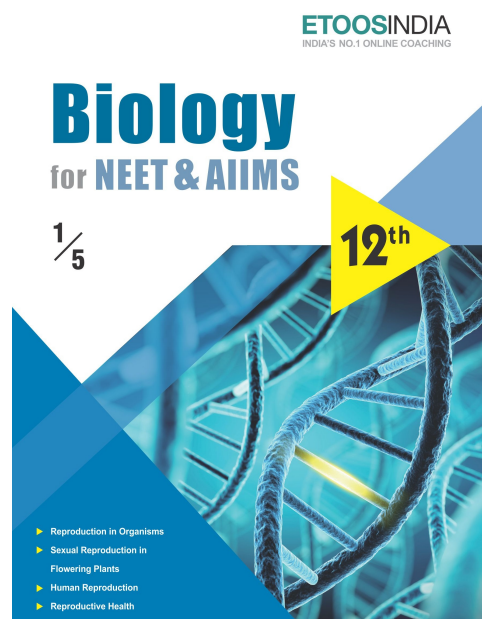
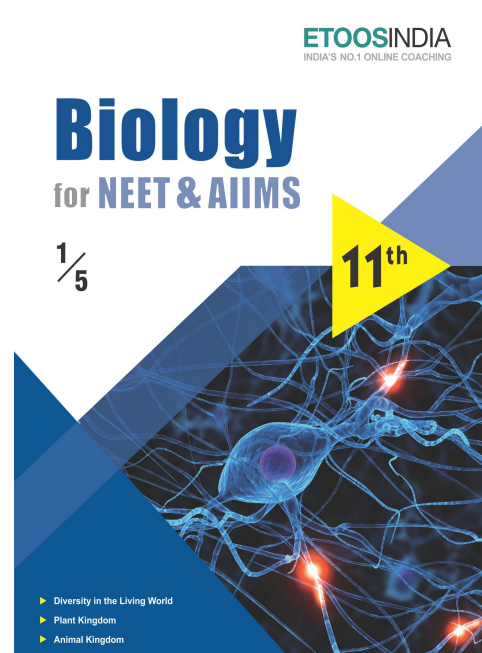
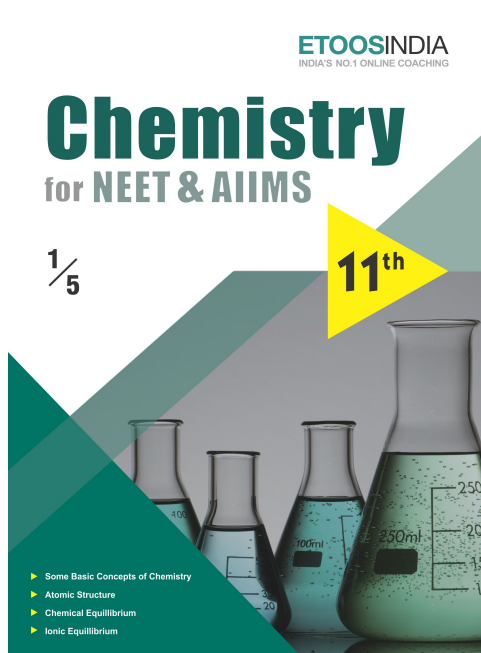
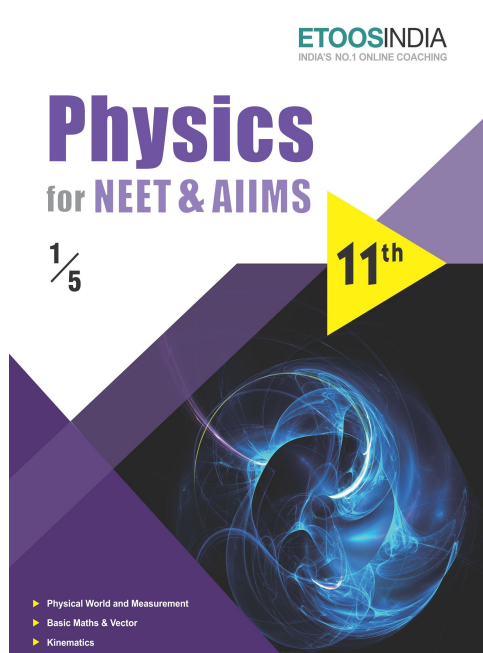


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# ECOSYSTEM

*“We must trust to nothing but facts: These are presented to us by Nature, and cannot deceive. We ought, in every instance, to submit our reasoning to the test of experiment, and never to search for truth but by the natural road of experiment and observation.”*

“ANTOINE LAVOISIER (1743-1794)”

## INTRODUCTION

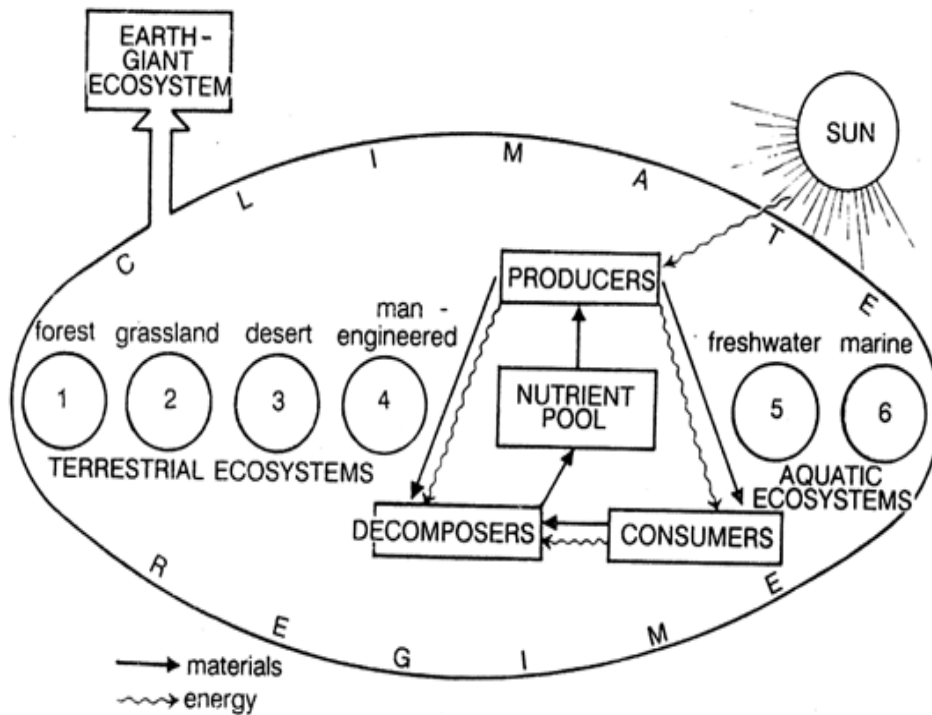
**E**cosystem can be visualized as a functional unit of nature which varies greatly in size from a small pond to a large forest or a sea. Many ecologists regard the entire biosphere as a global ecosystem, as a composite of all local ecosystems on earth. A wide range of living organisms are present on earth's surface. All living organisms such as plants, animals and microorganisms interact among themselves and also with the surrounding physical environment and maintain a balance in nature. This forms a self-sustaining or functional unit of the living world known as **Ecosystem**. This system is too much big so that is why it is divided into two parts: terrestrial and aquatic. Forest, grasslands and desert are examples of terrestrial ecosystems; pond, lake, wetland, river and estuary are examples of aquatic ecosystems.

This chapter gives us an overview of different types of ecosystems, structural as well as functional aspects related to productivity, energy flow, decomposition, ecological efficiencies, nutrient cycling.

# Ecosystem

## Introduction

- **A.G.Tansley** - The term "Ecosystem" first of all coined by A.G. Tansley.  
According to Tansley - Ecosystem is symbol of structure and function of nature.
- **E.P.Odum** - Father of ecosystem ecology.  
According to E.P.Odum - Ecosystem is the smallest structural and functional unit of nature or environment.
- **Karl Mobius** - Used term **Biocoenosis** for ecosystem.
- **Thienmann** - Used term **Biosystem** for ecosystem.
- **Sukhachov** - Used term **Biogeocoenosis** for ecology.
- **Misra** - Used term **Ecosom** for ecosystem.
- **Forbes** - Used term **Microcosom** for ecosystem. For artificial ecosystem in laboratory.



- **Definition** - Total living (biotic) and non living (abiotic) components of the environment present in a particular area is called ecosystem.
- In any ecosystem, communities or living organisms interact with their physical environment in such a way that there is a well defined flow of energy forming clear **trophic (food) levels** and **material cycles** within this ecosystem.
- Ecosystem is normally an open system because there is a continuous and variable entry and loss of **energy** and **materials**.
- An ecosystem may be small like a drop (microsystem) of water and as large as sea or tract of forest.
- An ecosystem may be temporary as a fresh water pool or a field or permanent like a forest or sea.
- Thus any area of nature that includes living organisms and nonliving substances interacting, so that a **flow of energy** leads to characteristic **trophic structures** and **cycling of materials** makes the ecosystem.



**ETOOS KEY POINTS**

(i) **Ecological efficiency** - The percentage of energy transferred from one trophic level to the next is called ecological efficiency or food chain efficiency.

$$E.E = \frac{\text{Energy in biomass production at a trophic level}}{\text{Energy in biomass production at previous trophic level}} \times 100$$

(ii) **Assimilation efficiency** - It is the production of consumed energy that is assimilated.

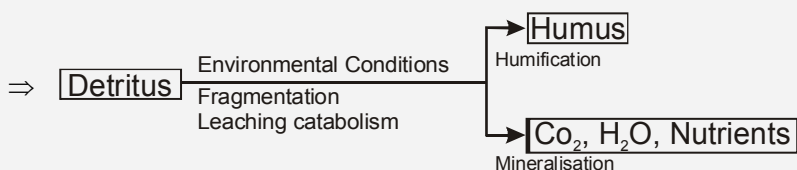
$$A.E. = \frac{\text{Food energy assimilated}}{\text{Food energy ingested}} \times 100$$

(iii) **Net production efficiency** -

$$N.P.E. = \frac{\text{Net primary productivity}}{G.P.P.} \times 100$$

(iv) **Photosynthetic efficiency** -

$$P.E. = \frac{G.P.P.}{\text{Incident total solar radiation}} \times 100$$



- Ecology is a subject which studies the interactions among organisms and between the organism and its physical (abiotic) environment.
- Key elements that lead to so much variation in the physical and chemical conditions of different habitats are temperature, water, light and soil.
- The productivity and distribution of plants is also heavily dependent on water.
- The salt concentration (measured as salinity in parts per thousand) is less than 5 percent in inland water 30-35 percent in the sea water and > 100 percent in some hypersaline lagoons) Some organisms are tolerant of a wide range of salinities (euryhaline) but other are restricted to a narrow range (stenohaline).
- Regulate : Some organisms are able to maintain homeostasis by physiological (sometimes behavioural also) means which ensures constant body temperature, constant osmotic concentration.
- Conform : An overwhelming majority (99 percent) of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration.
- Heat loss or heat gain is a function of surface area. Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside then they have to expend much energy to generate body heat through metabolism. This is the main reason why very small animals are rarely found in polar regions.
- If the stressful external conditions are localised or remain only for a short duration, the organism has two other alternatives. (i) Migration (ii) Suspension
- Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.
- Adaptation is any attribute of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat.
- Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (This is called the Allen's Rule).
- The body compensates low oxygen availability by increasing red blood cell production decreasing the binding capacity of haemoglobin and by increasing breathing rate.
- Some organism show behavioural responses to cope with variations in their environment.
- Desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone but move into shade when temperature rise above the comfort zone.
- Some organisms breed only once in their lifetime (Pacific salmon fish, bamboo) while others breed many times during their lifetime (most birds and mammals). Some produce a large number of small-sized offsprings (Oysters, pelagic fishes) while others produce a small number of large-sized offsprings (birds, mammals).
- Life history traits of organisms have evolved in relation to the constraints imposed by the a biotic and biotic components of the habitat in which they live.
- Predator acting as contents for energy transfer across tropic level.
- Since the invaded land does not have its natural predators. The prickly pear cactus introduced into Australia in the early 1920's caused havoc by spreading rapidly into millions of hectares of rangeland.
- Biological control methods adopted in agricultural pest control are based on the ability of the predator to regulate prey population. Predators are also help the in maintaining species diversity in a community by reducing the intensity of competition among competing prey species.
- Nearly 25 percent of all insects are known to be phytophagous (feeding on plant sap and other parts of plants) Thorns (Acacia, Cactus) are the most common morphological means of defence .
- Calotropis grow in abandoned fields. The plant produces highly poisonous cardiac glycosides and that is why you will never see any cattle or goat browsing on the plant.
- Competition : Competition occurs when closely related species compete for the same resources that are limiting.
- Resources need not be limiting for competition to occur, in interference competition, the feeding efficiency of one

**SOLVED EXAMPLE**

**Ex.1** In an aquatic ecosystem, the trophical level equivalent to cows in grassland is

- (A) Phytoplankton                      (B) Zooplankton  
(C) Nekton                                (D) Benthos

**Sol.** (B)

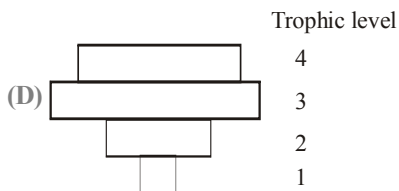
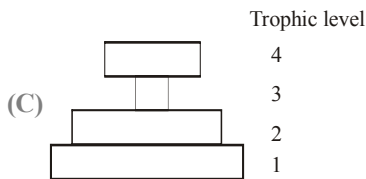
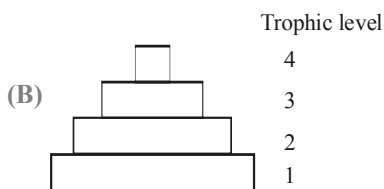
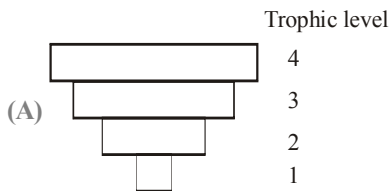
**Ex.2** When peacock eats snakes which eat insects thriving on green plants, the peacock is

- (A) A primary consumer  
(B) A primary decomposer  
(C) Final decomposer  
(D) The apex of food pyramid

**Sol.** (D) : Because Peacock is the top consumer

**Ex.3** Two food chains are given below  
Tree → aphid → insectivorous bird → bird of prey  
→ carnivorous fish

Which diagram is a pyramid of energy representing both food chains

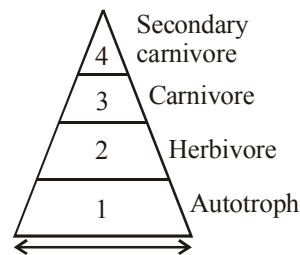


**Sol.** (B)

**Ex.4** Using the figure, determine which animals would be found in the same trophic level

A. Trophic level Trophic level	Feeding strategy	Grazing food chain	Decomposer food chain
4	Secondary carnivore	Cooper's hawk	Owl
3	Carnivore	Robin	Shrew
2	Herbivore	Cricket	Earthworm
1	Autotrophs	Maple tree leaves	Dead maple leaves

**B. Pyramid of productivity**



- (A) Humans and horses  
(B) Eagles and blue jays  
(C) Pine trees and garden snakes  
(D) Cricket and cows

**Sol.** (D)

**Ex.5** In a food chain herbivores are

- (A) Primary producers  
(B) Primary consumers  
(C) Secondary consumers  
(D) Decomposers

**Sol.** (B) : Primary consumers or herbivores of first order are depend upon producers or green plants for their food.

**Ex.6** Of the total incident solar radiation the proportion of PAR is

- (A) More than 80 %                      (B) About 70 %  
(C) About 60 %                          (D) Less than 50 %

**Sol.** (D) : Plants capture 2-10 % of PAR

**Ex.7** Plants growing on sandstone are

- (A) Psammophytes                      (B) Oxylophytes  
(C) Lithophytes                          (D) Phanerophytes

**Sol.** (C)

**Exercise # 1**

**SINGLE OBJECTIVE**

**NEET LEVEL**

1. In a pond if there is too much wastage, then the BOD of pond will  
 (A) Increase (B) Decrease  
 (C) Remain same (D) (A) and (B) both
2. Which of the following abundantly occurs in pond ecosystem  
 (A) Producer (B) Consumer  
 (C) Top consumer (D) Decomposers
3. If all decomposers are removed from an ecosystem, what will happen  
 (A) All consumers will die  
 (B) Energy cycle will be affected  
 (C) Balance of biogeochemical cycle will be disturbed  
 (D) Only herbivores will die
4. Which of the following is the most stable ecosystem  
 (A) Mountain (B) Desert  
 (C) Forest (D) Ocean
5. In a biotic community, primary consumers are  
 (A) Omnivores (B) Carnivores  
 (C) Detritivores (D) Herbivores
6. Which of the following does not effect the forest ecosystem  
 (A) Deforestation (B) Soil erosion  
 (C) Climatic variation (D) None of these
7. The pyramid of energy in a forest ecosystem is  
 (A) Always upright  
 (B) Always inverted  
 (C) Both upright and inverted  
 (D) None of the above
8. In an ecosystem, there is flow of energy at different trophic levels. This is as follows :  
 (A) Primary consumers - Tertiary consumers - Secondary consumers - Decomposers - Producers  
 (B) Producers - Primary consumers - Secondary consumers - Tertiary consumers - Decomposers  
 (C) Producers - Decomposers - Primary consumers - Tertiary consumers - Secondary consumers  
 (D) Producers - Primary consumers - Tertiary consumers - Secondary consumers - Decomposers
9. We refer to the following as the food chain  
 (A) Large number of animals near a source of food  
 (B) Transfer of food energy from the green plants through a series of consumer organisms  
 (C) Large number of human beings forming a human chain near a source of food  
 (D) None of these
10. In a food chain, lion is a  
 (A) Secondary consumer (B) Primary consumer  
 (C) Tertiary consumer (D) Secondary producer
11. In a pond ecosystem, benthos means  
 (A) Primary consumers in the depth of a pond  
 (B) Zooplankton on the water surface  
 (C) Periphyton  
 (D) Epineuston
12. Transfer of energy from one trophic level to other trophic level is according to the second law of thermodynamics. The efficiency of energy transfer from herbivorous to carnivorous is  
 (A) 25% (B) 50%  
 (C) 10% (D) 5%
13. In a food chain, which of the following produces in the largest amount  
 (A) Producers (B) Decomposers  
 (C) Tertiary consumers (D) Primary consumers
14. If forest area is reduced to half, which one of the following will be a long term effect  
 (A) The natives (tribals) of that area will die on account of hunger  
 (B) Cattles of that area will die due to scarcity of fodder  
 (C) To diversity in germplasm will effect the crop breeding  
 (D) It will be converted into large desert
15. The first link in any food chain is always a green plant because  
 (A) They are widely distributed  
 (B) They are firmly fixed to the soil  
 (C) They alone have a capacity to fix atmospheric CO<sub>2</sub> in the presence of sunlight  
 (D) All of the above
16. Food levels in an ecosystem are called  
 (A) Trophic levels (B) Consumer levels  
 (C) Producer levels (D) Herbivore levels

**Exercise # 2****SINGLE OBJECTIVE****AIIMS LEVEL**

1. Food chain consists of  
(A) Producer, consumer and decomposer  
(B) Producer, carnivore and decomposer  
(C) Producer and primary consumer  
(D) Producer, herbivore and carnivore
2. Animals which live at the bottom of sea are  
(A) Nekton (B) Diatom  
(C) Banthos (D) Plankton
3. Green plants are  
(A) Autotrophs (B) Heterotrophs  
(C) Chemotrophs (D) None of these
4. Pyramid of energy is  
(A) Upright (B) Inverted  
(C) Oblique (D) None of these
5. The flora and fauna in lakes or ponds are  
(A) Lentic biota (B) Lotic biota  
(C) Abiotic biota (D) Field layer
6. During food chain the maximum energy is stored in  
(A) Producers (B) Decomposers  
(C) Herbivores (D) Carnivores
7. Transition zone between two ecosystems or vegetational regions is termed  
(A) Ecocline (B) Ecotone  
(C) Ecad (D) Barrier
8. The ecosystem consists of  
(A) Producers (B) Consumers  
(C) Decomposers (D) All of these
9. In a food chain, the total amount of living material is depicted by  
(A) Pyramid of energy (B) Pyramid of numbers  
(C) Pyramid of biomass (D) All of these
10. The biotic part of ecosystem includes  
(A) Producers (B) Consumers  
(C) Decomposers (D) All of these
11. When the number of organisms at successive levels are plotted, they assume the shape of a pyramid. This is called the pyramid of  
(A) Energy (B) Number  
(C) Biomass (D) Both (A) and (C)
12. The two vegetation of ecosystem are separated by  
(A) Ecotone (B) Ecoline  
(C) Ecosystem (D) Ecesis
13. Energy enters into the ecosystem through  
(A) Herbivores (B) Carnivores  
(C) Producers (D) Decomposers
14. Which of the following is an artificial ecosystem  
(A) Rice-field (B) Forest  
(C) Grassland (D) Lake
15. Which are the biotic components of forest ecosystem  
(A) Producers (B) Decomposers  
(C) Consumers (D) All of the above
16. Which of the following is most important abiotic factor in pond ecosystem  
(A) Water (B) Phytoplankton  
(C) Zooplankton (D) Temperature
17. The bacteria that attack dead organic matter are  
(A) Producer (B) Herbivore  
(C) Carnivores (D) Decomposers
18. 10% law of flow of energy in ecosystem was proposed by  
(A) Lindemann (B) Carl Mobius  
(C) Tensely (D) Darwin
19. A plant being eaten by a herbivorous which in turn is eaten by a carnivorous makes  
(A) Food chain (B) Food web  
(C) Omnivorous (D) Interdependent
20. When peacock eats snakes which eat insects thriving on green plants, the peacock is  
(A) A primary consumer  
(B) A primary decomposer  
(C) Final decomposer  
(D) The apex of food pyramid
21. Acacia arabica is a  
(A) Mesophyte (B) Hydrophyte  
(C) Xerophyte (D) Halophyte
22. Casuarina equisetifolia is a  
(A) Mesophyte (B) Xerophyte  
(C) Halophyte (D) Forest epiphyte
23. The plants in which vascular tissues are absent and well developed aerenchyma is present, are  
(A) Xerophytes (B) Halophytes  
(C) Hydrophytes (D) Mesophytes



**Exercise # 3**

**PART - 1**

**MATRIX MATCH COLUMN**

1. Match Column - I (Indian forest types) with Column - II (dominant tree genera) and choose the correct option

**Column - I**

- (A) Tropical rain forest
- (B) Tropical deciduous
- (C) Temperate broad leaf forest
- (D) Temperate coniferous forest

- (A) A - 1, B - 2, C - 3, D - 4
- (C) A - 3, B - 2, C - 1, D - 4
- (E) A - 4, B - 3, C - 2, D - 1

**Column - II**

- (1) Hopea
- (2) Shoera
- (3) Quercus
- (4) Picea
- (B) A - 2, B - 1, C - 4, D - 3
- (D) A - 1, B - 2, C - 4, D - 3

2. Match Column - I with Column - II and choose the correct answer from the code given below.

**Column - I**

- (A) Population
- (B) Community
- (C) Ecosystem
- (D) Ecosphere

- (A) A - (iii), B - (ii), C - (i), D - (v)
- (C) A - (ii), B - (iii), C - (i), D - (iv)

**Column - II**

- (i) Part of the earth consisting of all the ecosystems of the world
- (ii) Assemblage of all the individuals belonging to different species occurring in an area
- (iii) Group of similar individuals belonging
- (iv) Interaction between the living organisms and their physical environment
- (v) Classification of organisms based on the type of environment

- (B) A - (iv), B - (v), C - (iii), D - (i)
- (D) A - (iii), B - (ii), C - (iv), D - (i)

3. Match Column - I with Column - II and choose the correct answer from the code given below.

**Column - I**

- (A) Gross primary productivity
- (B) Net primary productivity
- (C) Pond
- (D) Aquarium
- (E) Decomposition

- (A) A - (iv), B - (ii), C - (i), D - (iii), E - (v)
- (C) A - (i), B - (iii), C - (ii), D - (iv), E - (v)

**Column - II**

- (i) Self-sustainable ecosystem
- (ii) Aquatic
- (iii) O<sub>2</sub> requiring process
- (iv) Photosynthetic production
- (v) Available to secondary consumers

- (B) A - (iv), B - (v), C - (i), D - (ii), E - (iii)
- (D) A - (ii), B - (i), C - (iii), D - (v), E - (iv)

4. Match Column - I with Column - II and choose the correct answer from the code given below.

**Column - I**

- (A) Gross primary products
- (B) Secondary productivity
- (C) Transducers
- (D) Food web

- (A) A - (i), B - (ii), C - (iii), D - (iv)
- (C) A - (iii), B - (iv), C - (i), D - (ii)

**Column - II**

- (i) Green plants
- (ii) Rate of synthesis of organic matter by consumers
- (iii) Total organic matter produced from solar energy
- (iv) Interlocking pattern

- (B) A - (iii), B - (ii), C - (i), D - (iv)
- (D) A - (ii), B - (i), C - (iv), D - (iii)

**Exercise # 4**

**PART - 1**

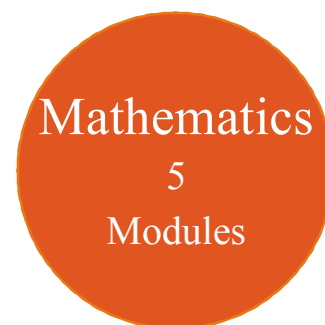
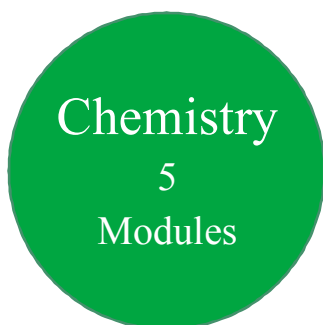
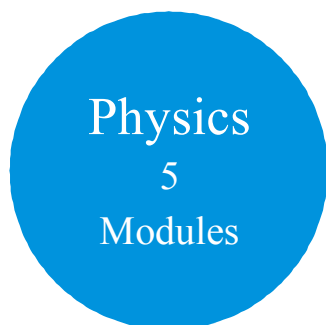
**PREVIOUS YEAR (NEET/AIPMT)**

1. The greatest biomass of autotrophs in the world's oceans is that of
  - (A) Benthic brown algae, coastal red algae and dephnids
  - (B) Benthic diatoms and marine viruses
  - (C) Sea grasses anmd slime molds
  - (D) Free-floating micro-algae, cyanobacteria and nanoplankton
2. Bamboo plant is growing in a far forest then what will be the trophic level of it : -
  - (A) First trophic level (T1)
  - (B) Second trophic level (T2)
  - (C) Third trophic level (T3)
  - (D) Fourth trophic level (T4)
3. Choose the correct match Bladderwert, sundew, venus flytrap : -
  - (A) Nepanthese, Dionea, Drosera
  - (B) Nepanthese, Utricularia, Vanda
  - (C) Utricularia, Drosera, Dionea
  - (D) Dionea, Trapa, Vanda
4. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having -
  - (A) Low stability and high resilience
  - (B) High stability and low resilience
  - (C) Low stability and low resilience
  - (D) High stability and high resilience
5. If by radiation all nitrogenase enzyme are inactivated, then there will be no :-
  - (A) Fixation of nitrogen in legumes
  - (B) Fixation of atmospheric nitrogen
  - (C) Conversion from nitrate to nitrite in legumes
  - (D) Conversion from ammonium to nitrate in soil
6. Which of the following is expected to have the highest value (gm/m<sup>2</sup>/yr) in a grassland ecosystem : -
  - (A) Secondary production (SP)
  - (B) Tertiary production (TP)
  - (C) Gross production (GP)
  - (D) Net production (NP)
7. Which one of the following pairs in mismatched-
  - (A) Biomass burning – Release of CO<sub>2</sub>
  - (B) Nuclear power – Radioactive wastes
  - (C) Solar energy – Green house effect
  - (D) Fossil fuel burning – Release of CO<sub>2</sub>
8. More than 70% of world's fresh water is contained in –
  - (A) Antarctica
  - (B) Glaciers and Mountains
  - (C) Greenland
  - (D) Polar ice
9. Prolonged liberal irrigation of agricultural fields is likely to create the problem of -
  - (A) Acidity
  - (B) Aridity
  - (C) Metal toxicity
  - (D) salinity
10. Which one of the following is not used for construction of ecological pyramids ?
  - (A) Dry weight
  - (B) Number of individuals
  - (C) Rate of energy flow
  - (D) Fresh weight
11. Which one of the following ecosystem types has the highest annual net primary productivity?
  - (A) Tropical rain forest
  - (B) Tropical deciduous forest
  - (C) Temperate evergreen forest.
  - (D) Temperate deciduous forest
12. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this?
  - (I) Lots of urea and phosphate fertilizer were used in the crops in the vicinity
  - (II) The area was sprayed with DDT by an aircraft
  - (III) The lake water turned green and stinky
  - (IV) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis
 Which two of the above were the main causes of fish mortality in the lake?
  - (A) II and III
  - (B) III and IV
  - (C) I and III
  - (D) I and II
13. The slow rate of decomposition of fallen logs in nature is due to their:
  - (A) Low moisture content
  - (B) poor nitrogen content
  - (C) anaerobic environment around them
  - (D) low cellulose content
14. About 70% of total global carbon is found in:
  - (A) Grasslands
  - (B) Agroecosystems
  - (C) Oceans
  - (D) Forests

## MOCK TEST

- The primary producers of the deep-sea hydrothermal vent ecosystem are  
 (A) Green algae (B) Chemosynthetic bacteria  
 (C) Blue-green algae (D) Coral reefs
- The rate of formation of new organic matter by deer in a forest ecosystem is called  
 (A) Standing crop (B) primary productivity  
 (C) Net primary productivity (D) Secondary productivity
- Identify the ecologist from the given hints.  
 (i) He carried out long-term ecosystem experiments using outdoor plots  
 (ii) In his experiments he showed that "increased diversity contributed to higher productivity"  
 (A) Ahmed Khan (B) David Tilman (C) Stanley Cohen (D) Ernest Chain
- Which one of the following is a characteristic feature of cropland ecosystem?  
 (A) Absence of weeds (B) Ecological succession  
 (C) Absence of soil organisms (D) Least genetic diversity
- Which of the following relations is correct regarding GPP and NPP of an ecosystem?  
 (A)  $NPP = GPP - \text{Animal consumption}$  (B)  $NPP = GPP + \text{Plant respiration}$   
 (C)  $NPP = GPP - \text{Plant respiration}$  (D)  $NPP = GPP + \text{Animal consumption}$
- Which of the following statements about productivity is true  
 (A) Primary productivity of all ecosystems is a constant.  
 (B) The annual net primary productivity of the whole of the biosphere is 17 billion tons (dry weight) of organic matter.  
 (C) Net primary productivity is the amount of biomass available for consumption by carnivores.  
 (D) Secondary productivity is defined as the rate of formation of new organic matter by decomposers.  
 (E) Primary productivity depends on the plant species inhabiting a particular area.
- The biomass available for consumption to heterotrophs and the rate of formation of new organic matter by consumers are defined as  
 (A) Gross primary productivity and net primary productivity respectively  
 (B) Net primary productivity and gross primary productivity respectively  
 (C) Gross primary productivity and secondary productivity respectively  
 (D) Net primary productivity and secondary productivity respectively  
 (E) Secondary productivity and net primary productivity respectively.
- The breakdown of detritus into small particles by detritivores is called  
 (A) Leaching (B) Humification (C) Fragmentation (D) Catabolism
- Lindeman for the first time gave energy transfer law, which states that  
 (A) only 20% of the energy is transferred to each trophic level  
 (B) only 10% of the energy is transferred to each trophic level  
 (C) only 30% of the energy is transferred to each trophic level  
 (D) only 50% of the energy is transferred to each trophic level.
- The gross primary productivity of an ecosystem is 170 tons of organic matter and amount used in respiration is 50 tons. Calculate the net primary productivity of the ecosystem  
 (A) 120 tons (B) 100 tons (C) 70 tons (D) 12 tons  
 (E) 17 tons

# 11<sup>th</sup> Class Modules Chapter Details



PHYSICS	CHEMISTRY	BIOLOGY
<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Physical World &amp; Measurements</li> <li>2. Basic Maths &amp; Vector</li> <li>3. Kinematics</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Law of Motion &amp; Friction</li> <li>2. Work, Energy &amp; Power</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Motion of system of particles &amp; Rigid Body</li> <li>2. Gravitation</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Mechanical Properties of Matter</li> <li>2. Thermal Properties of Matter</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Oscillations</li> <li>2. Waves</li> </ol>	<p><b>Module-1(PC)</b></p> <ol style="list-style-type: none"> <li>1. Some Basic Concepts of Chemistry</li> <li>2. Atomic Structure</li> <li>3. Chemical Equilibrium</li> <li>4. Ionic Equilibrium</li> </ol> <p><b>Module-2(PC)</b></p> <ol style="list-style-type: none"> <li>1. Thermodynamics &amp; Thermochemistry</li> <li>2. Redox Reaction</li> <li>3. States Of Matter (Gaseous &amp; Liquid)</li> </ol> <p><b>Module-3(IC)</b></p> <ol style="list-style-type: none"> <li>1. Periodic Table</li> <li>2. Chemical Bonding</li> <li>3. Hydrogen &amp; Its Compounds</li> <li>4. S-Block</li> </ol> <p><b>Module-4(OC)</b></p> <ol style="list-style-type: none"> <li>1. Nomenclature of Organic Compounds</li> <li>2. Isomerism</li> <li>3. General Organic Chemistry</li> </ol> <p><b>Module-5(OC)</b></p> <ol style="list-style-type: none"> <li>1. Reaction Mechanism</li> <li>2. Hydrocarbon</li> <li>3. Aromatic Hydrocarbon</li> <li>4. Environmental Chemistry &amp; Analysis Of Organic Compounds</li> </ol>	<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Diversity in the Living World</li> <li>2. Plant Kingdom</li> <li>3. Animal Kingdom</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Morphology in Flowering Plants</li> <li>2. Anatomy of Flowering Plants</li> <li>3. Structural Organization in Animals</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Cell: The Unit of Life</li> <li>2. Biomolecules</li> <li>3. Cell Cycle &amp; Cell Division</li> <li>4. Transport in Plants</li> <li>5. Mineral Nutrition</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Photosynthesis in Higher Plants</li> <li>2. Respiration in Plants</li> <li>3. Plant Growth and Development</li> <li>4. Digestion &amp; Absorption</li> <li>5. Breathing &amp; Exchange of Gases</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Body Fluids &amp; Its Circulation</li> <li>2. Excretory Products &amp; Their Elimination</li> <li>3. Locomotion &amp; Its Movement</li> <li>4. Neural Control &amp; Coordination</li> <li>5. Chemical Coordination and Integration</li> </ol>

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# 12<sup>th</sup> Class Modules Chapter Details

Physics  
5  
Modules

Chemistry  
5  
Modules

Mathematics  
5  
Modules

PHYSICS	CHEMISTRY	BIOLOGY
<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Electrostatics</li> <li>2. Capacitance</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Current Electricity</li> <li>2. Magnetic Effect of Current and Magnetism</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Electromagnetic Induction</li> <li>2. Alternating Current</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Geometrical Optics</li> <li>2. Wave Optics</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Modern Physics</li> <li>2. Nuclear Physics</li> <li>3. Solids &amp; Semiconductor Devices</li> <li>4. Electromagnetic Waves</li> </ol>	<p><b>Module-1(PC)</b></p> <ol style="list-style-type: none"> <li>1. Solid State</li> <li>2. Chemical Kinetics</li> <li>3. Solutions and Colligative Properties</li> </ol> <p><b>Module-2(PC)</b></p> <ol style="list-style-type: none"> <li>1. Electrochemistry</li> <li>2. Surface Chemistry</li> </ol> <p><b>Module-3(IC)</b></p> <ol style="list-style-type: none"> <li>1. P-Block Elements</li> <li>2. Transition Elements (d &amp; f block)</li> <li>3. Co-ordination Compound</li> <li>4. Metallurgy</li> </ol> <p><b>Module-4(OC)</b></p> <ol style="list-style-type: none"> <li>1. HaloAlkanes &amp; HaloArenes</li> <li>2. Alcohol, Phenol &amp; Ether</li> <li>3. Aldehyde, Ketone &amp; Carboxylic Acid</li> </ol> <p><b>Module-5(OC)</b></p> <ol style="list-style-type: none"> <li>1. Nitrogen &amp; Its Derivatives</li> <li>2. Biomolecules &amp; Polymers</li> <li>3. Chemistry in Everyday Life</li> </ol>	<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Reproduction in Organisms</li> <li>2. Sexual Reproduction in Flowering Plants</li> <li>3. Human Reproduction</li> <li>4. Reproductive Health</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Principles of Inheritance and Variation</li> <li>2. Molecular Basis of Inheritance</li> <li>3. Evolution</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Human Health and Disease</li> <li>2. Strategies for Enhancement in Food Production</li> <li>3. Microbes in Human Welfare</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Biotechnology: Principles and Processes</li> <li>2. Biotechnology and Its Applications</li> <li>3. Organisms and Populations</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Ecosystem</li> <li>2. Biodiversity and Conservation</li> <li>3. Environmental Issues</li> </ol>

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