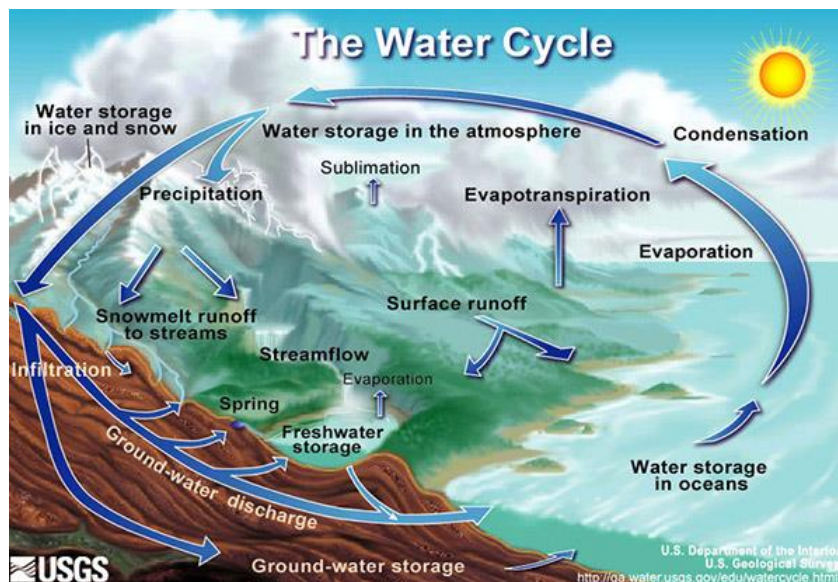


ENVIRONMENTAL STUDIES

- What is Environment?
- Why do we give notice so much interest in Environmental Studies?
- What do we exactly mean by Environmental Studies?
- The earth provided the right environment pure **air**, pure **water**, and pure **land, carbon dioxide** which in presence of strong sunlight helped in the development of the living world consisting of plants, animals and man.
- Nature through its own cycles has readily helped in the evolution of life forms. These natural cycles **water cycle, oxygen cycle, nitrogen cycle, carbon cycle**, etc. are conducted in harmony with environment.



- Man's **greed's** and **needs** led to **exploitation** of **natural resources** which caused **environmental degradation** and world-wide crisis threatening human survival.

It is now felt that the **public** in general and the **student community** in particular should be made aware of all aspects of environment in order to handle current **environmental issues** properly. The studies of all these aspects comprise **Environmental Studies**.

ENVIRONMENT DEFINITION, SCOPE AND IMPORTANCE

Definition

Environment is derived from the French word Environner, which means to encircle or surround.

In another words “Environment is sum total of water, air and land interrelationships among themselves and also with the human being, other living organisms and property”.

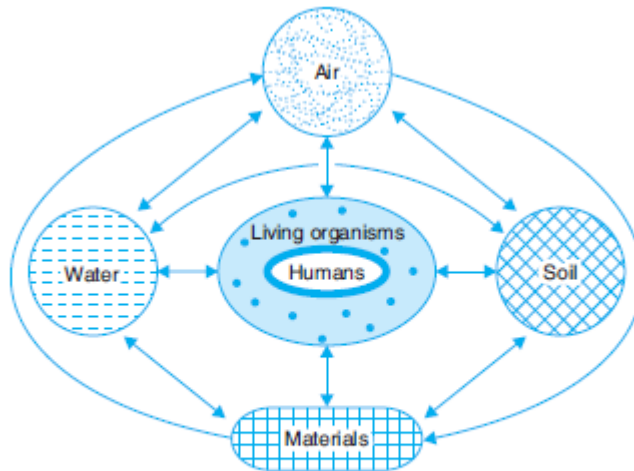


Fig. 1.1 Concept of Environment: air, water, land, living organisms and materials surrounding us and their interactions together constitute environment.

Element of environment

- **Physical elements**

Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals.

- **Biological elements**

Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

- **Cultural elements**

Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural setting.

Scope of environmental studies

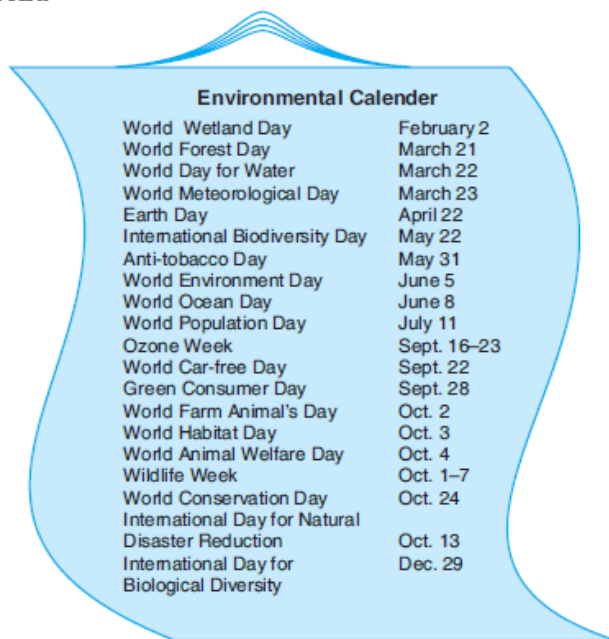
The scopes are summarized as follows:

- **Ecosystem structure and function** – It provides the knowledge about ecological systems and cause and effect relationships that link the living or biotic components to the non-living or abiotic components.

- **Natural resource conservation** – Apart from providing innumerable resources, natural assets such as forests contribute towards maintaining a balance in the environment. Therefore, managing and maintenance of forests and wildlife is a important task under natural resource conservation.
- **Environmental pollution control** – With the knowledge of environmental sciences, one can look for methods to control pollution and manage waste effectively.
- **Environmental management** – There are several independent environmental consultants working with the Central and State pollution control boards. These consultants offer advice related to environment problems and their solutions
- **Industry** – Rapid industrialization is increasingly degrading the environment. To combat this menace, there is a growing trend towards manufacture of **green goods** and products. There is an increasing emphasis on marketing goods that are environment friendly called **green marketing**. Such products have ecomark or ISO 14000 certification. **Environmental auditors** and **environmental managers** would be in great demand in the coming years.
- **Research and development** – There is tremendous scope for R & D in environmental issues. Various universities and governmental organizations offer research studies in order to develop or methods of monitoring and controlling environmental pollution. Because of an increasing threat form global warming, various steps are being taken towards of greenhouse gases and adoption of renewable energy sources. There is great awareness now regarding the use of solar energy.
- **Environmental journalism** – There is an increasing demand for people who can report on environmental issues to generate awareness among people.

Importance of environmental study

Internationally observed environment calendar to mark some important aspect or issue of environment

A light blue shield-shaped graphic with a wavy top edge, containing a table of environmental days and weeks.

World Wetland Day	February 2
World Forest Day	March 21
World Day for Water	March 22
World Meteorological Day	March 23
Earth Day	April 22
International Biodiversity Day	May 22
Anti-tobacco Day	May 31
World Environment Day	June 5
World Ocean Day	June 8
World Population Day	July 11
Ozone Week	Sept. 16–23
World Car-free Day	Sept. 22
Green Consumer Day	Sept. 28
World Farm Animal's Day	Oct. 2
World Habitat Day	Oct. 3
World Animal Welfare Day	Oct. 4
Wildlife Week	Oct. 1–7
World Conservation Day	Oct. 24
International Day for Natural Disaster Reduction	Oct. 13
International Day for Biological Diversity	Dec. 29

Environmental issues received international attention about **35 years back in Stockholm conference, held on 5th June, 1972**. Since then we celebrate **World Environment Day on 5th June**.

Importance

- Environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.
- World population is increasing at an alarming rate especially in developing countries and the resulting increase in material consumption and technological development have increased the rate and scale of degradation of the environment.
- The natural resources endowment in the earth is limited.
- The methods and techniques of exploiting natural resources are advanced.
- The unplanned exploitation of natural resources leads to pollution of all types and at all levels.
- The pollution and degraded environment seriously affect the health of all living things on earth, including man.
- Education and training are needed to save the biodiversity and species extinction.

Multidisciplinary nature of Environmental studies

Environmental studies deal with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity.

Its components include

1. Biology
2. Geology
3. Chemistry
4. Physics
5. Engineering
6. Sociology
9. Economics
10. Statistics
11. Philosophy

Keeping in view the complex nature of environment, knowledge inputs from various disciplines of science, social science, law and engineering are included in Environmental studies.

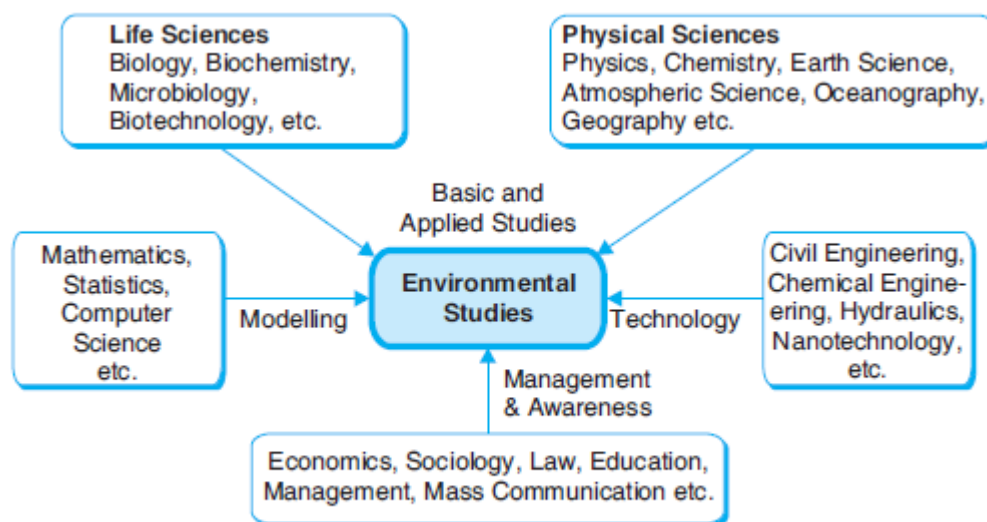


Fig 1.2 Multidisciplinary nature of environmental studies.

- Life sciences including botany, zoology, microbiology, genetics and biochemistry help in understanding the biotic components and their interactions. Genetics and biotechnology are emerging as useful tools for finding solutions to environmental problems.
- For understanding the physical and chemical structure of abiotic components of environment along with mass and energy transfers we have to make use of the basic concept of physics, chemistry, geology, atmospheric science, oceanography and geography.

- Mathematics, statistics and computer science likewise serve as effective tools in environmental modeling.
- Subjects like economics, management and sociology provide the inputs for dealing with the socio-economic aspects associated with various development activities.
- A synthesis of civil engineering, hydraulics, chemical engineering and nanotechnology provide the technical solutions to environmental pollution control and waste treatment that are extremely important for protection of the environment.
- Environmental laws provide the guidelines and legal measures for effective management and protection of the environment.
- Environmental education and mass communication are two important subjects that are instrumental in disseminating environmental awareness.
- Philosophers examine how we value our environment,

Environmental sciences, therefore is a multi-disciplinary subject where we deal with different aspects using a holistic approach.

FOOD CHAIN & FOOD WEB

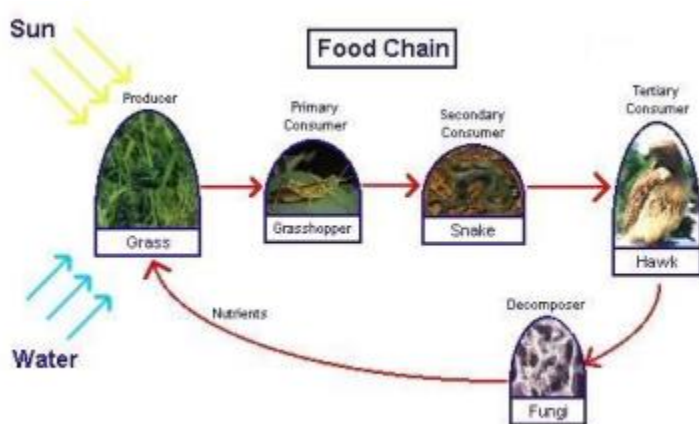
The chain of energy transferring from one species to another can continue several more times, but it eventually ends. It ends with the dead animals that are broken down and used as food or nutrition by bacteria and fungi. As these organisms, referred to as decomposers, feed from the dead animals, they break down the complex organic compounds into simple nutrients.

FOOD CHAIN

Food chains are the functional properties of ecosystems which make them dynamic.

The transfer of energy from one trophic level (eg. Producers) to the next trophic level (eg. Consumers) is called food chain.

Sun light → Plants (Producers) → Herbivores (Primary Consumers) → Carnivores (Secondary consumers)



Some of the examples of food chain

Eagle (C2)
↑
Snake (C1)
↑
Rat (H)
↑
Herbs & Shrubs (P)

Crane (C2)
↑
Fish (C1)
↑
Zooplankton (H)
↑
Phytoplankton (P)

Tiger (C)
↑
Deer (H)
↑
Plants (P)

There are two types of food chains

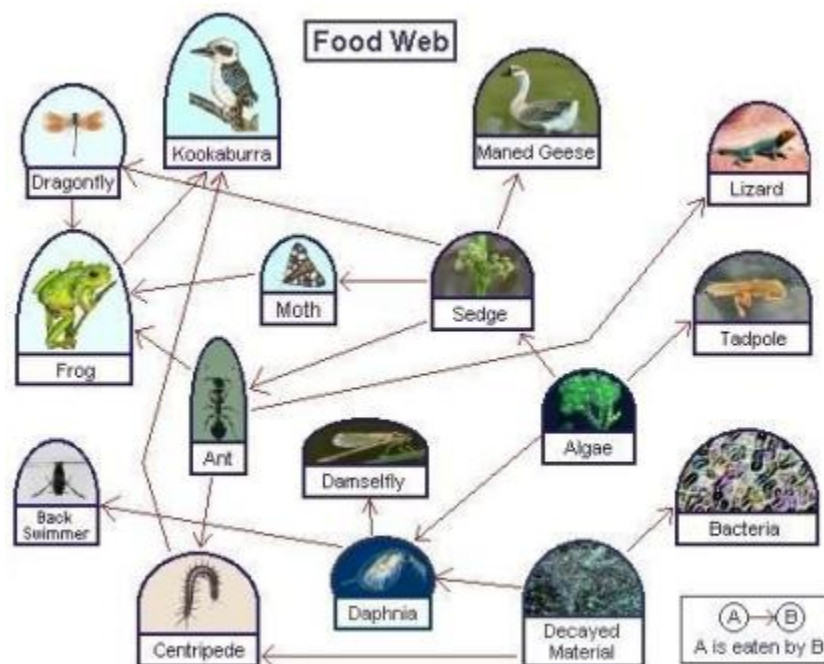
1. Grazing food chains: which starts from the green plants that make food for herbivores and herbivores in turn for the carnivores.
2. Detritus food chains: which starts from the dead organic matter and passes through detritus – feeding organisms which in turn make food for protozoan to carnivores etc.

FOOD WEB

Various food chains are often inter-linked at different trophic levels to form a complex interaction between different species from the point of food. Such interconnected matrix of food chains is called food web.

Eg. A specific herbivore of one food chain may serve as food of carnivores of several other food chains.

(One animal may be a member of several different food chains)

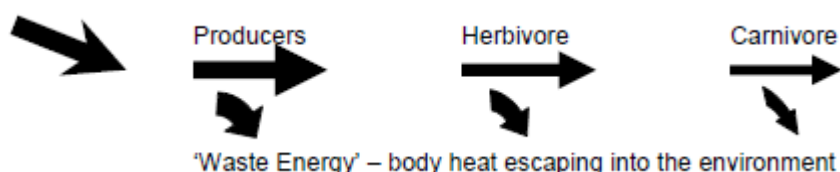


ENERGY FLOW AND MATERIAL CYCLING IN ECOSYSTEM

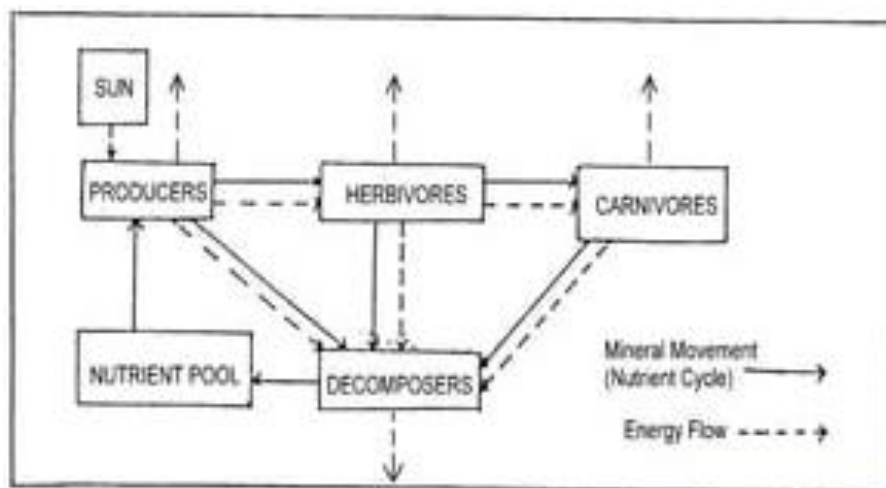
Three Sources of Energy

Three sources of energy account for all the work of the ecosystem. These sources are Gravitation, Internal forces within the earth and solar radiation. The last one is significant for ecosystem. The solar radiation, which originates from sun, is the source of energy for life.

Ecosystems get energy originally from the Sun through the process of **photosynthesis**. Light energy is used by plants to make food, which contains the chemical energy that plants use for their life functions. 90% of this energy is used by the plant and the remaining 10% is available to the herbivore that eats the plant. The herbivore uses 90% of this energy to maintain life functions and provides the remaining 10% to the carnivore. Most of the energy is used to maintain body heat, which escapes into the environment and cannot be used. The flow of energy is one way.



ENERGY FLOW AND MINERAL CYCLING



In the ecosystem, the unidirectional flow of energy and the cycling of nutrient elements proceed concurrently. The flow of energy has been described as **uni-directional** and **non-cyclic**. Whereas the decomposer mineralization activity is the movement of nutrients in **cycle**. From energy flow point of view, it is essential to understand in an ecosystem:

- ❖ The producer efficiency in absorption and conversion of solar energy
- ❖ Utilization of this converted chemical form of energy by the consumers

- ❖ Total energy input in the form of food and its efficiency of assimilation (absorption)
- ❖ The losses through heat, respiration etc and
- ❖ The net production

BIODIVERSITY AND THREATS TO BIODIVERSITY

Biodiversity is the vast range of all the species of plants, animals, insects and the microorganisms inhabiting the earth either in the aquatic or the terrestrial environments.

The variety and variability of organisms and ecosystems is referred to as biological diversity. The term biodiversity is a short form of the term biological diversity.

Importance of Biodiversity

- Biodiversity influences the water cycle and biogeochemical cycles in the ecosystem.
- Biodiversity is the biological wealth of a country or region.
- The human civilization depends directly or indirectly upon the biodiversity for their very basic needs of survival—food, fodder, fuel, fertilizer, timber, liquor, rubber, leather, medicines and several raw materials.

Levels of Biodiversity

The different types of biodiversity are:

1. **Genetic diversity:** Genetic diversity refers to the variations in the number and types of genes present within the same species. In short, it refers to the variations in genes within a species. Genes are the basic source of biodiversity.

For example, India has more than 50,000 genetically different strains of rice, and 1,000 varieties of mango.

2. **Species Diversity:** Species diversity refers to the variety of species inhabiting a region. In other words, it means the variety of different types of living things on earth such as plants, bacteria, fungi, insects, mammals, etc. within a region.

3. **Ecological Diversity:** Ecosystem diversity shows variations in ecological resources, trophic structure, food webs, nutrient cycles, etc. In other words, it refers to the differences in habitats and biological communities.

For example: This includes the different types of forests, grass lands, wet lands, water bodies like streams, lakes and oceans, coral reefs, rocky mountains etc.

Value of Biodiversity

1. Consumptive use value

Consumptive use value is the direct use value. i.e it is used for direct human consumption. Such as food, drugs, fuel, fiber, etc.

2. Productive use value:

Productive use value is the commercially usable value, i.e., the product can be marketed and sold. Animal products like tusks of elephants, musk from musk deer, silk from silkworms, wool from sheep, fur from fur-bearing animals, etc. can be traded in the market many industries are dependent upon the productive use value biodiversity, e.g. paper industry, plywood industry, textile industry, leather industry, etc.

3. Social Value:

Social value is the value associated with the social life, customs, religion and psycho-spiritual aspects of the people. Many of the plants are considered holy and sacred in our country, e.g., tulsi (holy basil), peepal, neem, mango, lotus etc. The leaves, flowers and fruits of these plants are used in worship, social life and customs. Many animals like cow, snake, bull, peacock, owl, etc. have significance in our psycho-spiritual arena and thus hold special importance.

4. Ethical value:

Ethical value sometimes known as existence value involves ethical issues like "all life must be preserved". It is based on the concept 'live and let live', If we want our human race to survive, then, we must protect our biodiversity, because biodiversity is valuable to man. Man holds great responsibility towards preserving and conserving other organisms.

5. Aesthetical Value:

The earth's natural beauty has always inspired man from time immemorial. The diverse plant life and its innumerable and diverse fauna bring the earth to life.

For instances, Nobody likes to visit vast stretches of barren lands with no signs of visible life. People spend a lot of time and money to visit only places where they can enjoy the anesthetic value of biodiversity.

THREATS TO BIODIVERSITY

- Overexploitation of natural resources and destruction of ecosystems for meeting the human requirements of food, shelter and comfort.
- Environmental pollutants like pesticides, heavy metals, chlorinated hydrocarbons, acid rain, global warming etc.
- Natural causes like earthquakes, floods, droughts, forest fires.
- Hunting for pleasure and poaching for commercial purposes of certain animal species like elephants, rhinos, whales, crocodile, snakes etc.
- Habitat Loss and Fragmentation - The destruction of habitats like cutting down trees, ploughing a grassland or burn a forest is the primary reason for the loss of biodiversity.
- Pollution - Species in habitats are increasingly being harmed by industrial activities and pollution from excessive use of agro-chemicals such as DDT, oil spills, acid precipitation etc.
- Introduced species / biological invasions - Species introduced in an ecosystem will cause changes in the ecosystem. Introduced species are organisms arising in areas/ habitats in which they were previously not native. Such introduced species are usually referred to as biological pollutants.

CONCEPT OF SUSTAINABLE DEVELOPMENT

By 2050, our planet will need to support some ten billion people compared to about six billion today. This raises huge challenges in food, clothing and shelter for the rapidly growing population without depleting the world's resources. Thus sustainable development is required to the society for balancing economic and managing resources efficiently.

DEFINITION

It is defined as the "Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs."

OBJECTIVES OF SUSTAINABLE DEVELOPMENT:

- (1) To promote equity (Social justice and equal opportunities to all).
- (2) To improve the quality of human life (Satisfaction of basic needs, education and employment).
- (3) Sustainable use of natural resources.
- (4) Protecting the Ecosystem.
- (5) Economic efficiency and growth of trade and commerce.
- (6) Considering environment in decisions (effectively involved in decision-making, concerned about their future).
- (7) Long-term planning and implements.
- (8) Zero pollutant emissions from the industrial process (Survival of human beings in a pollution free environment).

Factors Affecting Sustainable Development:

- (1) Excessive exploitation of Exhaustible resources.
- (2) Increasing population growth and population density.
- (3) Decreasing gross domestic product per capita.
- (4) Uncontrolled consumption of energy and environmental.
- (5) Pollution.
- (6) Weakening of land.

APPLICATIONS / STEPS TOWARDS SUSTAINABLE DEVELOPMENT:**1. Purchasing and Administrative Services**

- Only buy what you need.
- Implement an environmentally-friendly product.
- Buy products that are durable, reusable, recyclable, made from recycled materials or easily and sustainably disposed of.
- Buy products that are produced in an environmentally sound manner from companies that operated in an environmental responsible manner.

2. Solid Waste Reduction and Recycling:

- Reduce, Reuse, Recycle and Recover approach (4-R Approach).
- Expand recycling programs to include various papers, cardboard, metal/glass/plastic containers.
- Print two sides, reuse scrap paper

3. Energy Conservation

- Create a data base to tracks energy use, energy cost and resulting emissions.
- Organize energy conservation programs

- Encourage incoming students to purchase energy efficient products and conserve energy.

4. Water and Waste Water Management

- Implement a program to report, respond and repair leaks and faulty plumbing equipment.
- Use drought resistant plantings to minimize irrigation needs
- Consider capturing rainwater for irrigation or domestic water uses (Rain water harvesting).

5. Hazardous Waste Management

- Proper handling, collection, disposal and tracking minimum requirements.
- Educate campus hazardous waste generators about minimization and proper disposal techniques.
- Switch to non/least toxic paints, solvents and cleaning agents.

6. Transportation

- Encourage to travel by carpools or use of public transport.
- Develop and encourage public transportation between frequently visited locations.
- Encourage bicycling and walking.
- Minimize vehicle traffic
- Convert to alternative fuel, such as natural gas, electric and biodiesel.

7. Food and Food Service

- Promote eating "low on the food chain" for health and environmental reasons. A diet rich in fruits, vegetables and grains is healthier and easier on the planet.
- Minimize the use of disposable and throw away trays, plates cups and flatware

Multiple choice questions:

1. The environmental which has been modified by human activities is called
 - a. Natural environment
 - b. Anthropogenic environment**
 - c. Urban environment
 - d. Modern environment
2. The study of interactions between living organisms and environment is called as
 - a. Ecology**
 - b. Ecosystem
 - c. Phytogeography
 - d. Phytosociology
3. Which of the following is an ecosystem?
 - a. Forest
 - b. Desert
 - c. Mountain
 - d. All**
4. A trophic level of organism represents
 - a. An organisms position in a biome
 - b. An organisms position in a food chain**
 - c. Group of organisms in the food chain
 - d. An organisms position in an ecosystem
5. Physical environment includes
 - a. Hydrosphere
 - b. Lithosphere
 - c. Atmosphere
 - d. All**
6. Environment means
 - a. Surrounding in which organisms live**
 - b. Atmosphere around one self
 - c. Sum total of social, economical, biological behavior of animals
 - d. Sum total of developmental activities around
7. Which of it is not an example for an ecosystem
 - a. Forest
 - b. Desert
 - c. Water**
 - d. Grassland
8. Nutrient cycling is most related to appropriately
 - a. Energy, waste, nutrients
 - b. Autotrophs, nutrients, decomposers**
 - c. Light, weight, nutrients
 - d. None of these

9. Which of the following is not a part of atmosphere

- a. Heterosphere
- b. Mesosphere
- c. Biosphere**
- d. Stratosphere

10. Habitat refers to

- a. Physical conditions of the place where organism live
- b. Chemical conditions of the place where organism live
- c. Both (a) and (b)**
- d. Neither (a) nor (b)

11. The organisms who directly feed on producers are called

- a. Herbivores**
- b. Carnivores
- c. Decomposers
- d. Saprophytes

12. The sequence of eating and being eaten in an ecosystem is called

- a. Food chain**
- b. Carbon cycle
- c. Hydrological cycle
- d. Anthroposystem

13. _____ is termed as the life zone of the earth.

- a. Atmosphere
- b. Hydrosphere
- c. Biosphere**
- d. Stratosphere

14. Decomposers are

- a. Fungi and plants
- b. Fungi and bacteria**
- c. Animal and plants
- d. Fungi and animal

15. The term 'Environment' has been derived from the French word which means to encircle or surround

- a. Environ**
- b. Oikos
- c. Geo
- d. Aqua

16. In an ecosystem, the flow of energy is

- a. Bidirectional
- b. Cyclic
- c. Unidirectional**
- d. Multidirectional

17. In aquatic ecosystem phytoplankton can be considered as a

a. Consumer

b. Producer

c. Saprotrophic organisms

d. Macro consumer

18. The basic requirements of human beings are provided by

a. Industrialization

b. Agriculture

c. Nature

d. Urbanization

19. Environment is the life support system that includes

a. Air

b. Water

c. Land

d. All of the above

20. In an ecosystem biological cycling of materials is maintained by

a. Producer

b. Consumer

c. Decomposer

d. All of the above

21. Organisms which feed directly or indirectly on producers are called

a. Prey

b. Consumers

c. Decomposers

d. Herbivores

22. Abiotic component includes

a. Soil

b. Temperature

c. Water

d. All of the above

23. The word 'Environment' is derived from

a. Greek

b. French

c. Spanish

d. English

24. World Environment day is on

a. 5th May

b. 5th June

c. 18th July

d. 16th August

25. A food web consist of

a. A portion of a food chain

b. An organisms position in a food chain

c. Interlocking of food chains

d. A set of similar consumers

26. Biosphere is

a. The solid shell of inorganic materials on the surface of the earth

b. The thin shell of organic matter on the surface of earth comprising of all the living things

c. The sphere which occupies the maximum volume of all the spheres

d. All of the above

27. Sustainable development will not aim at

a. Social economic development which optimizes the economic and societal benefits available in the present, without spoiling the likely potential for similar benefits in the future

b. Reasonable and equitably distributed level of economic well being that can be perpetuated continually

c. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs

d. Maximizing the present day benefits through increased resource consumption

28. The main impact of urbanization on plant and animal is

a. Increase in species

b. Loss of species

c. Mutation in species

d. Both (b) and (c)

29. The food chain in which microorganisms breakdown dead producers is called

a. Consumer food chain

b. Predator food chain

c. Parasitic food chain

d. Detritus food chain

30. The natural world in which people, animals and plants live in is

a. Atmosphere

b. Hydrosphere

c. Biosphere

d. Lithosphere

31. Herbivores are _____ consumers in the food chain

a. Producers

b. Primary

c. Secondary

d. Tertiary

32. Material flow in an ecosystem

a. Bidirectional

b. Cyclic

c. Unidirectional

d. Multidirectional

33. Dead plant parts and animals remains are called

a. Producers

- b. Consumers
- c. Decomposers**
- d. All of the above

34. Tendency of pollutants to become concentrated in successive trophic levels is known as

- a. Bio-magnification**
- b. Bio-remediation
- c. Bio-accumulation
- d. All

35. Preserving resources for the future generation is known as

- a. EIA
- b. Bio-diversity**
- c. Sustainable development
- d. None of the above

36. _____ is the main source of energy on Earth.

- a. Plant
- b. Water
- c. Soil
- d. Sun**

37. Biodiversity includes _____ component of environment

- a. Abiotic
- b. Biotic**
- c. Both (a) and (b)
- d. None of the above

38. The French word "environ" means

- a. Earth
- b. Surround**
- c. Atmosphere
- d. Biotic

39. The primary source of all energy forms on the earth is

- a. Minerals
- b. Water
- c. Wind
- d. Sun**

40. _____ colour has become established as a sign of conservation of environment

- a. Blue
- b. Green**
- c. Yellow
- d. White

Answer the following questions:

1. Define Environment. Explain components of environment and their interactions.
2. Explain importance of environmental studies.
3. What do you mean by multidisciplinary nature of Environmental studies.
4. Explain food chain & food web with examples.
5. Explain how energy and material flow in an ecosystem.
6. Define Bio-diversity. What are the threats to Bio-diversity?
7. What are the types and values of Bio-diversity.
8. Define sustainable development and list the objectives.
9. Enlist the factors affecting sustainable development.
- 10 Describe the steps towards sustainable development.