

Fill in the Blanks

1. _____ is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings.
2. _____ occurs due to the presence of undesirable solid or gaseous particles in the air, in quantities that are harmful to human health and the environment.
3. _____ is a very vital resource for the survival of life and the extent of this resource.
4. _____ is made up of biotic and abiotic components.
5. _____ is the uneasy, unwanted and undesired sound produced by traffic, industrial units, aeroplanes and similar sources'.
6. The _____ among the people need to be promoted to enable proper implementation of rules and regulations.
7. PCB stands for _____
8. VOCS stands for _____
9. The Government formulated water Act in _____
10. Wildlife Protection Act _____

ANSWERS

1. Pollution
2. Air pollution
3. Water
4. Soil
5. Noise pollution
6. Environmental awareness
7. Volatile Organic compounds
8. Pollution Control Boards
9. 1974
10. 1972

UNIT V

Social Issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle, and disaster management in India.

5.1 WATER CONSERVATION

Q1. Discuss various methods of Water Conservation.

Ans : (Imp.)

1. The water used in washing various food items may be used to water the plants in the garden instead of pouring it down the drain.
2. We may take shorter showers and turn off the taps when we lather up.
3. The taps may be turned off while brushing the teeth.
4. The dishwashers and washing machines may be used only when they are fully loaded.
5. Energy efficient dishwashers helps to conserve water and electricity.
6. When the dishes are washed by hand, avoid washing under running water, but fill the sink with wash water and the other with rinse water.
7. Discourage use of water toys that need a constant flow of water.
8. The fields may be watered by drip irrigation methods.
9. Excess watering of the lawns need not be done. Sprinklers may be used to water the grass and plants.
10. Allow the lawn grass to grow a bit taller. This help to conserve the water loss due to increased water retention in the soil. Thus, we do not need to water the lawn daily.
11. Water can be saved if the plants are watered in the cool morning or evening, as it decreases the rate of evaporation.

12. Collect rain water in water-butts and use it for washing the car, watering the plants by using water can, etc.
13. Usage of toilet papers can be an alternative to preserve water while using toilets.
14. Avoid using of toilets as a wastebasket or flushing it without any reason.
15. Installing low-flush toilets in the bathrooms helps to conserve water.
16. Fill water in a milk bottle and put it in the toilet cistern. His reduces the water volume required for flushing by 45 liters daily.
17. While washing the vehicles, sponge them. This helps to conserve around 300 liters of water.
18. The dripping taps and pipes should be replaced with good ones or altered by applying water-flowing resistant materials like M-seal.
19. The leaks in the toilets should be repaired as annually around 200,000 liters of water gets wasted.

5.2 WATERSHED MANAGEMENT

Q2. What is watershed? Explain.

Ans :

Meaning

A watershed is a geographical area on the earth, 'where-water falls from the atmosphere, flows across, stored underground and then released from higher to lower elevation into a stream, river, pond, lake or other waterbody over a period of time, which then finally drains into the ocean or sea.'

Watershed divide can be defined as the imaginary line that divides one watershed from another.

An analogy can be drawn between a water body (pond) and a bowl containing water. The sides of the bowl can be compared to the land draining into the pond, while the rim around the bowl represents the watershed boundaries (watershed divide). Every land area on this planet is a part of a watershed.

Further, a watershed can be compared to a leaf. The edge of the leaf can be equated to watershed divide. The main veins and sub-veins of the leaf can be equated with the main river and its tributaries.

Definition

According to John Wesley Powell, a renowned scientist geographer, a watershed is "that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and whereas humans settled, simple logic demanded that they become a part of the community".

Watersheds may be large or small. They may vary in size from less than an acre to thousands of square miles in area. They can be found in all landscapes: forests, agricultural lands, small towns and cities.

Q3. Define watershed management. State its objectives.

Ans :

Meaning

Watershed management is a process to guide and organize natural resources in a watershed including land. This management of land resources is aimed to provide goods and services without adversely affecting soil, water and other natural resources. In other words, watershed management involves analysis, protection, development, operation or maintenance of land, vegetation of a drainage basin for the conservation of all its resources, primarily to benefit the residents.

Objectives

The main objectives of watershed management programme are,

1. To provide adequate quantities of usable water by adopting sustainable land use measures, protection of reservoirs and

channels from various types of pollution, promoting the growth of low-water consuming species and water-saving technologies.

2. To provide standard quality of water by encouraging vegetation and waste disposal facilities.
3. Rehabilitation of degraded/deteriorating lands to increase productivity of practicing soil conservation, agro forestry, afforestation and restricted grazing.
4. Reduce the occurrence of floods and the resultant flood damage by adopting strategies for flood management techniques such as river engineering, afforestation and planned urban development on flood plains.
5. To increase infiltration and percolation of rainwater to recharge the aquifers.

5.3 ENVIRONMENTAL ETHICS

Q4. Define environmental ethics. Describe the various issues and solutions environmental ethics.

Ans :

(Imp.)

Meaning

Environmental ethics deal with issues related to the rights of individuals that are fundamental to 'life and well-being'. These concern not only the needs of each person today, but also those who will come after us. It also deals with the rights of other living creatures that inhabit the earth.

Issues

➤ Resource Consumption Patterns and the Need for Equitable Utilization

There are to be a more equitable sharing of resources than what exists at present. There are rich and poor nations, there are rich and poor communities in every country, and there are rich and poor families. In this era of modern economic development, the disparity between the haves and have-nots is widening. Our human environments in the urban, rural and wilderness sectors use natural resources that shift from the wilderness (forests, grass

lands, wetlands) to the rural sector and from there to the urban sector. Wealth also shifts in the same direction. This unequal distribution of wealth and access to land and its resources is a serious environmental concern.

An equitable sharing of resources forms the basis of sustainable development for urban, rural and wilderness-dwelling communities. As the political power base is in the urban centers, this leads to inequalities and a subsequent loss of sustainability in resource management in the rural and forest sectors.

- (i) Environmental destruction is largely caused by the consumption of the rich.
- (ii) The worst sufferers of environmental destruction are the poor.
- (iii) Even where nature is being 'recreated', as in afforestation, it is being transformed away from the needs of the poor and towards those of the rich.
- (iv) Even among the poor, the worst sufferers are the marginalized cultures and occupations and, most of all, women.
- (v) There cannot be proper economic and social development without a holistic understanding of society and nature.
- (vi) If we care for the poor, we cannot allow the Gross Nature Product to be destroyed any further. Conserving and recreating nature has become our highest priority.
- (vii) The Gross Nature Product will be enhanced only if we can arrest and reverse the growing alienation between the people and the common property resources. Towards this end, we will have to learn a lot from our traditional cultures.
- (viii) It is totally inadequate to talk only of sustainable rural development as the World Conservation Strategy does. We cannot save the rural environment or rural people dependent on it, unless we can bring about sustainable urban development.

Environmental Education Different Perspectives

Urban dwellers who are far removed from the source of natural resources that sustain their lives require exposure to a well-designed environment education program to appreciate these issues. While the rural people have a deep insight on the need for sustainable use of natural resources and know about methods of conservation, there are however several newer environmental concerns that are frequently outside their sphere of life experiences.

Their traditional knowledge of environmental concerns cannot be expected to bring about an understanding of issues such as global warming, or problems created by pollution and pesticides. These people thus require a different pattern of environment education that is related to their gaps in information. With the rapidly changing rural scenario, the development that is thrust on unsuspecting rural communities needs to be addressed through locale-specific environment awareness programs designed specifically for rural school children and adults. This must also use their local traditional knowledge systems as a base on which modern concepts can be built, rather than by fostering concepts that are completely alien to their own knowledge systems.

Common property resources in India once included vast stretches of forests, grazing lands and aquatic ecosystems. When the British found that they were unable to get enough wood for ship building and other uses, they converted forest areas into Government 'Reserved Forests' for their own use to grow timber trees. This alienated the local people from having a stake in preserving these resources. This, in turn, led to large scale losses in forest cover and the creation of wasteland. In the past, in traditional villages that were managed by local panchayats, there were well-defined rules about managing grazing lands, collecting forest resources and protecting sacred groves that supported conservation. There was a more or less

equitable distribution that was controlled by traditional mechanisms to prevent the misuse of common property resources. Any infringement was quickly dealt with by the panchayat and the offender was punished. Common property resources were thus locally protected by communities. As land use patterns changed, these mechanisms were lost and unsustainable practices evolved, frequently as a result of an inadequately planned development strategy.

➤ The Need for Gender Equity

All over India, especially in the rural sector, women work longer hours than men. The life of a woman is enmeshed in an inextricable cycle of poverty. In attempting to eke out a living from their environment, women constantly collect fuelwood for their homes and for sale to nearby urban areas. They laboriously collect fodder for their cattle. They have to trudge several kilometers to reach a reasonably clean water source. And finally, they cook meals in a smoky unhealthy atmosphere on crop or animal waste or other inefficient sources of energy. All this can take 10 to 12 hours a day of very hard work, every day of the year. This begs the question of who should control the environmental resources of a rural community. Unfortunately, it is the men who play a decisive role in managing the village commons and their resources whereas it should really be the local women, whose lives are deeply linked with the utilization and conservation patterns of natural resources, who should be the decision makers at the local level. Unfortunately, women have not been given an equal opportunity to develop and better their lot. This begins with the lack of attention given to girls whose education is always secondary to that of boys in the family. Unless society begins to see that development cannot be planned by a male-dominated society from the male perspective alone, we will not be able to create a healthier environment for women and their children.

➤ Preserving Resources for Future Generations

Can we use up all the resources of the world, leaving nothing for future generations? This ethical issue must be considered when we use resources unsustainably. If we overuse and misuse resources and energy from fossil fuels, what happens to our future generations? A critical concern is to preserve species and natural undisturbed ecosystems that are linked with bioresources, which must be protected for the use of future generations. Just as our ancestors have left resources for us, it is our duty to leave them behind for our future generations. These unborn people have a right to these resources. We only hold the world as trustees for the future generations.

➤ The Rights of Animals

Human beings are just one small cog in the wheel of life on earth. We frequently forget that we have learned to exploit nature and other species well beyond what we should use justifiably. Every plant and animal has a right to life as a part of the earth's community of living things. While nature by itself has natural prey-predator relationships, left to itself, nature maintains a balance in each ecosystem. While evolution has developed a system whereby species become extinct and new ones evolve to fill the world's ecosystems with new plant and animal species, it is human beings alone that have been responsible for the recent rapid decline in the number of species on earth. More importantly, we are now reducing the numbers of so many species that in the near future we will in all probability create a major extinction spasm that will seriously endanger the existence of mankind. Thus, endangering the existence of wild plants and animals and bringing them close to the brink of extinction is not only unfair to those species but also to future generations of people who may find them of great use.

➤ The Ethical Basis of Environment Education and Awareness

Perhaps the most important concern is related to creating an ethos that will support a

sustainable lifestyle in society. This brings us to the need for environmental education. The Supreme Court of our country has thus ordered that every young individual at school and college level be exposed to a course on environment. It is not only to create only an awareness of environmental issues, but also to bring about pro-environmental action. Among the variety of tools that can bring home the ethical issues of the environment, no solution is as powerful as real-life experiences. Creating a love for nature brings about strong pro-environmental action. Our current educational processes at school and college level are being reoriented to bring this about.

There are two aspects that are closely connected with ethical issues that are related to our environment. These are based on valuing nature and appreciating the beauty of nature and treasuring the magnificence of the wilderness.

The Conservation Ethics and Traditional Value Systems of India

In ancient Indian tradition, people have always valued mountains, rivers, forests, trees and animals. Thus, much of nature was venerated and protected. Forests have been associated with the names of forest gods and goddesses, both in the Hindu religion as well as in tribal cultures. 'Tree' goddesses have been associated with specific plant species. *Ficus religiosa*, the people tree, is venerated and is not to be cut down. The Banyan tree in some regions, such as Maharashtra, is venerated once a year by tying a thread around it as a symbol of respect. The *Tulsi* plant is grown in every home.

Patches of forests, now called 'sacred groves' have been dedicated to the local deity in many Indian cultures, especially in tribal areas. These traditionally protected forest patches depict the true nature of undisturbed vegetation and have a large number of indigenous plant species; their exploitation has been controlled through local sentiments.

5.4 CLIMATE CHANGE

Q5. Explain the concept of Climate Change.

Ans :

Meaning

(Imp.)

Climate change is a newcomer to the international political and environmental agenda, having emerged as a major policy issue only in the late 1980s and thereafter. It has emerged since the 19th century that CO_2 in the atmosphere is a 'greenhouse gas', that is, its presence in the atmosphere helps to retain the incoming heat energy from the sun, thereby increasing the earth's surface temperature. Of course, CO_2 is only one of several such greenhouse gases in the atmosphere. Others include methane, nitrous oxide and water vapour. However, CO_2 is the most important greenhouse gas that is being affected by human activities. CO_2 is generated by a multitude of processes. Since the Industrial Revolution, when our usage of fossil fuels increased dramatically, the contribution of CO_2 from human activities has grown large enough to constitute a significant perturbation of the natural carbon cycle.

The concentration of CO_2 in the Earth's atmosphere was about 280 parts per million by volume (ppmv) in 1750, before the Industrial Revolution began. By 1994 it was 358 ppmv and rising by about 1.5 ppmw per year. If emissions continue at the 1994 rate, the concentration will be around 500 ppmv, nearly double the pre-industrial level, by the end of the 21st century.

Rising Concentrations

The effect is that the atmosphere retains more of the Sun's heat, warming the Earth's surface. While the pattern of future warming is very much open to debate, it is indisputable that the surface of the Earth has warmed, on average, 0.3 to 0.6 °C since the late 19th century when reliable temperature measurements began. Under the existing scenarios of economic growth and development leading to greenhouse gas emissions, on a worldwide average, temperatures would rise by 1 to 3.5 °C by the year 2100, and global mean sea level by about 15 to 95 cm. It is likely that changes of this magnitude and rapidity could pose severe problems for many

natural and managed ecosystems. Indeed, for many low-lying and deltaic areas and small islands, a sea level rise of one meter could threaten complete loss of land and extinction of habitation.

Extreme Weather Events

In addition, most of the ill effects of climate change are linked to extreme weather events, such as hot or cold spells of temperature, or wet or dry spells of rainfall, or cyclones and floods. Predictions of the nature and distributions of such events in a changed climate are even more uncertain- to the extent that virtually no authoritative predictions exist at all. While there are costs as well as benefits associated with climate change, the scientific consensus is clearly that the overall effects are likely to pose a significant burden on the global community. Unlike many other environmental issues, such as local air or water pollution, or even stratospheric ozone depletion caused by chlorofluorocarbons (CFCs), global warming poses special challenges due to the spatial and temporal extent of the problem covering the globe and with decades to centuries time scales.

Analysis and assessment of just what steps needed to be taken to limit greenhouse gas emissions. This process resulted in the negotiation of a protocol, the final details of which were completed at the third meeting of the Conference of the Parties to the Framework Convention held December 1-12, 1997, in Kyoto, Japan. The Kyoto Protocol to the United Nations Framework Convention on Climate Change commits industrialized nations to specific, legally binding emission reduction targets for six greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, per-fluorinated compounds and sulphur hex fluoride.

First, although India does not currently have any obligations under the Convention to reduce its greenhouse gas emissions. It is important for us to develop a clear understanding of our emission inventory. We also need to document and analyze our efforts in areas such as renewable energy, wasteland development and a forestation - all of which contribute towards either reducing CO₂ emissions or increasing CO₂ removal from the atmosphere.

Considering that these efforts may often be undertaken for a variety of reasons not directly

related to global warming, but yet has benefits as far as climate change is concerned, we may be able to leverage such efforts in the international context. The Research community could contribute substantially in this regard. We need to significantly improve our ability to plan and adapt to extreme events such as floods, droughts, cyclones and other meteorological hazards. Any robustness that we build into the system in this regard will always stand us in good stead no matter what climate change actually transpires.

5.5 GLOBAL WARMING

Q6. Define Global Warming. What are the causes of Global Warming?

Ans :

Meaning

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth. However, the concept of global warming is quite controversial but the scientists have provided relevant data in support of the fact that the temperature of the earth is rising constantly.

There are several causes of global warming, which have a negative effect on humans, plants and animals. These causes may be natural or might be the outcome of human activities. In order to curb the issues, it is very important to understand the negative impacts of global warming.

Causes

Following are the major causes of global warming:

I) Man-made Causes of Global Warming

i) Deforestation

Plants are the main source of oxygen. They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.

Use of Vehicles

The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.

Chlorofluorocarbon

With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer. The ozone layer protects the earth surface from the harmful ultraviolet rays emitted by the sun. The CFCs have led to ozone layer depletion making way for the ultraviolet rays, thereby increasing the temperature of the earth.

Industrial Development

With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

In 2013, the Intergovernmental Panel for Climate Change reported that the increase in the global temperature between 1880 and 2012 has been 0.9 degrees Celsius. The increase is 1.1 degrees Celsius when compared to the pre-industrial mean temperature.

Agriculture

Various farming activities produce carbon dioxide and methane gas. These add to the greenhouse gases in the atmosphere and increase the temperature of the earth.

Overpopulation

An increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.

Natural Causes of Global Warming**Volcanoes**

Volcanoes are one of the largest natural contributors to global warming. The ash and

smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.

(b) Water Vapour

Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature, more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.

(c) Melting Permafrost

Permafrost is frozen soil that has environmental gases trapped in it for several years and is present below Earth's surface. It is present in glaciers. As the permafrost melts, it releases the gases back into the atmosphere, increasing Earth's temperature.

(d) Forest Blazes

Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.

Q7. Explain the impact of Global Warming.

Ans :

(Imp.)

- Rising sea-levels: The density of water decreases as temperature rises. Thus, increase in temperature warms the ocean water which increases in volume. This contributes to sea-level rise due to thermal expansion.
- Changes in the precipitation (rain and snowfall) patterns cause devastating flooding in some areas and droughts in other areas.
- Increase in the frequency of severe weather events such as hurricanes, tornadoes, etc.
- Reports indicate that retreating mountain glaciers due to global warming contribute to approximately 2.5 cm rise in sea-level.
- Melting of ice at the earth's poles near West Antarctic, Greenland and Arctic sea ice.
- Loss of species as ecosystems change. Some biologists are of the view that if sea-ice disappears, the polar bears and penguins too will vanish due to loss of their habitat.

- (g) Scarcity of freshwater in some areas due to the disappearance of glaciers.
- (h) Frequent occurrences of diseases such as malaria carried by mosquitoes.

Q8. State the effects of global warming.

Ans :

Following are the major effects of global warming:

- i) **Rise in Temperature:** Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by 1 degrees. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal regions.
- ii) **Threats to the Ecosystem:** Global warming has affected the coral reefs that can lead to the loss of plant and animal lives. Increase in global temperatures has made the fragility of coral reefs even worse.
- iii) **Climate Change:** Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.
- iv) **Spread of Diseases:** Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.
- v) **High Mortality Rates:** Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.
- vi) **Loss of Natural Habitat:** A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

5.6 ACID RAIN

Q9. Explain the concept of Acid Rain.

Ans :

Meaning (Imp.)

Although the phenomenon of "acid rain" (more correctly acid deposition) was identified in Manchester, England, as long ago as 1852, and described more thoroughly in 1872, modern scientific research has been going on only since the mid-1950s. Public concern about the problem began in the late 1960s. Acid rain is an environmental hazard that is transponder in nature. Northeastern America, North Western Europe and India are facing an acute problem of acid rain. Acid rain has affected certain rivers, lakes, streams and forests in United Kingdom (UK), United States of America (USA), Germany and many other countries. Acid rain literally means 'the presence of excessive acids in rain waters'. Acid precipitation is a mixture of strong mineral acids sulphuric acid (H_2SO_4), nitric acid (HNO_3) and in some locations, hydrochloric acid (HCl). It usually has a pH of less than 5.6, the value of distilled water in equilibrium with atmospheric carbon dioxide.

Acid in the Rain Water's

Acid rain problem is a result of anthropogenic activities. Most acids come from cars, homes, industries and power stations but some share is contributed by natural sources such as volcanoes, swamps and planktons. The acid problem is basically associated with the transport and subsequent deposition of oxides of sulphur, nitrogen and their oxidative products. These are produced by combustion of fossil fuels, power plants, automobile exhausts and domestic fires etc.

Formation of Acid Rain

Acid rain is one of the form of acid deposition which can either be wet or dry, acid rain, snow, dew, fog, frost and mist are the wet form of deposition, while dust particles containing sulphate and nitrates which settle on ground is called dry deposition.

Wet Acid Rain

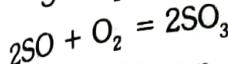
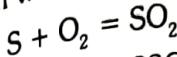
Coal, fuel wood or petroleum products have sulphur and nitrogen. These elements, when burnt

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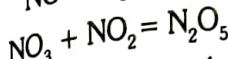
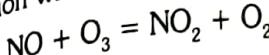
'atmospheric oxygen,' are converted into their respective oxides (SO_2 and NO_3), which are highly soluble in water. By anthropogenic and by natural sources, oxides of sulphur and nitrogen enter the atmosphere.

Reactions

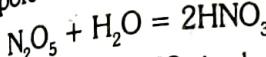
Reaction with Sulphur



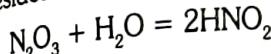
Reaction with Nitrogen



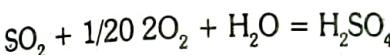
When air is saturated with water droplets (humid conditions), N_2O_5 invariably reacts with water vapors to form droplets of HNO_3 .



Besides some HNO_2 is also formed



SO_3 in humid conditions forms droplets of



HNO_3 and H_2SO_4 thus formed combine with HCl to generate precipitation, which is commonly referred to as acid rain.

The primary reason for concern is that acid deposition acidifies streams, and taken on coarse, sandy soils low in lime: The effect is seen particularly in headwater areas and in wet montane environments, wherever sulphate loading from anthropogenic sources is strong.

The chemical and physical consequences of lake acidification include, increased leaching of calcium from terrestrial soils, mobilization of heavy metals such as aluminium, zinc, and manganese and an increase in the transparency of lake waters. The biological consequences include market changes in communities of aquatic plants and animals, with a progressive lessening of their diversity.

Acid deposition may further impoverish forests soils, developed on sandy substrata poor in lime. As a consequence of accelerated leaching of nutrients, such as phosphorous, potassium, magnesium and calcium from these soils, forest productivity would eventually be reduced.

Moreover, the acid sulphate particles that contribute to acid precipitation are in the size range that penetrates deep into the lung, and they may well exacerbate lung diseases and increase mortality rates.

Q10. What are the effects of Acid Rain?

Ans :

An ecosystem is a community of plants, animals and other organisms along with their environment including the air, water and soil. Everything in an ecosystem is connected. If something harms one part of an ecosystem – one species of plant or animal, the soil or the water – it can have an impact on everything else.

1. Effects of Acid Rain on Fish and Wildlife

The ecological effects of acid rain are most clearly seen in aquatic environments, such as streams, lakes, and marshes where it can be harmful to fish and other wildlife. As it flows through the soil, acidic rain water can leach aluminium from soil clay particles and then flow into streams and lakes. The more acid that is introduced to the ecosystem, the more aluminium is released.

Some types of plants and animals are able to tolerate acidic waters and moderate amounts of aluminium. Others, however, are acid-sensitive and will be lost as the pH declines. Generally, the young of most species are more sensitive to environmental conditions than adults. At pH 5, most fish eggs cannot hatch. At lower pH levels, some adult fish die. Some acidic lakes have no fish. Even if a species of fish or animal can tolerate moderately acidic water, the animals or plants it eats might not. For example, frogs have a critical pH around 4, but the mayflies they eat are more sensitive and may not survive pH below 5.5.

2. Effects of Acid Rain on Plants and Trees

Dead or dying trees are a common sight in areas effected by acid rain. Acid rain leaches aluminium from the soil. That aluminium may be harmful to plants as well as animals. Acid rain also removes minerals and nutrients from the soil that trees need to grow.

At high elevations, acidic fog and clouds might strip nutrients from trees' foliage, leaving them with brown or dead leaves and needles. The trees are then less able to absorb sunlight, which makes them weak and less able to withstand freezing temperatures.

3. Buffering Capacity

Many forests, streams, and lakes that experience acid rain don't suffer effects because the soil in those areas can buffer the acid rain by neutralizing the acidity in the rainwater flowing through it. This capacity depends on the thickness and composition of the soil and the type of bedrock underneath it. In areas such as mountainous parts of the Northeast United States, the soil is thin and lacks the ability to adequately neutralize the acid in the rain water. As a result, these areas are particularly vulnerable and the acid and aluminium can accumulate in the soil, streams, or lakes.

4. Episodic Acidification

Melting snow and heavy rain downpours can result in what is known as episodic acidification. Lakes that do not normally have a high level of acidity may temporarily experience effects of acid rain when the melting snow or downpour brings greater amounts of acidic deposition and the soil can't buffer it. This short duration of higher acidity (i.e., lower pH) can result in a short-term stress on the ecosystem where a variety of organisms or species may be injured or killed.

5. Nitrogen Pollution

It's not just the acidity of acid rain that can cause problems. Acid rain also contains nitrogen, and this can have an impact on some ecosystems. For example, nitrogen pollution in our coastal waters is partially responsible for declining fish and shellfish populations in some areas. In addition to agriculture and wastewater, much of the nitrogen produced by human activity that reaches coastal waters comes from the atmosphere.

6. Effects of Acid Rain on Materials

Not all acidic deposition is wet. Sometimes dust particles can become acidic as well, and this is called dry deposition. When acid rain and dry acidic particles fall to earth, the nitric and

sulphuric acid that make the particles acidic can land on statues, buildings, and other manmade structures, and damage their surfaces. The acidic particles corrode metal and cause paint and stone to deteriorate more quickly. They also dirty the surfaces of buildings and other structures such as monuments.

The consequences of this damage can be costly:

- Damaged materials that need to be repaired or replaced,
- Increased maintenance costs, and
- Loss of detail on stone and metal statues, monuments and tombstones.

5.7 OZONE LAYER DEPLETION

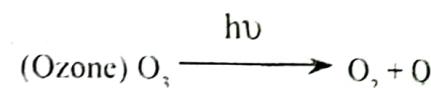
Q11. Write a detailed note on Ozone Layer Depletion.

Ans :

(Imp.)

Ozone or trioxygen gas, made up of three oxygen atoms, forms a layer of about 3 mm (0.12 inches) thick over the entire earth at approximately 10 to 30 miles above the earth's surface. In the absence of ozone layer, life on earth would not have existed. Ozone layer forms a natural shield or a protective layer, at high altitude regions of stratosphere, against the bombardment of ultraviolet radiation from the sun.

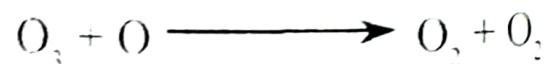
Ozone layer at high altitude region in the stratosphere is produced naturally by the following chemical reaction,



The ultraviolet radiation splits the ozone molecule in a photochemical reaction.



Ozone is reformed when an atomic oxygen combines with oxygen molecule.



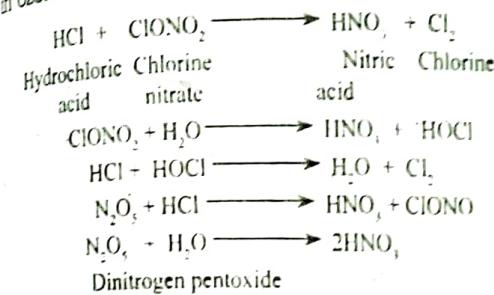
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Ozone may react with atomic oxygen to form ozone molecules.

The above mentioned reactions are called as Chapman reactions, named after S. Chapman for his contribution to the first theoretical explanation of the stratospheric ozone layer.

Mechanism of Ozone Layer Depletion

Halocarbons released in the lower atmosphere (troposphere) make their way into the upper atmosphere. Here the strong ultraviolet radiation from the sun reacts with the halocarbons to form chlorine and bromine compounds which have a great potential of destroying ozone. This concept has been accepted by all across the globe. Hydrochloric acid (HCl) and chlorine nitrate (ClONO_2) are the breakdown products of CFCs formed on the surface of the polar stratospheric clouds.

The mechanism of chemical reaction involved in ozone layer destruction are:



Exposure of CFCs to strong UV radiation breaks it down to release atomic chlorine. A chlorine molecule can destroy about 1,00,000 molecules of ozone. The net effect is that the rate of destruction of ozone is faster than its synthesis. Exposure of methyl bromide and halons to strong UV radiation, releases bromine atoms, which are 40 times more destructive to Ozone molecules than chlorine atoms. Aircraft emission of nitrogen oxides and water vapour add to the depletion effect by creating ice crystals that serve as a base for ozone destroying reaction.

Q12. What are the important areas where human activities can influence ozone layer.

Ans :

The three important areas where human activities influence the ozone layer are,

1. Use of aerosols in agriculture, electronic industry and domestic processes.

The aerosols contain chlorofluorocarbons, or CFCs, which are the compounds containing only carbon, chlorine and fluorine. These compounds are widely used as working fluids in refrigerators and air conditioners. The CFCs are in gaseous form at room temperature and can be liquefied under compression. CFCs are also used as foaming agents for the production of polystyrene and polyurethane foam plastics used for insulation and packaging materials. The propellants used in spray cans for paint, insect repellents and deodorants also contain CFCs.

The different types of CFCs are CCl_3F , CCl_2F_2 , and CHClF . For instance, CCl_3F is dissociated by absorption of photons with $\lambda < 200 - 250$ nm, to produce CCl_2F and Cl atoms. The chlorine atoms can destroy the ozone layer as depicted in the following reaction.



One molecule of CFC can destroy many ozone molecules in the ozone layer.

2. Release of emissions by the aviation industry. The supersonic jets, rockets, air planes and space shuttles and the advancements in the space technology release emissions directly into the stratosphere. The oxides of nitrogen, carbon, sulphur, hydrocarbons and particulate material are released into the stratospheric layer.

3. Increasing industrialization all over the globe, releases large amounts of greenhouse gases which produce greenhouse effect.

Halogens oxides, XO (where $\text{X} = \text{Cl}, \text{Br}, \text{I}$) and HOX hydrazoacids can undergo photo dissociation in the stratosphere.

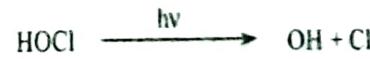


Photo dissociation of hypochlorous acid produces OH radicals which have an important role in the destruction of ozone layer.

5.8 ENVIRONMENTAL DISASTER MANAGEMENT

Q13. What is a disaster.

Ans :

A disaster is defined as a disruption on a massive scale, either natural or man-made, occurring in short or long periods of time. Disasters can lead to human, material, economic or environmental hardships, which can be beyond the bearable capacity of the affected society. As per statistics, India as a whole is vulnerable to 30 different types of disasters that will affect the economic, social and human development potential to such an extent that it will have long-term effects on productivity and macro-economic performance.

Q14. What is Disaster Management?

Ans :

Disaster management deals with various types of disasters and measures of avoiding risks. It is a continuous process wherein individuals, groups, communities, the government and some non-governmental organizations (NGOs) manage the disasters to lessen the impact of catastrophe. To put it simply, disaster management is an endeavour to combat disaster of any kind.

The Indian subcontinent is bestowed with unique geoclimatic conditions with a propensity to some of the natural disasters like floods, drought, cyclones, earthquakes, tsunamis etc. These disasters cause immeasurable loss to life and property. The need of the hour is a well-structured and integrated disaster management mechanism. Therefore, appropriate disaster management considerations should be armed to reduce or avoid potential losses from hazards, provide proper assistance to the victims of disaster and attain rapid and effective recovery. The goal of disaster management should be to reduce hazards, prevent disasters and prepare for emergency situations.

Space technology has the capability to provide vital information for management of disasters. The earth observation satellites like multipurpose geostationary satellites provide observations about weather conditions including cyclone monitoring and the likelihood of genesis of tropical storms. The Cyclone Detection Radars (CDRs) installed along the Indian coastline, Area Cyclone Warning Centres (ACWCs) at Calcutta, Chennai and Mumbai, and Cyclone Warning Centres (CWCs) at Bhubaneshwar, Visakhapatnam and Ahmedabad provide information about the weather conditions to Indian Meteorological Department (IMD). IMD has the necessary infrastructure to disseminate information about the weather conditions like warnings about cyclones to the cyclone prone coastal areas, using a number of communication channels like telegram, telefax, e-mails etc., thereby alerting people to take necessary steps for the safety of life and property.

5.8.1 Types of Disasters

Q15. Explain different types of disasters.

Ans :

Disaster is a sudden, catastrophic event that causes widespread and immeasurable damage, loss, destruction and devastation to life, property, livelihood, economy and environment.

Some of the features of disaster are uncertainty, unfamiliarity, rapidity, unpredictability and risk. Disasters that result from extremes of weather conditions are floods, cyclones, tornadoes, blizzards, droughts and avalanches, while disasters that result from extremes of the earth's geology are earthquakes, volcanic eruptions and tsunamis.

Based on the origin of disasters, they are broadly categorized into two types. They are,

1. Natural disasters
2. Man-made disasters.

1. Natural Disasters

It may be further classified into two types. They are,

- (a) Major natural disasters and
- (b) Minor natural disasters.

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The major natural disasters include flood, cyclones, droughts and earthquakes, while minor natural disasters are cold waves, thunderstorms, heat waves, landslides, storms etc.

Man-made Disasters

Man-made disaster may be further classified into two types. They are,

- Major man-made disasters and
- Minor man-made disasters.

The major man-made disasters include forest fires, epidemic, deforestation, pollution and wars, while minor man-made disasters are road/train accidents, food poisoning, riots, bomb blasts and industrial disasters.

All these types of disasters disrupt the functioning of society and cause heightened mortality due to injuries and increased risk for outbreak of communicable disease.

Q16. What are natural hazards/disasters? Explain.

Ans :

Natural hazards are caused by natural phenomenon with a potential to have severe impact on the environment.

Natural hazards are further categorized into two groups:

1. Terrestrial (Planetary) Hazards

These hazards arise from tectonic movements of lithosphere to cause sudden violent movement of the earth's surface and even the oceanic plates resulting in great damage to life and property. The terrestrial hazards can be described as follows,

- Endogenic Hazards:** The high pressure and high temperature present beneath the earth's surface produce major internal forces to cause movement of the plates for a disaster of great intensity and dimension. Endogenic hazards may also be referred as geomorphic/geological hazards. Examples of such hazards are earth quake, volcanic eruptions, tsunamis, landslides, avalanches and natural radio activity.

(ii)

Exogenic Hazards (Cumulative Atmospheric Hazards): These hazards arise from atmospheric phenomenon or changes in it. Examples of such hazards are storms, thundering or lightning, cloudbursts, flashfloods etc. Exogenic hazards are further classified as follows,

- Climatic Hazards:** This type includes the phenomenon of El Nino, sea-level rise glacier melting causing serious environmental effects. The phenomenon of El Nino occurs as a result of abnormal warming of surface water of the Pacific Ocean on a large scale on the eastern side in Galapagos Islands in every 3 to 10 years.

Changes in the sea-level is a new found cause for concern, which has been occurring over many years. The major processes that contribute to sea-level rise are global warming, melting of non-oceanic waters of glaciers and ice-caps. There is a drastic reduction in the Arctic sea ice and Antarctic ice shelves. It has been observed that the glaciers and ice-sheets are retreating at a fast rate. The net loss of ice has been estimated to be in the range of 80 and 225 cubic kilometers per year.

The impact of sea-level rise will cause flooding risks to the low-lying areas in the United States", Europe, small island nations lying in the Pacific (Marshal, Kiribati Tuvalu, Tonga, Micronesia, Cook), Atlantic (Antigua, Nevis) and Maldives in the Indian Ocean, a number of large cities in South East Asia, including Bangkok, Mumbai, Kolkata, Dhaka, Manila.

- Chronic Hazards:** These hazards occur as a result of long term conditions or problems such as drought, pollution, resource degradation etc., causing serious environmental and health effects. Global warming is also a chronic hazard due to its continuous presence in the environment. The damage caused due to chronic hazards is usually gradual and cumulative.

- (c) **Hydrologic Hazards:** This includes cyclones, hail, ice, snow, floods, drought, tsunami, rapid glacier advance and wave action (coastal and lakeshore erosion).
- (d) **Meteorological Hazards:** This type includes storms, heat waves and cold waves.
- (e) **Infrequent Events:** Examples include cyclones, lightning and hail storms.

2. Extra planet are Hazards (Extra terrestrial / Super hazards)

This type of hazard is caused by collision of celestial bodies and the resultant falling of debris on the earth's surface.

According to NASA's Wide-field Infrared Survey Explorer (WISE) space telescope data, about 4,700 Potentially Hazardous Asteroids (PHA), with diameters greater than 330 feet are present near the earth (approximately 8 million kilometers from earth). Other examples of extraplanetary hazards include magnetic storms, catastrophic earth changes, meteorite impacts and impact from near-earth objects.

Q17. List man-made hazards that emanate from / human activities ultimately leading to a disaster.

(or)

What are anthropogenic hazards? Explain.

Ans :

Anthropogenic hazards are the man-made/man-induced hazards, caused by human activities leading to loss of life and property as well as damage to a country's economy and productive capacity.

They include environmental pollution, terrorism, destruction of property, widespread hunger, road and rail accidents, bomb explosion, chemical spills, industrial accidents, nuclear accidents, all caused by complex anthropogenic interactions.

Anthropogenic or man-made hazards are described as follows,

- (a) **Physical Hazards:** Physical hazards are caused due to human induced developmental activities, particularly in the age of information and technology, leading to environmental degradation due to deforestation, desertification, loss of natural resources, pollution, waste disposal etc.
- (b) **Technological Hazards:** These hazards are generally anthropogenic in nature and are caused by interaction of society, technology and natural systems. Such type of hazard includes explosions, terrorism (bioterrorism), release of toxic substances into the environment, oil spills, nuclear disasters (Chernobyl Nuclear Power Plant Disaster, Ukraine; Fukushima Daichii Nuclear Plant disaster, Japan).

Environmentalists have further categorized technological hazards into the following types.

- (i) **Industrial Hazards:** Hazards caused by industrial operations as well as storage and transportation of hazardous materials have disastrous environmental repercussions.
- (ii) **Structural Collapse Hazards:** This type includes the collapse of construction projects, roads and buildings due to poor engineering.
- (iii) **Nuclear Hazards:** Nuclear hazards occur as a result of release of massive amounts of radiation and radioactive material into the environment. They have the greatest damage potential over a wide geographic area often leading to mass destruction of human civilization.
- (iv) **Computer Hazards:** The hazards caused by S' electronic appliances include carpal tunnel syndrome, repetitive strain injury, computer eye strain, computer vision syndrome.
- (v) **Transportation Hazards:** This includes the accidents occurring on roads, railways, airways or waterways.
- (c) **Biological Hazards (Biohazards):** This type of hazard originates from biological sources such as bacteria, viruses, medical waste, insects, plants,

birds, animals and humans. Examples include severe epidemic in humans: AIDS, malaria; severe epidemic in plants and wild animals. Biohazards can be further categorized into two types,

- (i) **Pathogens:** These are the organisms that are the causative agents of diseases such as anthrax, small pox, influenza, plague, hemorrhagic fever, rickettsias, etc.
 - (ii) **Toxins:** These are poisonous substances synthesized by plants and animals.
- (d) **Social Hazards:** Hazards that originate from social systems such as population explosion, famine, warfare, conflict, terror attack, hostage taking, hijacking are called social hazards. They may also be referred as "intentional hazards" as these are caused by human activities.

Q18. What is the difference between natural disaster and man-made disaster?

Ans:

Natural disasters are the destructive forces of nature that have severe impact on the environment. They include blizzards, cyclones, earthquakes, famines, floods, landslides, tornadoes, tsunamis, volcanoes, wildfires, bushfires etc.

Man-made disasters are the hazards caused by human activities leading to loss of life and property as well as damage to a country's economy and productive capacity. They include environmental pollution, terrorism, destruction of property, widespread hunger, road and rail accidents and bomb explosion, chemical spills, industrial accidents, nuclear accidents, all caused by complex anthropogenic interactions.

5.8.2 Impact of Disasters on Environment, Infrastructure, and Development

Q19. What is the impact of disasters on environment?

Ans :

All of us across the globe are facing an increasing frequency and intensity of disaster (both natural and man made) that has detrimental impact

on life, property and environment. It is not surprising to note that disasters cause less number of mortalities in rich countries, than in low income countries, owing to the differences in the vulnerability and preparedness of a catastrophe.

Environmental changes contribute to the occurrence of disasters. Increased deforestation across the world leads to soil erosion and thus a greater tendency for landslides along the hills. Deforestation also leads to global warming that enhances the tendency for occurrence of extreme weather events like floods, cyclones, tornadoes and droughts.

Uncontrolled industrialization heightens the risk for technological disasters (eg. Bhopal gas tragedy). With the growth of population and urbanization, there is a greater risk to a number of individuals when a disaster strikes. Along with rapid industrialization, the greenhouse gases released due to increase in consumption of fossil fuels too contribute to global warming, leading to greater frequency of extreme weather events like heat waves and rising sea levels.

Disasters affect human health in various ways. In the event of a major catastrophe, people are often rendered shelterless (environmental exposure), thus being exposed to all kinds of infections and an increased risk for occurrence of communicable diseases. Such a situation arises, due to changes in the vector population, changes in housing arrangements for disaster affected people and disruption of health care infrastructure.

As a consequence of disasters, the mental health of people too suffers, most often referred to as "disaster syndrome".

The primary hazard from the human health perspective from tornadoes, hurricanes or cyclones is the risk of injuries from flying debris, due to high winds. A hazard exists for victims affected by head and chest trauma, due to falling down of huge structures. Some people may be lifted into the air by hurricanes, cyclones and tornadoes and dropped at some other place.

In the event of floods and especially in flash floods there is a greater risk of drowning. Driving automobiles in flash floods is hazardous as there is a fair chance of getting drowned with the vehicle.

The stagnant waters in case of large floods pose a hazard to existing sanitation and drinking water systems.

In the event of significant tremor or earthquakes, individuals get trapped and injured from buildings and other structural collapse.

The primary health concern associated with volcanic eruptions is the respiratory illnesses of affected population owing to the inhalation of toxic gases and ash from the volcano. The volcanic ash contains pulverized rock, it is acidic, gritty, gassy and odorous that may cause lung damage to infants and older adults. The flow of molten lava also pose great fire hazard, because of its intense heat.

Most often, disasters do cause damage to the psyche (mind) of the affected individuals leading to mental trauma. The disorders related to the psyche are acute stress disorder, anxiety symptoms, depression, post traumatic stress symptoms and alcohol and drug abuse. Other abnormal symptoms include excessive crying, insomnia, anger and irritation.

5.8.3 Basic Principles of Disaster Mitigation

Q20. Explain the Basic Principles of Disaster Mitigation.

Ans :

1. **Early Warning Symptoms:** Early warning symptoms of an impending disaster have a major role in mitigating the effects of disasters.

It enables the affected people to enhance the disaster response operations. The early warning symptoms include detection of signs of impending catastrophe, analysis of symptoms and disseminating information to the concerned people.

2. **Land-use Zoning:** Hazard prone areas must be identified and marked. Their usage must be prevented through national or local legislations or prohibitions. Such areas should not be used for residential or industrial purpose. However, hazard prone areas can be used for agricultural activities.

3. **Building Codes:** The building codes are meant to improve the quality of new constructions in order to resist catastrophes

and thus protect life and property. Building codes are established in consultation with builders, architects and the public.

4. Incentives: Hazard mitigation can be accomplished by a wide range of incentive techniques. For example, funds may be given to firms or households in hazard prone areas to strengthen the existing buildings or to include certain modifications during the construction phase.

5. Provision of Assets at Subsidized Rates: Community cyclone shelters may be provided to people residing in cyclone prone areas at subsidized rates or for free. Deep bore holes may be drilled in drought prone areas or sufficient land should be provided for water harvesting in such regions.

6. Increase Public Awareness: Awareness raising campaigns about the hazards must be conducted to educate the population about how to respond and cope when hazards occur.

Efficient mitigation plans must be considered and implemented systematically to prevent the impact of natural hazards.

5.8.4 Disaster Management and Methodology

Q21. Explain the methodology of disaster Management.

Ans :

(Imp.)

1. Prevention is better than cure. Disaster prevention is the first and foremost thing one can do. Be prepared according to the natural disasters that may occur according to the locality/area. Know the hazards in your area and know the risk. The information about natural hazards, their occurrence and effect should be known according to the location, region, etc. Geographical information systems (GIS) play a crucial role in this criterion.

2. Social media is a great tool now-a-days, make use of it. Social network can help in communicating with those who are aware and can help you, before or during a disaster.

Know about your nearby community officials and government servants who can help you and your neighbours in evacuating the place and also announce a 'mandatory evacuation' in the hazard prone area.

Identify your nearest local media sources so that they provide valuable information and useful safety measures to people living in the area.

Make sure you have a stock of first aid kit or a go-kit that helps you and your family during a disaster. If possible make sure you have stock pile of medication, food and enough water for at least 3 days during the disaster.

In order to make sure you are not affected by the hazards, be in touch with any of your friends or relatives who stay far from you or from the disaster hit area. So that when you are evacuated, you are least affected in any terms.

Raising your home, buying flood insurance, securing heavy furniture to the walls all are a part of mitigation, and these help in reducing or eliminating the impact caused by the disasters.

Make sure you are adaptable to the environment or surrounding that you are evacuated to, so that no day of your work is missed out in case it takes long time for your previous area where you have lived to cope up from the disaster effect.

Making use of Remote sensors in natural hazard assessments with the help of satellites or sensors mounted to aircrafts. They are very helpful in showing the evidences for occurrence and presence of the disasters according to the geographical, geological and hydrologic and natural phenomena.

Public awareness is the most important one in disaster management. Development, planning and management will only be possible with the people being aware of the natural hazards and safety measures that are to be followed during or before a disaster. The study or knowledge on disaster management helps in taking good decisions regarding buying homes, building and living in hazard-prone areas.

5.8.5 Disaster Management Cycle

Q22. Explain different stages of disaster management.

Ans :

(Imp.)

The different stages for the management of disasters can be broadly categorized into the following,

I) Pre-disaster stage

The pre-disaster stage includes,

1. Preparedness phase (Phase of readiness)
2. Mitigation phase (Risk diminution phase/ Prevention phase).

II) Emergency stage (Disaster phase/Phase of Catastrophe), in Post-disaster stage (Recovery/ Rehabilitation phase).

Pre-disaster Stage

1. Preparedness Phase (Phase of Readiness): This phase involves planning to respond immediately in anticipation of a disaster. This includes awareness about emergency exercises or training in various methods of safely vacating the disaster-stricken areas and first-aid measures. Such awareness programs must also strengthen the technical and managerial capacity of governments, organization and communities to minimize the mortality and property loss and enhance disaster response operations. Installation of disaster warning systems, emergency communication system, emergency personnel/contact lists, plenty of food reserves, equipment, water, medicines and other necessities must be maintained.

Phase of readiness (preparedness phase) includes the following aspects,

- (a) **Hazard Zone Mapping:** Regions vulnerable to natural disasters must be mapped accurately using the latest techniques, via Remote Sensing (RS), Geographic Information System (GIS) etc.

The various parameters assessed in such studies include geology, lithology, soil type, minerals forming the rocks and soils, water resources (both ground and surface), vegetation, climate etc.

Example: Flood hazard zones are identified by interpreting the topographic map, soil map and landsat imagery. The topographic map of watershed of each stream and river is identified, followed by characterization of flood plain and coastal plain. The flood hazard zones are stored in a computer in digital format.

- (b) **Hazard Forecasting, Warning and Prediction:** Hazard forecasting, warning and prediction are inter-linked with each other. Landslides and floods can be predicted as they occur mostly during the rainy season.

If the general public is warned of the impending disaster in advance, then they can make last-minute preparations or vacate the area and move to safer places or take other protective actions. The essential supplies may be transported to the affected site before the hazard conditions strike and make movement to the affected areas difficult. Some countries have developed easily transportable disaster equipment kits containing medicines, food and clothes which are stored in trailers, train cars, and/or shipping crates.

- (c) **Disaster Preparedness Plan:** The regions vulnerable to disasters must have a well co-ordinated comprehensive preparedness plan for mitigating disasters. For instance, certain preventive measures may be taken up, like placing sand bags near the levees to raise its height or to create barriers around buildings to prevent rain water from flooding the homes. Stockpiling of essential commodities like food, batteries, candles and water can limit the hazard's consequences.

Protection of people in case of emergency at the government level is a necessary step. The governments of all the nations must know well in advance about what and how they would deal in an emergency.

Emergency Operations Plan (EOP): An important component of disaster planning is the basic Emergency Operations Plan (EOP). An EOP is a document that serves as an emergency management guidance document. It contains a detailed description of the duties, roles, responsibilities and actions of agencies and people who will be involved in response to emergencies or disaster events. It also includes a description of how the people and structures will be protected in case of a disaster. EOP are referred by several names.

The municipal solid waste collection involves the following functional components,

- (a) **Municipal Solid Waste Collection from Non-point Sources.**

The waste generated from various households are collected by garbage collectors who are employed under contract by the firms or local governing bodies. The waste is collected generally in three-wheeled cart and dumped in the community bins/communal containers.

This stage also involves the garbage clearance operations including sweeping of roads, removal of road silts, rubbles, debris, shrubs and all types of solid wastes on the roads on all days of the week.

- (b) **Municipal Solid Waste Collection from Point Source**

The waste deposited in the community bins/communal containers now form the point source for municipal solid waste. The community bins are placed at specified street corners, near markets, apartment complexes, shopping malls, hotels, gardens and religious places.

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The frequency of lifting garbage from the community bins should be increased to prevent garbage pile up and create other health problems.

(c) **Transfer of Garbage to Disposal Sites**

Large dumper placer vehicles collect waste from the community bins and dump the waste at garbage dumping yards, located several kilometers away from the main city. At certain places, small collection vehicles are used to carry the garbage to transfer stations where the wastes are loaded into large vehicles (such as, trailers or Bulk Refuse Carriers) for transportation to the disposal or processing sites or a specified landfill site.

5.8.6 Disaster Management in India

Q23. Explain about disaster Management in India.

(Imp.)

Ans :

The Disaster Management Act was passed by the Lok Sabha on December 12 2005 and by the Rajya Sabha on 28 November 2005. It received the assent of the President of India on 2005 December 23. The Act calls for the establishment of a National Disaster Management Authority (NDMA), with the Prime Minister of India as chairperson. The NDMA has not more than nine members at a time, including a Vice-Chairperson. The tenure of the members of the NDMA is 5 years. The NDMA which was initially established on 30 May 2005 by executive order, was constituted under Section-3(1) of the Disaster Management Act, on 27 September 2005. The National Disaster Management Authority (NDMA), headed by the Prime Minister of India, is the apex body for Disaster Management in India. Setting up of NDMA and the creation of an enabling environment for institutional mechanisms at the State and District levels is mandated by the Disaster Management Act, 2005. NDMA is mandated to lay down the policies, plans and guidelines for Disaster Management. India envisions the development of an ethos of Prevention, Mitigation, Preparedness and Response.

The Indian government strives to promote a national resolve to mitigate the damage and destruction caused by natural and man-made disasters, through sustained and collective efforts of

all Government agencies, Non-Governmental Organizations and People's participation. This is planned to be accomplished by adopting a Technology-Driven, Pro-Active, Multi-Hazard and Multi-Sectoral strategy for building a Safer, Disaster Resilient and Dynamic India.

The NDMA Logo reflects the aspirations of this National Vision, of empowering all stakeholders to improve the effectiveness of Disaster Management in India. NDMA has 5 major divisions viz. Policy & Plans, Mitigation, Operations & Communications & Information & Technology, Administration and Finance.

Q24. Enlist the various institutions and national centres involved in natural disaster reduction.

Ans :

Some of the institutions and national centres for national disaster reduction are mentioned below,

1. **Central Disaster Management Authority:** It is the apex body set up by the Government of India for implementing disaster management plans to prevent and mitigate any eventuality.
2. **National Centre For Disaster Management (NCDM):** This institute has been set up by the Indian Institute of Public Administration to provide training to government officials on disaster mitigation and coordinate research activities on disaster management.
3. **Centre for Disaster Management:** This institute has been set up by Yashwant Rao Chavan Academy of Development Administration to coordinate disaster management activities, develop training modules on disaster management, develop disaster preparedness and capacity building.
4. **National Information Centre of Earthquake Engineering - IIT Kanpur:** The aim of this institute is to collect information on earthquake engineering and maintain a storehouse of this information in the form of publications and audiovisual materials. The other objective is to disseminate information about the availability of material pertaining to earthquake engineering to interested

persons like academicians, researchers and professionals. The institute is sponsored by HUDA, Telecom Commission, Railway Board, Ministry of Agriculture, Department of Atomic Energy and AICTE.

5. **Disaster Management Institute, Bhopal:** This institute was set up in the year 1987 to develop techniques for the prevention or mitigation of consequences of disaster for the welfare of people. It provides professional training and guidance to managers and government officials pertaining to management of natural disasters like earthquakes, floods, drought, famine and cyclones, on-site and off-site emergency planning, risk analysis, identification of major hazards etc.
6. **Disaster Mitigation Institute, Ahmedabad:** Disaster Mitigation Institute was established in Ahmedabad with the prime motive to mitigate and prevent disasters by the following ways:
 - (i) Assisting and strengthening the decision making process.
 - (ii) Making critical and objective analysis available to the policy makers.
7. **Environment Protection Training and Research Institute (EPTRI):** The institute was established by the Government of Andhra Pradesh with the aid of Government of India. It has technical collaboration with Swedish International Development Agency. The objective of EPTRI is to safeguard life and property from disasters by providing training and consultancy services in Risk Assessment and Safety Control.
8. **Gujarat State Disaster Management Authority (GSDMA):** GSDMA was established by the Government of Gujarat at Gandhinagar on 8th February, 2001 with the following objectives.
 - (i) To provide relief and rehabilitation to the disaster affected people.
 - (ii) To implement the precautionary programmes and schemes to reduce the impact of natural disasters.
 - (iii) To conduct research and analysis of reasons for the occurrence of disasters and suggest remedies to reduce the effects of the same.
 - (iv) To utilize the funds, grants, donations and assistance from the federal government in the best possible manner for prevention of disasters.