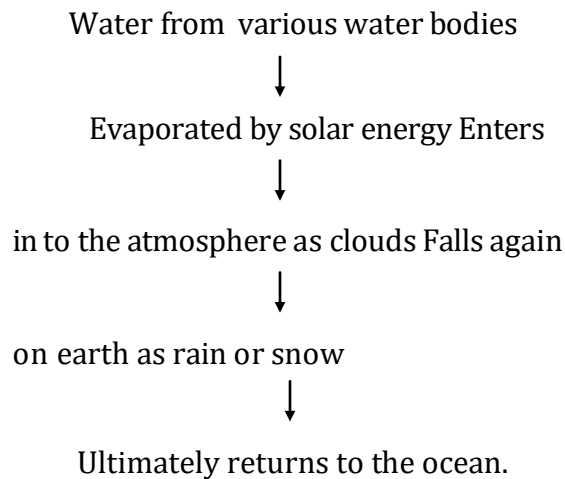
WATER RESOURCES

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

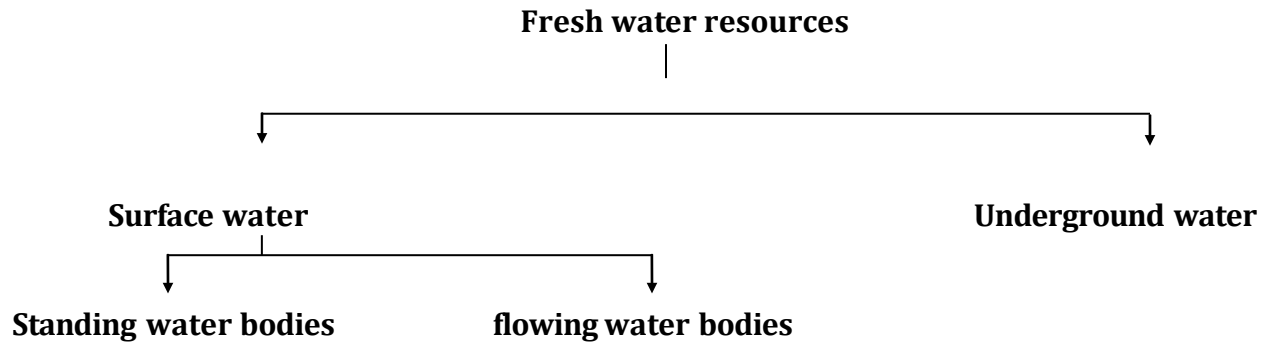
USES

- Is essential for all forms of life.
- Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually, all of these human uses, require fresh water.
- No plant or animal species can survive without water.

HYDROLOGICAL CYCLE:



DISTRIBUTION OF WATER RESOURCES



UNDERGROUND WATER

Aquifer: Layers of highly permeable rock that can store water is called an aquifer. Layer of sand and gravels are good aquifers. Clay and crystalline rocks are not good aquifers.

Effects of over utilization of water

1. Decrease of ground water:

- i. Increased usage decreases the ground water.
- ii. Insufficient rain fall
- iii. Building construction activities sealing the permeability of the soil.

2. Ground subsidence: If ground water withdrawal is greater than its recharge rate, then the sediments in the aquifers get compacted. As a result shrinkage of land surface takes place.

3. Lowering of water table: Over utilization of ground water in arid and semi arid regions for agriculture disturbs the state of equilibrium of the hydrological cycle.

4. Intrusion of salt water: In coastal area over exploitation of ground water leads to the intrusion of salt water from sea. Therefore that water cannot be used for drinking and agriculture.

5. Over utilization of water causes earth quakes, landslides and famines.

6. Drying up of wells: Due to over utilization, ground water level decreases much faster than can be regenerated. It leads to drying up of dug well and bore wells.

7. Pollution of water: Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollute the ground water.

Problem: Water which contains excess nitrate content is not suitable for drinking.

REASONS FOR DECLINE OF GROUNDWATER

Population continues to rise at an unprecedented and unsustainable rate; many more areas are expected to experience this imbalance in the near future.

1. Population explosion

2. Overutilization of Surface and Groundwater:

3. Deforestation

4. Hydropower generation

5. Dams

- 6. Rain fall:** The erratic and inadequate rainfall results in reduction in storage in subsurface reservoirs. The building construction activities are sealing the permeable zone, reducing the area for percolation of rainwater into subsurface and increase in surface runoff.
- 7.** India's increasing demand for water for intensive irrigated agriculture, for generating electricity, and for consumption in urban and industrial centers, has been met by creating large dams. Dams support 30 to 40% of this area.

FLOOD

It is an over flow of water.

CAUSES OF FLOOD

1. Heavy rainfall, melting of snow and sudden release of water from dams. (Flash floods)
2. Reduction in the carrying capacity of the channel.
3. Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

EFFECT OF FLOOD

1. Water spreads in the surrounding area and submerges them.
2. Cultivated land gets affected.
3. Extinction of civilization.

FLOOD MANAGEMENT

1. Floods can be controlled by dams.
2. Channel management control flood.
3. Flood hazards reduced by forecasting or flood warning.
4. Flood may also be reduced by reduction of run off by increasing infiltration through appropriate afforestation in the catchment area.

DROUGHT

Drought is nothing but scarcity of water, which occurs due to

1. Inadequate rain fall
2. Late arrival of rain fall
3. Excessive withdrawal of groundwater.

Lack of water for the needs of agriculture, livestock, industry or human population may be termed as a drought. Drought causes serious damages to plants, animals and human life.

CAUSES OF DROUGHT

1. When annual rain fall is below normal and less than evaporation, drought is created.
2. High population.
3. Intensive cropping pattern

Ex: Maharashtra - There has been no recovery from drought for the last 30 years due to over exploitation of water by sugarcane crop.

EFFECTS OF DROUGHT

1. Drought causes hunger, malnutrition and scarcity of drinking water and also changes the quality of water.
2. Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and live stock population.
3. Worst situation of drought causes desertification.
4. Raw materials of agro based industries are critically affected during drought time, hence industrial and commercial growth decreases.
5. Drought increases the degradation of natural resources.
6. Drought causes large migration of people and urbanization.

DROUGHT MANAGEMENT

1. Indigenous knowledge is essential.
2. Rain water harvesting system.
3. Construction of reservoirs to improve ground water level.
4. Modern irrigation technology (drip irrigation) very useful to conserve water.
5. Afforestation activities also improve the potential of water in the drought area.
6. Crop mixing and dry farming are the suitable methods which minimize the risk of crop failures in dry area.

DAMS

Dams made significant contributions to human development and the benefits derived from them have been considerable. Large dams are designed to control floods and to help the drought prone areas, with supply of water. But large dams have proved to

cause severe environmental damage. Hence an attempt has been made to construct small dams. Multiple small dams have less impact on the environment.

Benefits: Dams ensure a year round supply of water for domestic use and provide extra water for agriculture, industries and hydropower generation.

Problems: They alter river flows, change nature's flood control mechanisms such as wetlands and flood plains, and destroy the lives of local people and the habitats of wild plant and animal species, particularly is the case with mega dams.

Some of the problems are mentioned below.

- Dam construction and submersion leads to significant loss of farmland and forest and land submergence
- Siltation of reservoirs, water logging and salination in surrounding lands reduces agricultural productivity
- Serious impacts on ecosystems - significant and irreversible loss of species and ecosystems, deforestation and loss of biodiversity, affects aquaculture
- Socio economic problems for example, displacement, rehabilitation and resettlement of tribal people.
- Fragmentation and physical transformation of rivers
- Displacement of people - People living in the catchment area, lose property and livelihood
- Impacts on lives, livelihoods, cultures and spiritual existence of indigenous and tribal people
- Dislodging animal populations
- Disruption of fish movement and navigational activities
- Emission of green house gases due to rotting of vegetation
- Natural disasters – reservoirs induced seismicity, flash floods etc and biological hazards due to large-scale impounding of water – increase exposure to vectorborne diseases, such as malaria, schistosomiasis, filariasis.

MINERAL RESOURCES

Naturally occurring inorganic crystalline solids with uniform chemical composition are called as minerals.

USES AND EXPLOITATION OF MINERALS

1. Development of industrial plants and machinery. - Fe, Al & Cu
2. Construction work – Fe, Al&Ni
3. Generation of energy - coal, lignite, uranium
4. Designing defense equipments like weapons and ornaments
5. Agricultural purposes – fertilizers and fungicides – Zn & Mn
6. Jewellery –Au, Ag & Pt
7. Making alloys for various purposes
8. Communication purposes – telephone, wires, cables and electronic devices
9. Medicinal purposes, particularly in ayurvedic system

ENVIRONMENTAL DAMAGES CAUSED BY MINING ACTIVITIES

1. Devegetation:

- Topsoil and vegetation get removed
- Deforestation leads to several ecological losses
- Land scape gets badly affected

2. Ground water contamination: Mining pollutes ground water; sulphur is converted into sulphuric acid which enters into the soil.

3. Surface water pollution: Radioactive wastes and other acidic impurities affect the surface water, which kills many aquatic animals.

4. Air pollution: Smelting and roasting are done to purify the metal which emits air pollutants and damage the nearby vegetation. It causes many health problems.

5. Subsidence of land: Mainly underground mining results in cracks in houses, tilting of buildings and bending of rail tracks.

EFFECTS OF OVER EXPLOITATION OF MINERALS

1. Rapid depletion of mineral deposits
2. Wastage
3. Environmental pollution
4. Needs heavy energy requirements.

MANAGEMENT OF MINERAL RESOURCES

1. The efficient use and protection of mineral resources.
2. Modernization of mining industries
3. Search for new deposit
4. Reuse and recycling of the metals.
5. Environmental impacts can be minimized by adopting eco friendly mining technology.

CASE STUDIES-MINING AND QUARRYING IN UDAIPUR

200 open cast mining and quarrying in Udaipur. But 100 mines are illegal. 150 tons of explosives are used per month. It pollutes air, soil and water. It affects irrigation and wild life.

FOOD RESOURCES

Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins.

TYPES OF FOOD SUPPLY

- 1. Crop plants:** Grains mostly constitute about 76% of the world's food. Ex:
Rice, Wheat and Maize
- 2. Range lands:** Produces 17% of world's food from trees and grazing animals.
Ex: Fruits, milk and meat
- 3. Ocean:** Fisheries – 7% of world's food

WORLD FOOD PROBLEM

1. In the earth's surface, 79% is water out of total area. 21% land (forest, desert, mountain and barren land) . Less % cultivated land, at the same time population explosion is high therefore world food problem arises.
2. Environmental degradation like soil erosion, water logging, water pollution, salinity affects agricultural land.
3. Urbanization affects agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.

TYPES OF NUTRITION

1. Nutritious nutrition: To maintain good health and disease resistance, we need large amount of carbohydrate, proteins, fats and smaller amount of micronutrients such as vitamins and minerals such as Fe, Ca and iodine.

2. Under nutrition: People who cannot buy enough food to meet their basic energy needs suffer from under nutrition. They receive less than 90% of this minimum dietary calorie.

Effect of under nutrition: Suffer from mental retardation and infectious diseases.

3. Mal nutrition: Besides minimum calorie intake we also need proteins, minerals, vitamins, iron and iodine. Deficiency leads to malnutrition resulting in several diseases.

ENERGY RESOURCES

ENERGY DISTRIBUTION IN THEWORLD

- Developed countries like USA and Canada constitute only 5% of the world's population but consume 25% of the world's available energy.
- Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year.

TYPES OF ENERGYRESOURCES:

1. Renewable energy resource (or) Non conventional energy resources
2. Non renewable energy resources (or) Conventional energy resources

RENEWABLE ENERGY SOURCES: Energy which can be regenerated.

Merits of renewable energy resources

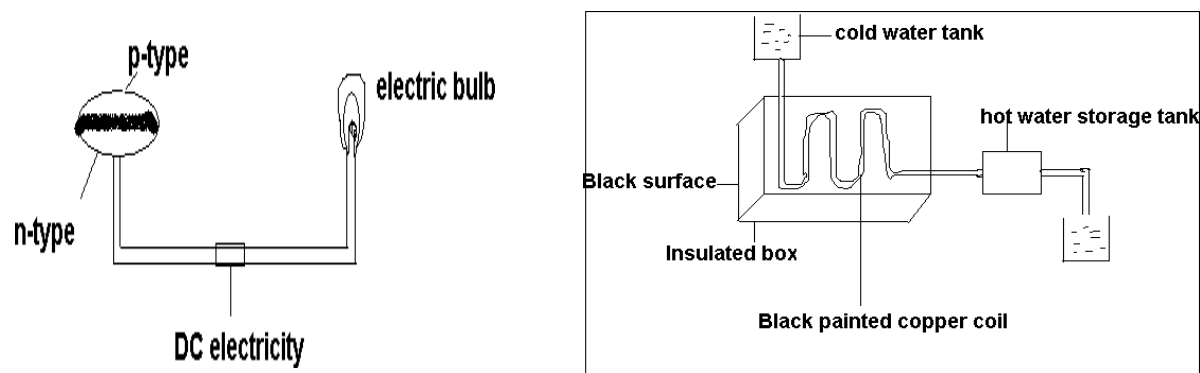
1. Unlimited supply

2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralized energy production.

Types of renewable energy resources

1. **Solar energy:** Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.

Uses: It is used in calculators, electronic watches, street light, water pumps etc.



- a. **Solar battery:** Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.
 - b. **Solar water heater:** It consists of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.
2. **Wind energy:** Moving air is called wind. The energy recovered from the force of the wind is called wind energy. Its speed is high.
 - a. **Wind mills:** When a blowing wind strikes the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.
 - b. **Wind farms:** When a large number of mills are installed and joined together in a definite pattern – it forms wind farm. It produces large amount of electricity.

Condition: Minimum speed for wind generator is 15 Km/hr

Advantages:

1. It does not cause air pollution
2. Very cheap

3. Ocean energy:

Tidal energy (or) Tidal power: Ocean tides are due to gravitational force of sun and moon which produce enormous amount of energy. High tides – rise of water in the ocean. Low tides – fall of water in the ocean. Tidal energy can be used by constructing a tidal barrage. During high tides sea water enters into the reservoirs and rotates the turbine, produce electricity. During low tides water from reservoir enters into the sea rotate the turbine produce electricity.

Ocean thermal energy:

Temperature difference between surface water and deeper level water in ocean generates electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.

3. **Geo thermal energy:** Temperature of the earth increases at a of 20 –750C per/km when we move down the earth. The energy utilised from the high temperature present inside the earth is called geothermal energy.

4. Bio mass energy:

Bio mass: Organic matter produced by plants or animals used as source of energy

Bio gas: Mixture of methane, carbondioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by anerobic fermentation of animal dung (or) plant wastes in the presence of water.

NON RENEWABLE ENERGY SOURCES:

Energy which cannot be regenerated is called as non-renewable.

1. Coal: It is a solid fossil fuel.

Disadvantages:

1. When coal is burnt large amount of CO₂ is released which causes global warming.
2. S, N produces toxic gases during burning.

2. Petroleum: Crude oil is a liquid consists of more than hundreds of hydrocarbons and small amount of impurities. The petroleum can be refined by fractional distillation. In the world level 25% of oil reserves are in Saudi Arabia. At present rate of usage, the world crude oil reserves are expected to get exhausted in just 40 years.

- 3. Liquefied petroleum gas (LPG):** Petroleum gases cracking can be easily converted into liquid under high pressure as LPG. It is colorless and odorless gas, but during cylindering mercaptans are added to detect leakage.
- 4. Natural gas:** These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.
- 5. Nuclear energy:** Nuclear energy can be produced by two types of reactions. Nuclear fission and nuclear fusion.

Nuclear fission; It is a nuclear change in which heavier nucleus split into lighter nuclei on bombardment of fast moving neutrons. Large amount of energy is released through chain reaction.

Ex: Uranium with fast moving neutron gives barium and krypton in addition to three neutrons; in the second stage it gives nine neutrons and so on. This process of propagation of the reaction by multiplication is called chain reaction.

Nuclear fusion: It is a nuclear change in which lighter nucleus is combined together at extremely high temperature (1 billion °C) to form heavier nucleus and a large amount of energy is released.

Ex: Isotopes of hydrogen combine to form helium molecule.

