

**DIRECTORATE OF SCHOOL
EDUCATION
CHENNAI DISTRICT**

LEARNING MATERIAL
2022 – 2023

HIGHER SECONDARY – SECOND YEAR
BIO-BOTANY / BOTANY

PREFACE

We take pleasure in presenting this simplified learning material of Bio-Botany and Botany for students of Std XII.

Specific lessons have been selected and the answers are framed in a precise manner to make learning easier. The objective of this learning material is to enable students to understand the concepts with ease and to ultimately perform better in the board examination. We express our heartfelt thanks to the Respected Chief Educational Officer, Chennai for his initiative and valuable guidance.

“Hard Work never fails”

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LEARNING MATERIAL

BIO – BOTANY & BOTANY

CHAPTER – 1

ASEXUAL AND SEXUAL REPRODUCTION IN PLANTS

Two Mark Questions

1. Define the term Diplospory.
 - A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division.
 - Examples: Eupatorium and Aerva.
2. What is layering?
 - It is an artificial method of vegetative propagation.
 - The stem of the parent plant is allowed to develop roots while still intact.
 - The root develops. The rooted part is cut. It is planted to grow as a new plant.
 - Examples: Ixora, Jasminum
3. What is Cantharophily?
Pollination by beetles is called Cantharophily.
4. What is endothelium?
 - In Ovules, the inner layer of integument is specialised for nutritive function for embryo sac. It is called endothelium.
 - Example: Asteraceae
5. What is Mellitophily?
Pollination by bees is called Mellitophily.
6. “Endothelium is associated with dehiscence of anther.” Justify the statement.
 - It is a layer in the anther wall
 - It has single layer of radially elongated cells. It is below epidermis
 - The tangential and radial walls has lignified thickenings.
 - These cells are hygroscopic. This nature helps in the dehiscence of anther at maturity.
7. What is Myrmecophily?
Pollination by ants is called Myrmecophily.
8. Define apomixis.
 - It is defined as the substitution of the usual sexual system by a form of reproduction.
 - It does not involve meiosis and syngamy.
9. Name the abiotic agents of pollination.
 - Pollination by wind or anemophily.
 - Pollination by water or hydrophily

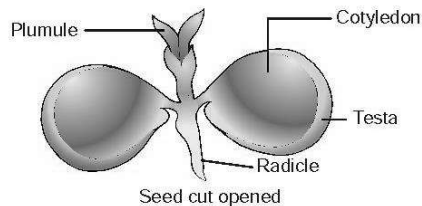
10. What are clones?

The individuals formed by asexual method are morphologically and genetically identical. They are called clones.

11. Define Pollinium.

- In some plants, all the microspores in a microsporangium remain held together called pollinium.
- Example: Calotropis.

12. Draw diagram and label the parts of dicot seed.



13. Differentiate Autogamy from Allogamy.

- Autogamy – Transfer of pollen on the stigma of the same flower.
- Allogamy – Transfer of pollen of one flower to the stigma of another flower.

14. What are epiphyllous buds?

In Bryophyllum, the leaf is succulent and notched on its margin. Adventitious buds develop at these notches and are called epiphyllous buds.

15. What is scutellum?

- The seeds of paddy is one seeded and is called caryopsis.
- The Embryo is small and consists of one shield- cotyledon known as scutellum present towards lateral side of embryonal axis.

16. What is cap block?

- The hemispherical, transparent tip of pollen tube is called cap block. It is seen by microscope.
- When it disappears the growth of pollen tube stops.

Three Mark Questions

17. What is Polyembryony? How it can be commercially exploited?

- Occurrence of more than one embryo in a seed.
- Practical applications:
- Seedling from nucellar tissue of Citrus are better clones of Orchards.
- Embryos from polyembryony are virus free

18. List out the functions of tapetum.

- Tapetum is the innermost layer of anther wall.
- Supplies nutrition to developing microspores.

- Contributes sporopollenin through ubisch bodies. They play role in pollen wall formation.
- Pollen kitt material is contributed by tapetal cells.

19. Write short note on pollen kitt.

- Tapetum Contributes for the pollen kitt.
- It is coloured yellow or orange made up of carotenoids or flavonoids
- It is an oily layer forming thick viscous coating.
- It attracts insects and protects from UV radiation.

20. How does the pollen tube enter into the ovule?

- There are three types of pollen tube enter:
- Porogamy: When the pollen tube enters through the micropyle.
- Chalazogamy: When the pollen tube enters through the chalaza.
- Mesogamy: When the pollen tube enters through the integument.

21. Enumerate the characteristic features of entomophilous flowers.

- Generally large or aggregated in dense inflorescence.
- Flowers are brightly coloured to attract insect.
- These flowers are scented and produce nectar.
- Foul odour also attracts flies and beetles.

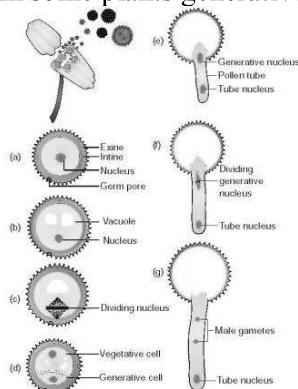
22. Distinguish between tenuinucellate and crassinucellate ovules

Tenuinucellate	Crassinucellate
<ul style="list-style-type: none"> • Sporogenous cell is hypodermal • Ovule has small nucellus 	<ul style="list-style-type: none"> • Sporogenous cell is Sub-hypodermal • Ovule has large nucellus

Five Mark Questions

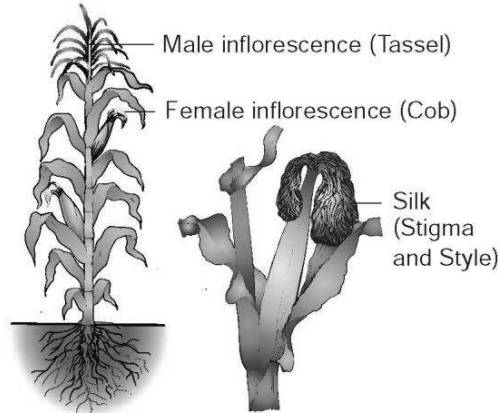
23. How does the male gametophyte develop?

- Haploid microspore is the first cell of gametophyte.
- Development takes place at microsporangium
- Microspore nucleus divides into vegetative and generative nucleus.
- Large vegetative cell and small generative cell is formed.
- At this 2 celled stage pollens are liberated from anther.
- In some plants generative cell form 2 male gametes.



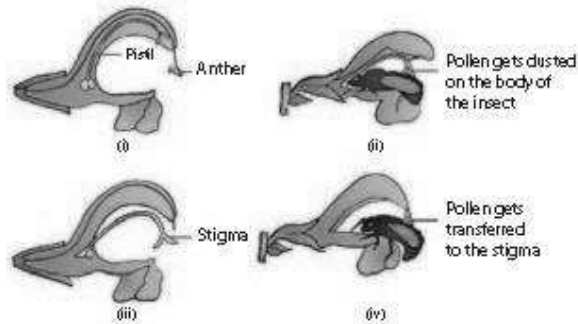
24. Explain pollination in Maize.

- Maize is monoecious and unisexual.
- Male inflorescence is at the terminal.
- Female inflorescence is at lateral lower level.
- Heavy pollens cannot be carried by breeze.
- Male inflorescence is shaken by wind. The released pollens fall vertically below.



25. What do you know about the lever mechanism of pollination? Explain.

- Salvia is adapted for bee pollination.
- Bilabiate corolla has two stamens.
- Each anther has upper fertile lobe and lower sterile lobe separated by long connective the anthers swing freely.
- The bee strikes against the sterile end of connective, so fertile part of the stamen descend it strikes at the back of the bee.



26. What is Endosperm? Explain its types?

- The primary endosperm nucleus divides immediately after fertilization but before the zygote starts to divide, to form the endosperm.
- They are nuclear endosperm, Cellular endosperm and Helobial endosperm.

Nuclear endosperm:

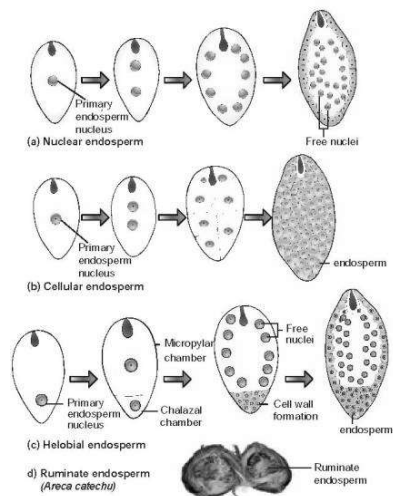
- In the nuclear type, the primary endosperm nucleus divides into two without any wall formation. They consists of only free nuclei.
- Example Coccinia

Cellular endosperm:

- In this type, the primary endosperm nucleus divides into 2 nuclei which immediately followed by wall formation. Eg. Adoxa

Helobial endosperm:

- The primary endosperm nucleus moves towards the base of the embryo sac where it divides into two nuclei.
- The nucleus of the micropylar chamber undergoes several free nuclear divisions whereas, that of the chalazal chamber may or may not divide.
- Example: Hydrilla



27. What is Parthenocarpy? Write note on its significance.

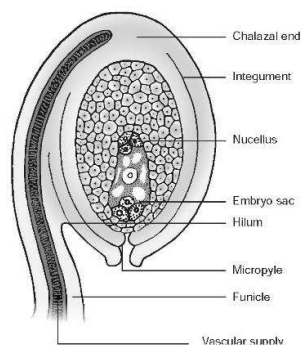
- Fruit like structures may develop from the ovary without the act of fertilization is called parthenocarpy.

Significance:

- The seedless fruits have great significance in horticulture.
- Seedless fruits have great commercial importance.
- Seedless fruits are useful for the preparation of jams, jellies, sauces, fruit drinks etc.
- High proportion of edible part is available in parthenocarpic fruits due to the absence of seeds.

28. With a suitable diagram explain the structure of an ovule.

- The ovule is protected by coverings called integuments.
- The stalk of the ovule is funicle
- The ovule bears a central mass of tissue called nucellus.
- The integument form a pore called micropyle and opposite to it is chalaza.
- A large oval structure towards the micropylar end is embryo sac.
- The embryo sac has 8 nuclei.



CHAPTER 2

CLASSICAL GENETICS

Two Mark Questions

1. What are multiple alleles?
Alleles are alternative form of gene and they are responsible for differences in phenotypic expression of a given trait.
2. Define Genetics.
It is the branch of biological science which deals with the mechanism of transmission of characters from parent to offsprings.
3. What is back cross?
 - Back cross is a cross of F1 offspring with either one of the parental genotypes.
 - The recessive back cross helps to identify the heterozygosity of the hybrid.
4. What is continuous variation with example?
A variation in a characteristic in which individual show a range of traits with small difference between them. Eg. Human height and skin colour.
5. Write a short notes on discontinuous variation with suitable example.
Discontinuous is a variation in characteristic in which individual show two or few traits with a large difference between them. Eg. Height or length of a plant.
6. What is hybridization?
The process of mating two individuals that differ with the goal of achieving a certain characteristics in their offspring.
7. What is hypostatic?
The epistatic gene whose expression is interfered by non-allelic gene and prevents from exhibiting its character is known as hypostatic.
8. What is Dihybrid cross?
 - It is a genetic cross which involves individuals differing in two characters.
 - It is the inheritance of two separate genes each with two alleles.
9. What are the reasons for Mendel's success?
 - He applied Mathematics and statistical methods to biology and laws of probability to his breeding experiments.
 - His experiments were carefully planned and he used large samples.
10. What is Heredity?
Heredity is the transmission of characters from parents to offsprings.

11. Define variation.

The organisms belonging to the same natural population or species that shows a difference in the characteristic is called variation.

12. Define law of Dominance.

In a dissimilar pair of factors one member of the pair is dominant and the other is recessive. This law gives an explanation to the Monohybrid.

13. What is Pleiotropy?

Here, the single gene affects multiple traits and alter the phenotype of the organism.

14. Define law of segregation.

- During the formation of gametes the factors or alleles of a pair separate and segregate from each other such that each gametes receives only one of the factor.
- Gametes are never hybrid.

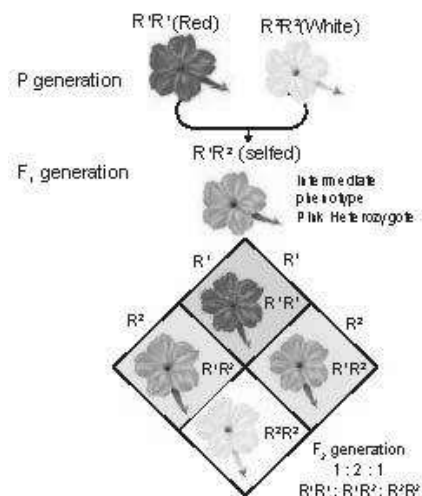
15. What is epistasis?

Epistasis is a term which describe how genes interact to affect a phenotype where by an allele at one locus prevents an allele at another locus from manifesting its effect.

Three Mark Questions

16. Write a note on Incomplete dominance.

It refer to genetic situation in which one allele does not completely dominate another allele and therefore results in a new phenotype. Example: Flower colour in *Mirabilis jalapa*.

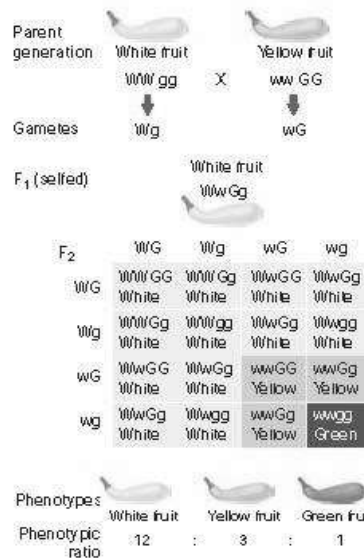


Five Mark Questions

17. Describe dominant epistasis with an example.

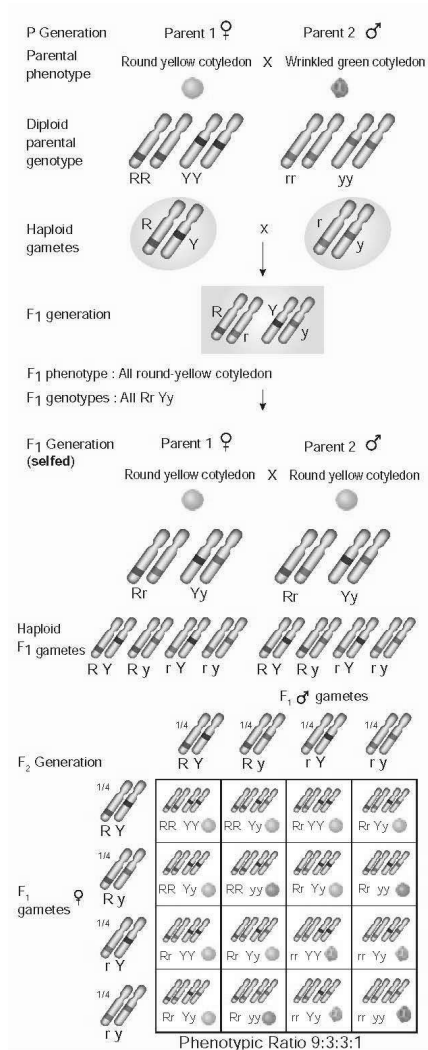
- Epistasis can be defined as a gene interaction whereby one gene interferes with the phenotype expression of another non-allelic gene.

- The gene or locus which suppresses or masks the action of a gene at another locus is called epistatic gene.
- The gene or locus whose expression is suppressed by an epistatic gene is called gene hypostatic. E.g. fruit colour in Cucurbita



18. Explain dihybrid cross.

- It is a genetic cross that occurs between two individuals, focusing on the inheritance of two independent traits at one time. It is also known as two trait cross.
- Two parents considered for this cross have two independent traits.
- Thus a dihybrid cross involves two pairs of genes.
- Example: Seed shape and colour of Garden pea.



19. What is meant by cytoplasmic inheritance?

- DNA is the universal genetic material
- Genes located in nuclear chromosomes follow Mendelian inheritance
- The cytoplasmic organelles chloroplast and mitochondrion act as inheritance vectors, so called cytoplasmic inheritance.
- It is based on self-replicating, extra chromosomal unit called plasmogene.
- The cytoplasmic organelles are mitochondria and chloroplast.

20. Differentiate continuous and discontinuous variation.

Continuous variation	Discontinuous variation
It is also called quantitative inheritance	It is also called qualitative inheritance
Controlled by many genes	Controlled by one or two major genes.
Exhibit complete gradation	No intermediate form
Affected by environmental factors	Unaffected by environmental condition.
Example: Human height	Example: Plant height in garden pea.

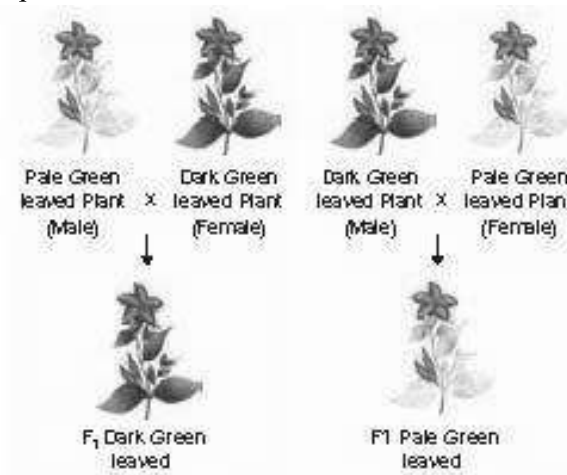
21. What is Atavism?

Atavism is a modification of biological structure whereby ancestral trait reappears after having been lost through reemergence of sexual reproduction in the flowering plant.

Example: Hieracium pilosella

22. Explain the Chloroplast inheritance.

- There are two types of variegated leaves namely, dark green and pale green plants
- When the pollen of dark green leaved plants (male) is transferred to the stigma of pale green leaved plant (female) and the same is repeated vice versa.
- The F1 generation of both the crosses were not same.
- This inheritance is not through nuclear gene.
- It is due to the chloroplast gene found in the ovum of the female plant which contributes the cytoplasm.



CHAPTER – 3

CHROMOSOMAL BASIS OF INHERITANCE

Two Mark Questions

1. What is called crossing over?
Crossing over is a biological process that produces new combination of genes by interchanging the corresponding segments between non-sister chromatids of homologous pair of chromosomes.
2. What is genetic mapping?
The diagrammatic representation of position of genes and related distances between the adjacent genes is called genetic mapping.
3. What is point mutation?
It refers to alterations of single base pairs of DNA.

Three Mark Questions

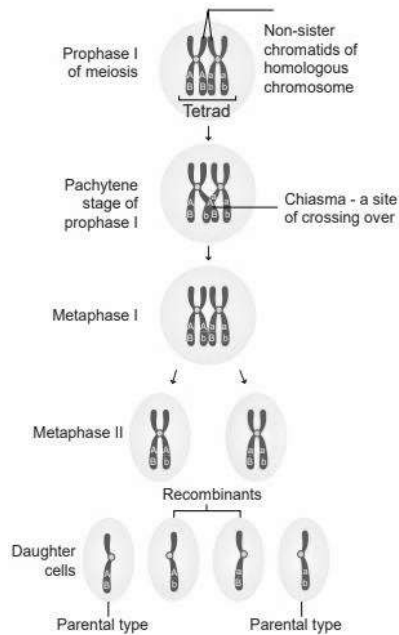
4. Distinguish between complete and incomplete linkage

Complete linkage	Incomplete linkage
The linked genes are located very close to each other on the same chromosome.	The linked genes are sufficiently apart.
They do not exhibit crossing over.	They can separate and crossing over is possible

5. What are the uses of genetic mapping?
 - Useful in predicting dihybrid and trihybrid crosses.
 - Allows to understand the genetic complexity of an organism.
 - Used to determine gene order and calculate the distance between the genes.
6. What are mutagens? What are its types?
 - The factors which cause genetic mutation are called mutagens.
 - They are of two types.
 - Physical mutagens
 - Chemical mutagens.

Five Mark Questions

7. What is crossing over? Explain.



- Crossing over is a biological process that produces new combination of genes by interchanging the corresponding segments between non-sister chromatids of homologous chromosomes.
- It includes
 - Synapsis
 - Tetrad formation
 - Crossover
 - Terminalisation

Synapsis

- Homologous chromosomes are aligned side by side, resulting in pairing called bivalents.

Tetrad formation

- Each homologous chromosomes of a bivalent begin to form two identical sister chromatids, which remain held together by a centromere.
- Each bivalent has four chromatids and this is called tetrad stage.

Crossover

- The non-sister chromatids of homologous pair make a contact at one or more points.
- These points are called chiasmata.
- At chiasma, X shaped structures are formed.
- Breaking and rejoining of two chromatids occur.
- Results in reciprocal exchange of equal and corresponding segments between them.

Terminalisation

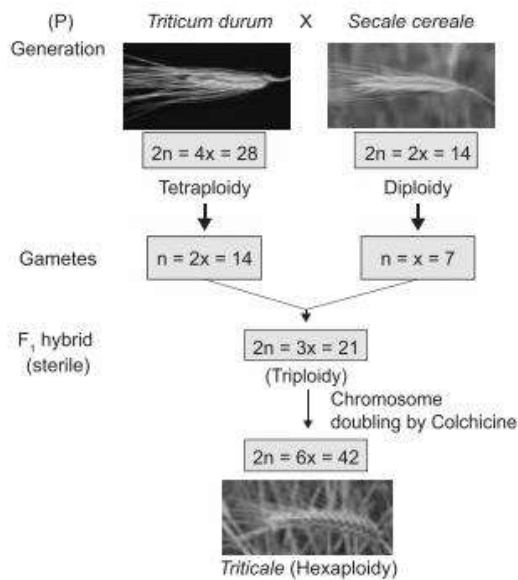
- After crossing over, chiasma move towards the terminal end of chromatids.
- This is called terminalisation.
- Homologous chromosomes separate from each other.

8. Write the importance of crossing over.

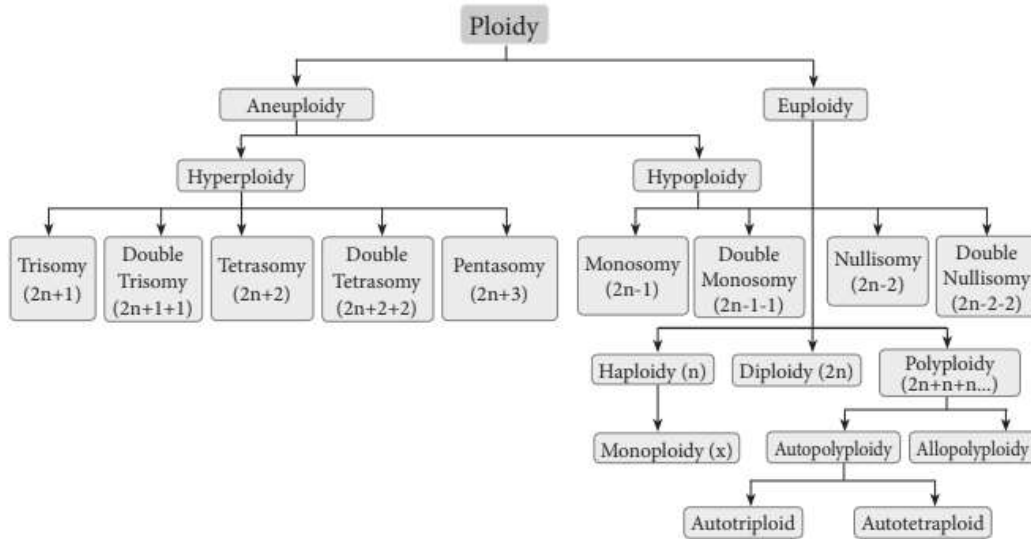
- Exchange of segments leads new gene combinations which plays an important role in evolution.
- It shows genes are arranged linearly on the chromosomes.
- Genetic maps are made based on the frequency of crossing over.
- It helps to understand the nature and mechanism of gene action.
- If useful new combination is formed it can be used in plant breeding.

9. Mention the name of man-made cereal. How it is formed?

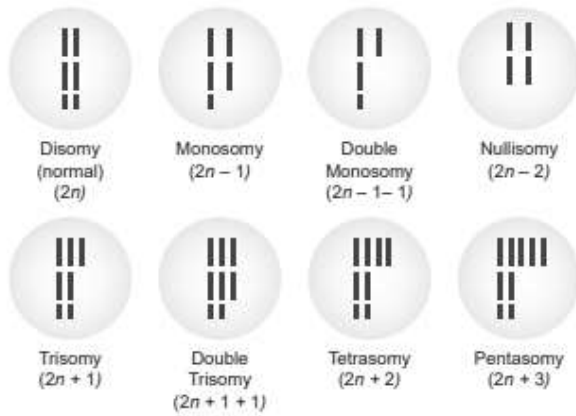
The man-made cereal is Triticale.



10. Draw the flow chart showing different types of ploidy.



11. Draw the diagram of different types of aneuploidy



CHAPTER - 4

PRINCIPLES AND PROCESSES OF BIOTECHNOLOGY

Two Mark Questions

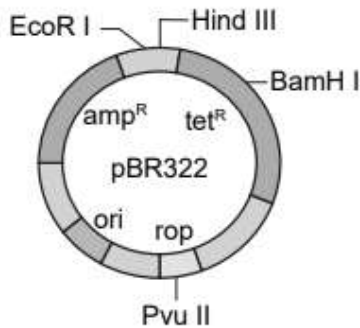
1. What is called SCP?
Single celled proteins are dried cells of microorganism that are used as protein supplement in human foods or animal feeds.
2. Name the bacteria used for the production of single cell protein.
 - *Methylophyllus methylotrophus*
 - *Cellulomonas*
 - *Alcaligenes*
3. Name the fungi used for the production of single cell protein
 - *Agaricus campestris*
 - *Saccharomyces cerevisiae*
 - *Candida utilis*
4. Name the Algae used for the production of single cell protein.
 - *Spirulina*
 - *Chlorella*
 - *Chlamydomonas*
5. What is PCR?
Polymerase Chain Reaction is a common laboratory technique used to make copies of a particular region of DNA.
6. What is recombinant DNA technology?
Recombination carried out artificially using modern technology is called recombinant DNA technology
7. What are the enzymes used in DNA recombinant technology
 - Restriction endonuclease
 - DNA ligase
8. What is Vector?
Vector is a small DNA molecule capable of self replication and used as a carrier and transporter of DNA fragment.
9. Define – Biopharming.
Bio pharming is the production and use of transgenic plants to produce pharmaceutical substances for use of human beings.

10. Define – Bioremediation

Bio remediation is defined as the use of microorganisms or plants to manage environmental pollution.

Three Mark Questions

11. What do you know about pBR 322?



- pBR 322 plasmid is a reconstructed plasmid.
- In pBR,
- P – plasmid
- B&R- Boliver & Rodriguez, the name of the scientists who developed the plasmid.
- 322- Number of plasmids developed from their laboratory.

Five Mark Questions

12. Write the applications of Single Cell Protein.

- It is used as protein supplement.
- It is used in cosmetic products for healthy hair and skin.
- It is used as an excellent source of protein for cattle, birds, fishes etc.
- It is used in food industry as aroma carriers, in soups, baked products etc.
- It is used in paper processing, leather processing industries as foam stabilizers.

13. Write the advantages and disadvantages of Bt cotton

Advantages

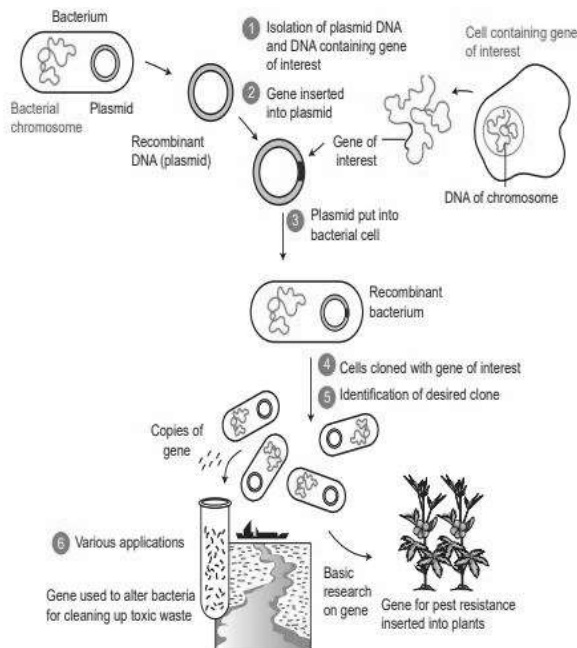
- Yield of cotton is increased due to effective control of bollworms.
 - Reduction in insecticide use.
 - Reduction in cost of cultivation
- Disadvantages
- Cost is high
 - Effectiveness lasts only upto 120 days.
 - Affecting pollinating insects and yield.
 - Ineffective against jassids, aphids and whitefly.

14. Compare the various types of blotting techniques.

Differences between Blotting Techniques

	Southern blotting	Northern blotting	Western blotting
Name	Southern name of the inventor	Northern a misnomer	Western a misnomer
Separation of	DNA	RNA	Proteins
Denaturation	Needed	Not needed	Needed
Membrane	Nitrocellulose/ nylon	Amino benzyloxymethyl	Nitrocellulose
Hybridisation	DNA-DNA	RNA-DNA	Protein-antibody
Visualising	Autoradiogram	Autoradiogram	Dark room

15. What are the steps involved in recombinant DNA Technology?



- Isolation of a DNA Fragment containing a gene of interest that needs to be cloned. This is called an insert.
- This insert is inserted into a carrier molecule called vector.
- As a result rDNA or recombinant DNA is formed.
- This transformed host cells carrying the rDNA is allowed to multiply.
- A large amount of rDNA or a large amount of protein expressed by the insert is produced.
- Wherever vectors are not involved, the desired gene is multiplied by PCR technique.

CHAPTER - 5

PLANT TISSUE CULTURE

Two Mark Questions

1. Define Totipotency:
Totipotency is defined as the genetic potential of a plant cell to give rise to a complete individual plant in a nutrient medium.
2. What is meant by explant?
The tissue taken from a selected plant is transferred to a culture medium often to establish a new plant.
3. List out the basic concepts of plant tissue culture
a) Totipotency b) Differentiation c) Redifferentiation d) Dedifferentiation
4. Name of the different types of medium used in plant tissue culture.
a) MS. Medium b) B5 medium c) White medium d) Nitsch medium
5. What is agar?
A complex mucilaginous polysaccharide obtained from marine algae (sea weeds) used as solidifying agent in media preparation.
6. What is Sterilization?
Sterilization is the technique employed to get rid of microbes, such as bacteria and fungi in the culture medium, vessels, and explants.
7. What is callus?
Callus is a mass of unorganized growth of plant cells or tissues in invitro culture medium.
8. What are called embryoids?
The callus cell undergoes differentiation and produces somatic embryos known as Embryoids.
9. What is meant by Hardening?
Hardening is the gradual exposure of invitro developed plantlets for acclimatization, so as to enable them to grow under normal condition.
10. Define embryogenesis:-
Embryogenesis is the process through which the callus cells undergo differentiation to produce somatic embryos called embryoids.

11. What is cybrid?

The fusion product of protoplast without nucleus of different cells is called a cybrid.

12. What are the types of plant tissue culture based on the explants?

a) Organ culture b) Meristem culture c) Protoplast culture d) Cell culture

13. What are called cryoprotectants?

Protective agents like dimethyl sulphoxide, glycerol or sucrose are added before cryopreservation process. These protective agents are called cryoprotectants. They protect the cells or tissues from the stress of freezing temperature.

14. What are called secondary metabolites?

Secondary metabolites are chemical compounds that are not required for normal growth and development of plants. ex: alkaloids, flavonoids, terpenoids and phenolic.

15. What is meant by PEG?

PEG is Poly Ethylene Glycol.

It is the fusogenic agent that facilitates the fusion of 2 different protoplasts coming together in somatic hybridization to produce cybrid.

Three Mark Questions

16. Distinguish between Redifferentiation and Dedifferentiation.

Redifferentiation	Dedifferentiation
The ability of callus tissue to develop into shoot & root	Reversion of mature tissue into meristematic state leading to the formation of callus.

17. How will you produce virus-free plants?

Chemical methods can be used to control fungal and bacterial pathogens, but not viruses generally.

Shoot meristem tip culture is the method to produce virus free plants, because shoot meristem tip is always free from viruses.

18. What is Intellectual Property Right (IPR)?

IPR is a category of rights that includes intangible creation of human intellect and primarily consists of copyrights, patent and trademarks.

19. Write down the basic techniques involved in plant tissue culture.

1. Sterilization 2. Media preparation 3. Culture condition 4. Induction of callus.
5. Embryogenesis 6. Hardening

20. What are the steps involved in the production of secondary metabolites?

1. Biotransformation. 2. Elicitation 3. Immobilisation

21. Write a note on Biosafety.

Biosafety is the prevention of large scale of loss of biological integrity focussing both on Ecology and human health.

22. What are the different inert materials used for coating the somatic embryoids for the production of artificial seeds?

1. Agarose 2. Sodium Alginate.

23. What are the applications of somatic embryogenesis?

- Somatic embryogenesis provides potential plantlets which after hardening period can establish into plants.
- Somatic embryoids can be used for the production of synthetic seeds.
- It is possible in any plant. Eg. *Allium sativum*, *Oryza sativa*

24. Write the differences between somaclonal variations and gametoclonal variations.

Somaclonal variations	Gametoclonal variations
Found in plants regenerated invitro (i.e leaves, stem, root, tuber or propagule).	Found in plants regenerated invitro genetic origin. (i.e gametes and gametophytes).

25. What is organogenesis?

The morphological changes occur in the callus leading to the formation of shoot and roots is called organogenesis.

26. Write about micropropagation of banana.

Micropropagation of plants at industrial level maintains high standards of homogeneity in plants like pineapple, banana, strawberry and potato.

Five Mark Questions

27. Explain the basic concepts involved in plant tissue culture.

Basic concepts of PTC (Plant Tissue culture):

- Totipotency: Plant cells have the inherent genetic potential to develop into a complete individual plant if provided a nutrient medium.

Differentiation

- The process of biochemical and structural changes by which cells become specialized in form and function.

Redifferentiation

- Callus have the ability to develop into whole plant in nutrient medium.
- It is the further differentiation of already differentiated cell into another type of cell.

Dedifferentiation

- Reversion of mature tissue into meristematic state leading to the formation of callus is called dedifferentiation.

28. Explain Advantages of Artificial seeds.

- Millions of artificial seeds can be produced at any time at low cost.
- They provide an easy method to produce genetically engineered plants with desirable traits.
- It is easy to test the genotype of plants.
- They can be potentially stored for long time under cryopreservation method.
- Artificial seeds produce identical plants.

29. Explain about patent.

- Granted by the Government to the discoverer/inventor for trading new articles.
- A personal property which can be licenced or sold by the person or organisation.
- It gives the inventor the rights to exclude others from making, using or selling his invention.

30. Explain Cryopreservation.

- Cryopreservation
- Biological materials like protoplasts, tissue organelles, organs are subjected to preservation by cooling to very low temperature of -196°C using liquid nitrogen.
- Enzymatic or chemical activity of the biological material will be totally stopped in dormant status.
- These materials can be activated by subjecting them to room temperature.
- Cryoprotectants such as Dimethyl Sulphoxide, Glycerol or Sucrose are added before cryopreservation.

31. Explain the steps involved in protoplasmic fusion.

ISOLATION OF PROTOPLASTS

- Leaf tissue is immersed in 0.5% Macerozyme, 2% Onozuka cellulase enzymes dissolved in 13% sorbitol or mannitol at pH 5.4.
- Incubated overnight at 25°C .
- Protoplasts are transferred to 20% sucrose solution to retain their viability.

FUSION OF PROTOPLASTS

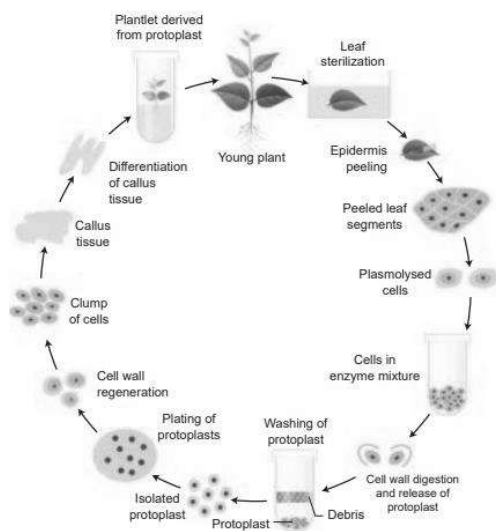
- The isolated protoplasts are incubated in 25 to 30% concentration of PEG (Poly Ethylene Glycol)

CULTURE OF PROTOPLASTS.

- Ms liquid medium is used.
- Cultures are incubated in continuous light 1000-2000 lux at 25°C .

SELECTION OF SOMATIC HYBRID

- The fusion product of protoplasts without nucleus of different cells is called cybrid.
- This is followed by nuclear fusion.
- This process is called somatic hybridization.



32. What are the applications of plants tissue culture:-

- Improved hybrid productions through somatic hybridizations.
- Synthetic seed helps in conservation of plants diversity.
- Production of disease resistant plants through meristem and shoot tip culture.
- Micropropagation techniques to obtain large number of plantlets of both crop and tree species.)
- Secondary metabolites of cell culture utilized in pharmaceutical cosmetic and food industries.

33. Write about the secondary metabolites and its plant resources.

Secondary metabolites	Plant source	Uses
Digoxin	<i>Digitalis purpurea</i>	Cardiac tonic
Codeine	<i>Papaver somniferum</i>	Analgesic
Capsaicin	<i>Capsicum annuum</i>	Rheumatic pain treatment
Vincristine	<i>Catharanthus roseus</i>	Anti-carcinogenic
Quinine	<i>Cinchona officinalis</i>	Antimalarial

Additional Questions

34. What is the role of gene bank?

- Gene bank or DNA bank involve in germplasm conservation.
- It has the elite breeding lines of plant resources for the maintenance of biological diversity and food security.

35. What is GEAC-Genetic Engineering Appraisal Committee?

GEAC is an apex body under Ministry of Environment, Forests and Climatic change for regulating, manufacturing, use, import, export and storage of hazardous microbes or genetically modified organisms and cells in the country.

CHAPTER - 6

PRINCIPLES OF ECOLOGY

Two Mark Questions

1. Define. – Ecology.
The study of living organisms, both plants and animals, in their natural habitats or homes.
2. What is Seed ball?
Seed ball is an ancient Japanese technique of encasing seeds in a mixture of soil humus and cow dung and scattering them on to suitable ground.
3. What is Phytoremediation?
Removal of poisonous substances like Cadmium from contaminated soil by plants is known as Phytoremediation.
Eg. Rice, Eichhornia.
4. What is Vivipary?
When seeds or embryos begin to develop before they detach from the parent plant is called Vivipary

Three Mark Questions

5. What is ecological hierarchy? Name the levels of Ecological hierarchy.
The interaction of organisms with their environment results in the establishment of grouping of organisms is called ecological hierarchy.
Biosphere
↑
Biome
↑
Landscape
↑
Ecosystem
↑
Community
↑
Population
↑
Individual organism

6. Distinguish between Habitat and Niche.

S. No.	Habitat	Niche
1.	A specific physical space occupied by an organism	A functional space occupied by an organism in the same ecosystem.
2.	Same habitat may be shared by many organisms.	A single niche is occupied by a single species.
3.	Habitat specificity is exhibited by organism.	Organisms may change their niche with time and season.

7. What are the branches of ecology?

Autecology

It is the ecology of individual species and is also called species Ecology.

Synecology

It is the ecology of population or community with one or more species.

8. What is thermal stratification? Mention their types.

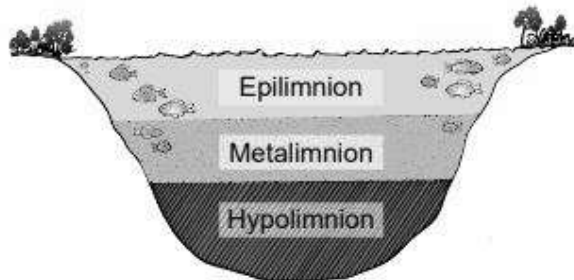
The change in the temperature profile with increasing depth in a waterbody is called thermal stratification.

There are three levels.

Epilimnion - The upper layer of warm water.

Metalimnion - The middle layer with gradual decrease in temperature.

Hypolimnion - The bottom layer of colder water.



CHAPTER – 7

ECOSYSTEM

Two Mark Questions

1. Define standing quality (or) standing state.
Total inorganic substances present in any ecosystem at a given time is called standing quality (or) standing state.
2. What is standing crop?
The amount of living materials present in a population at any given time is called standing crop.
3. What is Photosynthetically Active Radiation (PAR)?
 - The amount of light available for photosynthesis of plants is called Photosynthetically Active Radiation.
 - Wavelength range is 400-700 nm
 - Essential for photosynthesis and plant growth.
4. Define food chain.
 - The movement of energy from producers up to top carnivores is called food chain.
 - i.e., energy flows from producers → primary consumers → secondary consumers → tertiary consumers. It shows linear network links.
5. Explain the term ecological pyramids.
 - Graphic representation of the trophic structure and function at successive trophic levels of an ecosystem is called ecological pyramids (or) Eltonian pyramids.
 - concept was introduced by Charles Elton.
6. What is Biogeochemical cycle?
Circulation of nutrients within the ecosystem or biosphere is known as biogeochemical cycle. Or cycling of materials.
7. Differentiate Gaseous cycle and Sedimentary cycle.

Gaseous cycle	Sedimentary cycle
It includes atmospheric gases	It includes sediments of earth
Oxygen, Carbon, Nitrogen cycles	Phosphorus, Sulphur, Calcium cycles

8. What is plant succession?
The successive replacement of one type of plant community by other of the same area/place is known as plant succession.

9. What are pioneers?

The first invaded plants in a barren area are called pioneers.

10. Explain seral communities.

A series of transitional developments of plant communities one after another in a given area are called seral communities.

11. How climax community is formed?

At the end a final stage and a final plant community gets established which are called as climax and climax community.

12. Define food web.

- The inter-locking pattern of a number of food chain form a web like arrangement.
- It is the basic unit of an ecosystem, to maintain its stability in nature.

Three Mark Questions

13. Write a note on concept of trophic level in an ecosystem.

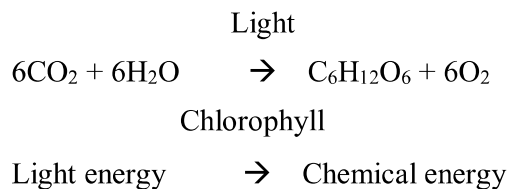
- A trophic level refers to the position of an organism in the food chain.
- The number of trophic levels is equal to the number of steps in the food chain.
- The green plants occupying the first trophic level (T_1) are called producers.
- The producers is utilized by the plant eaters which occupy the second trophic level (T_2) are called primary consumers.
- They in turn are eaten by secondary consumers which occupy the third trophic level (T_3)
- The Carnivores in T_3 are eaten by other carnivores in the fourth trophic level (T_4) called as tertiary consumers.

14. Explain first law of thermodynamics with an example.

- It states that energy can be transmitted from one system to another in various forms.
- Energy cannot be destroyed or created. But it can be transformed from one form to another.

Example:

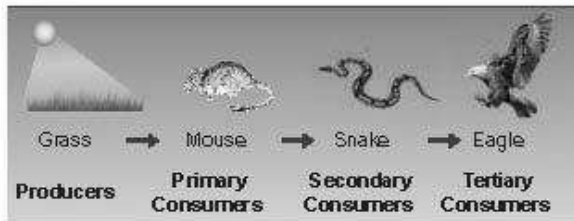
- In photosynthesis, the product of starch is formed by the combination of reactants.



15. Write about second Law of thermodynamics.

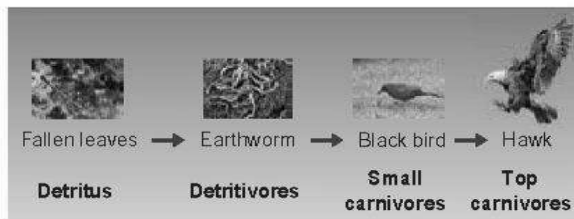
- It states that energy transformation results in the reduction of the free energy of the system.
- As energy is transferred from one organism to another in the form of food, a portion of it is stored as energy is dissipated as heat through respiration.
- Example Ten percent law.

16. Write a note on Grazing food chain.



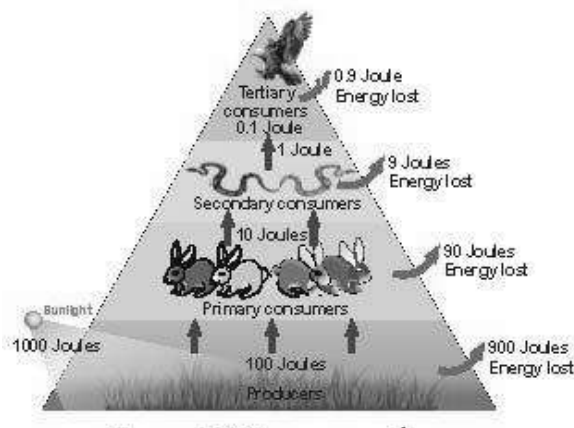
- Main source of energy for the grazing food chain is the SUN.
- It begins with the first link → Producers (plants) → second link → primary consumers (mouse) → third link → secondary consumers (snake) → fourth link → Tertiary consumers (eagle).

17. Explain Detritus food chain.



- Important source of energy begins with dead organic matter.
- This food chain is present in all ecosystems.
- The transfer of energy from the dead organic matter, is transferred through a series of organisms called detritus consumers (detritivores)- small carnivores- large(top) carnivores with repeated eating and being eaten respectively.

18. Pyramid of energy – Explain.



- A graphical representation of energy flow at each successive trophic level.
- The bottom of this pyramid is occupied by the producers.
- There is a gradual decrease in energy transfer at successive trophic levels.
- Pyramid of energy is always upright.

19. Explain carbon cycle.

- The circulation of carbon between organisms and environment is called carbon cycle.
- Cycling of carbon between organisms and atmosphere by two processes- photosynthesis and respiration.
- Carbon increases due to burning of fossil fuels, deforestation, forest fire, volcanic eruption and decomposition of dead organic matters.

20. Explain Phosphorus cycle.

- It is a type of sedimentary cycle.
- It is present in rock deposits, marine sediments and guano.
- The producers absorb phosphorus in the form of phosphate ions and it is transferred in the food chain.
- Again death of the organisms and degradation by the action of decomposers, the phosphorus is released back.

21. Classify different types of plant succession.

- Hydrosere - succession in plenty of water Eg. Ponds, lakes
- Mesosere - succession where moisture is adequate.
- Xerosere - succession starts in minimal amount of water
- Lithosere – begins on barren rock.
- Halosere - starts on saline water
- Psammosere - initiates on sand

22. List the significance of food web.

- It is constructed to describe species interaction/direct interaction.
- Illustrate indirect interactions among different species.
- It can be used to study control of community structure.
- Energy transfer in terrestrial and aquatic ecosystems can be studied.

Five Mark Questions

23. Describe the components of structure of ecosystem.

Two major components are:

Abiotic components:

- It includes climatic factors, edaphic factors, topography, organic components, and inorganic components.
- It play vital role in any ecosystem.
- The total inorganic substances present in any ecosystem at a given time is called standing quality.

Biotic components:

- It includes all living organisms like plants, animals, fungi and bacteria.
- They form the trophic structures of any ecosystem.
- Based on nutritional relationships, they are of two types:

Autotrophic components:

- Organisms which manufacture the organic compounds from simple inorganic components through photosynthesis and are called producers.

Heterotrophic components:

- Organisms which consume the producers are called consumers.
- Macroconsumers - herbivores, carnivores and omnivores.
- Microconsumers - decomposers.

Decomposers:

- Decompose the dead plants and animals Eg. Bacteria and Fungi.
- They all are essential to construct food chain, food web and ecological pyramids.

24. Briefly explain the mechanism of decomposition.

It is a step wise process of degradation mediated by enzymatic reactions.

Fragmentation: The breaking down of detritus into smaller particles by detritivores like bacteria, fungi and earthworm.

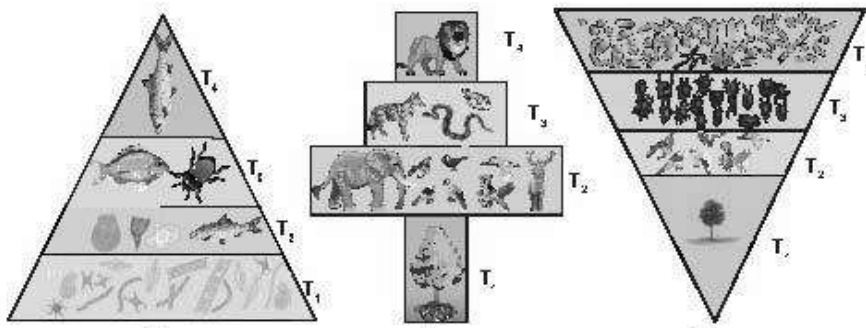
Catabolism: The decomposers breaks out complex organic and inorganic compounds into simple ones by extracellular enzymes.

Leaching/Eluviation: The movement of decomposed water soluble compounds from the surface to the lower layer of soil or the same transported by water.

Humification: Here the detritus is changed into dark coloured substance called humus. It is highly resistant to microbial action and reservoir of nutrients.

Mineralisation: The release of inorganic nutrients from the humus of the soil by microbes.

25. What is Pyramid of number? Explain Pyramid of number in detail with examples.



A graphical representation of the number of organisms present at each successive trophic level in an ecosystem.

Shapes - upright, spindle and inverted.

UPRIGHT – Eg. Grassland and pond ecosystems.

A gradual decrease in the number of organisms in each trophic level from producers to tertiary consumers.

SPINDLE – Eg. Forest ecosystem

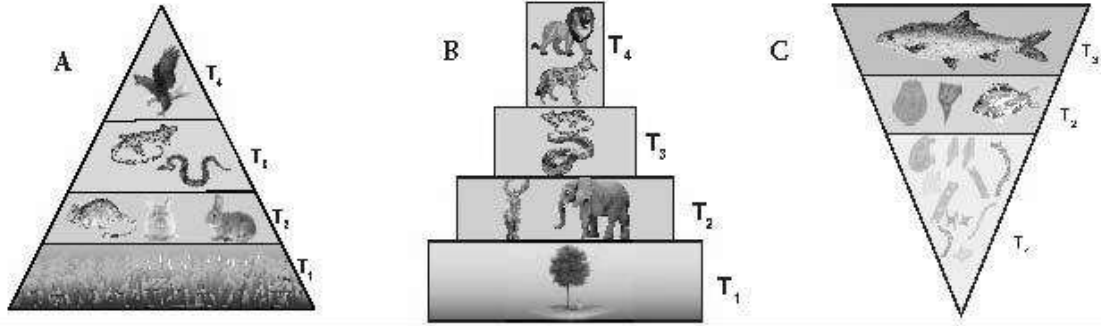
The base of the pyramid (T₁) occupies large sized trees which are lesser in number.

The second trophic level (T2) occupying herbivores are more in number than producers.
 The final trophic level (T4) are lesser in number than (T3) secondary consumers, hence it is spindle shaped.

INVERTED – Eg. Parasite ecosystem

It starts with a single tree followed by gradual increase from producer to tertiary consumers.

26. Define Pyramid of biomass. Illustrate with examples.



A graphical representation of the amount of biomass present at each successive trophic level in an ecosystem.

Shapes – upright and inverted

UPRIGHT – Eg. Grassland and forest ecosystems

A gradual decrease in biomass of organisms at successive trophic levels from producers to tertiary consumers.

INVERTED – Eg. Pond ecosystem

The bottom of the pyramid is occupied by the producers which includes very small organisms with least biomass. Followed by gradual increase toward the tip of the pyramid.

27. Write a note on the structure of pond ecosystem.

It is a natural, aquatic, freshwater, lentic type of ecosystem.

It is a self-sustaining and self-regulatory fresh water ecosystem.

Components:

Abiotic - consists of dissolved organic and inorganic substances.

Factors: Light, temperature, pH value of water and climatic conditions.

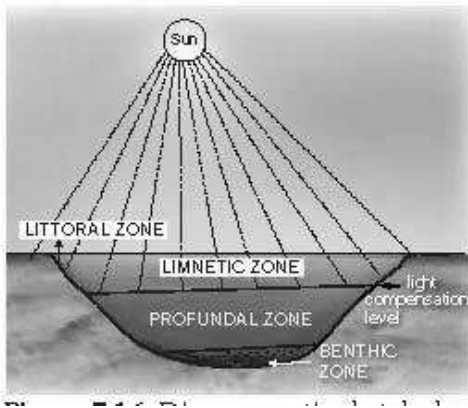
Biotic – consists of producers, consumers and decomposers.

Producers: phytoplanktons eg. Chlamydomonas, Filamentous algae eg. Spirogyra, floating plants eg. Pistia, rooted plants Nymphaea and macrophytes like Typha

Consumers: zooplanktons eg. Paramecium, benthos eg. Molluscs followed by frog then duck even manetc.

Decomposers: microconsumers helps to recycle the nutrients in the ecosystem Eg. Bacteria and fungi.

28. Explain stratification of pond ecosystem.



Based on the factors like distance from the shore, penetration of light, depth of water, types of plants and animals, there are three zones, littoral, limnetic and profundal.

Littoral zone: shallow water region, closest to the shore, easy penetration of light, occupied by rooted plants.

Limnetic zone: open water region, effective light penetration with domination of planktons.

Profundal zone: deeper region of a pond, no effective light penetration, predominance of heterotrophs.

Benthic zone: bottom zone of a pond, occupied by a community of organisms.

29. Explain the various stages of succession in Hydrosere.

Phytoplankton stage: It is the first stage consisting of the pioneer community i.e., blue green algae, green algae, diatoms, bacteria.

They enrich the amount of organic matter and nutrients of pond.

Submerged plant stage: As a result of death and decomposition of planktons, silt brought from land by rain water forms the bottom of the pond.

Rooted submerged hydrophytes begin to appear eg. Chara etc.

The death and decay of these plants forms the substratum of pond.

Submerged free floating stage: During this stage, the depth of the pond is almost 2-5 feet.

Rooted floating plants eg. Trapa etc., free floating plants e.g. Azolla etc. are also present.

By death and decay of these plants the pond becomes more shallow.

Reed-swamp stage: also called as amphibious stage. Rooted floating plants are replaced by plants which live in aquatic and aerial environment e.g. Typha

At the end of this stage water level is very much reduced.

Marsh meadow stage: Due to decreasing water level, species of Poaceae etc. colonise the area forming a mat-like vegetation with branched root system.

At the end of this stage, the marshy vegetation disappears and soil becomes dry.

Shrub stage: These areas are now invaded by terrestrial plants like shrubs, trees.

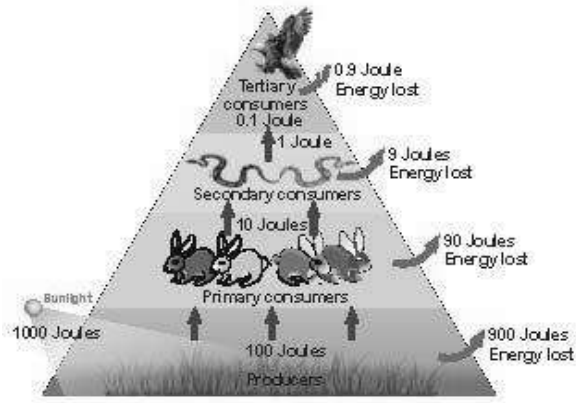
The accumulation of humus with a rich flora favours the arrival of new tree species in the area.

Forest stage: It is the climax community of hydrosere. A variety of trees invade the area and develop any one of the diverse type of vegetation eg. Tropical rain forest.

30. Explain Ten percent law with an example.

- This law was proposed by Lindeman (1942).

- During transfer of food energy from one trophic level to other, only about 10% stored at every level and rest of them (90%) is lost in respiration, decomposition and in the form of heat.
- Hence, the law is called ten percent law.



Example:

- It is shown that of the 1000 Joules of Solar energy trapped by producers, 100 Joules of energy is stored as chemical energy through photosynthesis.
- The remaining 900 Joules would be lost in the environment. In the next trophic level herbivores, which feed on producers get only 10 Joules of energy and the remaining 90 Joules is lost in the environment.
- Likewise, in the next trophic level, carnivores, which eat herbivores store only 1 Joule of energy and the remaining 9 Joules is dissipated.
- Finally, the carnivores are eaten by tertiary consumers which store only 0.1 Joule of energy and the remaining 0.9 Joule is lost in the environment. Thus, at the successive trophic level, only ten percent energy is stored.

31. Generally, human activities are against to the ecosystem, whereas you a student how will you help to protect the ecosystem.

- Grow more trees
- Reduce the use of natural resources
- Recycle and reduce the amount of wastes you produce
- Reduce consumption of water and electricity
- Maintain your cars and vehicles properly

CHAPTER - 8

ENVIRONMENTAL ISSUES

Two Mark Questions

1. What is green house effect?
 - The radiant heat from the sun is captured by the gases in the atmosphere that increase the temperature of the earth untimely.
 - This is called Green House Effect.
2. Name the green house gases.
Carbon dioxide, Methane, Nitrous Oxide and Chlorofluorocarbon.
3. What is Ozone hole?
The decline in the thickness of the ozone layer over restricted area is called Ozone hole.
4. Distinguish between Afforestation and Deforestation.

Afforestation	Deforestation
Planting of trees where there was no trees and converting them forests by planting trees.	The conversion of forested area into a non-forest area.

Three Mark Questions

5. What are the effects of Global Warming on plants?
 - Low agricultural productivity in tropics.
 - Species extinction
 - Strong storms and intense flood damage.
6. Expand CCS and explain.
CCS – Carbon Capture and Storage
Capturing Carbon di oxide and injects it deep into the underground rocks to a depth of 1km or more and it is an approach to mitigate global warming.
7. What is remote sensing?
It is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area.
8. Write about Chipko Movement.
 - It was started by the tribal women of Himalayas to protest against the exploitation of forest in 1972.
 - Later it was transformed into Chipko Movement by Sundarlal Bahuguna
 - People protested by hugging trees together which were felled by a sports goods company.

Five Mark Questions

9. What is global warming? What are its effects?

- The increase in mean global temperature due to increased concentration of green house gases is called global warming.

Effects of global warming

- Sea levels to rise as polar ice caps and glaciers begin to melt causing submergence of many coastal cities.
- Drastic change in weather patterns leading to more floods or droughts.
- Biological diversity may get modified leading to decreased food production.

10. What are the effects of Ozone depletion?

- Juvenile mortality of animals.
- Increased incidents of mutation.
- Increased incidence of cataract, throat and lung irritation, skin cancer etc., in human beings.
- Changes in climate and rainfall results in flood/drought' seawater rise etc.
- In plants, photosynthetic chemicals will be affected and photosynthesis will be inhibited, leading to food crisis.