



BOTANY



# **12th- BIO-BOTANY STUDY MATERIAL**

**KRISHNAGIRI DISTRICT**

**2023-2024.**

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தெய்வத்தான் ஆகா தெனினும் முயற்சிதன்  
மெய்வருத்தக் கூலி தரும்.

**12th Std.**

**One-mark questions (Botany, Bio-Botany)**

We inform you that the one-mark questions in the 12th standard Botany, Bio-botany textbook, with the help of GeoGebra software, are designed to enhance the learning skills of the students by providing a maximum of three opportunities to choose the correct answer to a question.

**Note:** The software has been developed in hi-tech lab for students to practice by scanning the QR code or clicking on the link.

BOTANY,BIO-BOTANY



<https://www.geogebra.org/m/acmrdhg3>

## XII STD

## BIO – BOTANY / BOTANY

## 1. Asexual and sexual reproduction in plants

**One Marks Questions:**

1. An eminent Indian embryologist is – **P.Maheswari**
2. Pollen tube was discovered by – **G.B. Amici.**
3. The size of pollen grain in Myositis – **10 micrometer.**
4. Megagametophyte – **Embryo sac.**
5. First cell of male gametophyte in angiosperm is – **Microspore.**
6. The scar left by funiculus is the seed is – **hilum.**
7. Parthenocarpic fruits lack – **Seed.**
8. In Majority of plants pollen is liberated at – **2 called stage.**
9. Eyes of potato is an – **axillary bud.**
10. Ruminant endosperm is found in – **Areca.**
11. Transmitting tissue is found in – **Stylar region of gynoecium.**
12. Coleorhiza is found in – **Paddy.**
13. Protandry – **Helianthus.**
14. Pollination by snails – **Malacophily.**
15. Self – sterility or self – incompatibility – **Abutilon, Passiflora.**
16. Vegetative reproduction in leaf – **Bryophyllum.**
17. Orthotropous ovule – **Piperaceae, Polygonaceae.**
18. Anatropous ovule – **Micropyle and funicle** come to lie very close to each other.
19. Hemianatropous – **Primulaceae.**
20. Campylotropous – **Leguminosae.**
21. Circinotropous – **Cactaceae.**
22. Distyly – **Primula.**
23. Tristyly – **Lythrum**
24. Chiropterophily – **Pollination by bats.**
25. Pollination by Butterflies – **Psycophily.**
26. Pollination by ants – **Myrmecophily.**
27. The extreme tip of pollentube appears hemispherical and transparent – **Cap block.**
28. Double fertilization – **S.G Nawaschin and Guignard (in Lilium and Fritillaria).**
29. A basic nutrient medium – **Coconut milk.**
30. Nuclear endosperm – **Coccinia, Arachis.**
31. Cellular Endosperm – **Adoxa, Helianthus.**
32. Helobial endosperm – **Hydrilla, Vallisneria.**
33. Apomixis – **Winkler (1908).**
34. Occurrence of more than one embryo in a seed – **Polyembryony.**
35. Polyembryony – **Anton von leeuwenhoek (1719-in orange plant)**
36. “Terror of Bangal” – **Eichhornia crassipes (Water Hyacinth).**

**Two Marks Questions:****1. What is clone?**

The individuals formed by asexual reproduction is morphologically and genetically identical.

**2. Mellitophily define.**

Pollination by bees.

**3. What is called pollinium?**

In some plants, all the microspores in a microsporangium remain held together called pollinium. E.g. Calotropis.

**4. What is cantharophily?**

Pollination by Beetle.

**5. Write short note on pollenkit.**

- ❖ A sticky covering, Found on the surface of the pollen.
- ❖ That helps to attract insects.

**6. What is sporopollenin?**

- ❖ Pollenwall material derived from carotenoids.
- ❖ And is resistant to physical and biological composition.

**7. Define the term Diplospory.**

- ❖ A diploid embryosac is formed from megaspore mother cell.
- ❖ Without a regular meiotic division. E.g. Eupatorium.

**8. What is Micro sporogenesis?**

- ❖ The stages involved in the formation of haploid microspores.
- ❖ From diploid microspore mother cell.
- ❖ Through meiosis is called micro sporogenesis.

**9. What is pollination?**

The process of transfer of pollen grains from the anther to a stigma of a flower is called pollination.

**10. What is meant by scutellum?**

- ❖ The embryo is small and consists of one shield shaped cotyledon known as scutellum.
- ❖ Present towards lateral side of embryonal axis.

**Three Marks Questions:****1. What is Endothelium or integumental tapetum?**

In some species the inner layer of the integument may become specialized to perform the nutritive function for the embryo sac is called endothelium. E.g. Asteraceae.

**2. What is polyembryony? How it can be commercially exploited.**

Occurrence of more than one embryo in a seed is called polyembryony.

**Commercial uses:**

- ❖ To derive virus free embryos.
- ❖ The seedlings formed from the nucellar tissue in Citrus are found better clones for orchards.

**3. List out the functions of tapetum.**

- ❖ Tapetum is the innermost layer of anther wall.
- ❖ It supplies nutrition to the developing microspores.
- ❖ Contributes sporopollenin through ubisch bodies. They play role in pollen wall formation.
- ❖ Pollenkitt material is contributed by tapetal cells.
- ❖ Exine proteins from tapetal cells responsible for "Rejection reaction".

**4. What are the functions of endosperm?**

- ❖ Nutritive tissue for the developing embryo.
- ❖ In majority of angiosperms, the zygote divides only after the development of endosperm.
- ❖ It regulates the precise mode of embryo development.

**5. Distinguish mound layering and air layering.**

| <b>Mound layering</b>  | <b>Air layering</b>   |
|--|---|
| The lower branch with leaves is bent to the ground and part of the stem is buried in the soil and top of the branch is exposed above the soil. | The stem is grided at nodal region and hormones are applied to the region which promoted rooting.             |
| In the buried nodal region root develops and a cut is made in parent plant to separate the buried part.  | In the covered nodal region roots develop after 2-4 months. Then the branch is removed from the parent plant. |
| Hormones are not required to promote rooting.  | Hormones are applied to promote rooting.  |

**6. Differentiate Grafting and Layering.**

| Grafting  | Layering  |
|---|---|
| In this method parts of two different plants are joined to that they continue to grow as one plant    | In this method the stem of a parent plant is allowed to develop roots while still intact. |
| The plant which is in contact with the soil is stock and the plant used for grafting is called scion. | When the roots develop. The rooted part is cut and planted to grow as a new plant.        |
| E.g. Citrus, Mango & Apple  | E.g. Ixora and Jasminum   |

**7. Differentiate Tenuinucellate and Crassinucellate ovule.**

| Tenuinucellate ovule  | Crassinucellate ovule  |
|---|--|
| If the sporogenous cell is hypodermal with a single layer of nucellar tissue around it if called tenuinucellar. | Ovules with subhypodermal sporogenous cell is called crassinucellate ovule |
| Normally it has very small nucellar.  | Normally it has fairly large nucellar.                                     |

**8. Differentiate Secretary and Invasive tapetum.**

| Secretary tapetum   | Invasive tapetum   |
|---|--|
| The tapetum retains the original position and cellular integrity and nourishes the developing microspores | The cells lose their inner tangential and radial walls and the protoplast of all tapetal cells coalesces to form a periplasmodium. |

**9. What are the significance of the pollination?**

- ❖ A prerequisite for the process of fertilization. Fertilization helps in formation of fruits and seeds.
- ❖ It brings the male and female gametes closer for the process of fertilization.
- ❖ Cross pollination introduces variations in plants variations help the plants to adapt to the environment and results in speciation.

**10. “Pollination in Gymnosperm is different from angiosperms?”- Giver reason.**

| Gymnosperms   | Angiosperms  |
|---|--|
| Direct pollination  | Indirect pollination                                   |
| The pollens are deposited directly on the exposed ovules. | The pollens are deposited on the stigma of the pistil. |

**Five Marks Question:****1. Explain the structure of mature anther**

The mature anther wall consists of the following layers.

- Epidermis
- ❖ Endothecium.
- ❖ Middle layers.
- ❖ Tapetum.

**Epidermis:**

- ❖ Single layered
- ❖ Protective in function.
- ❖ Cells undergo repeated anticlinal divisions to cope up with the rapidly enlarging internal tissues.

**Endothecium:**

- ❖ It is found below the epidermis.
- ❖ The inner tangential wall develops bands of cellulose.
- ❖ The hygroscopic nature of endothecium helps in the dehiscence of anther at matures.



**Middle layers:**

- ❖ Two to three layers of cells next to endothecium constitute middle layers.
- ❖ They are generally ephemeral.
- ❖ They disintegrate or get crushed during maturity.

**Tapetum:**

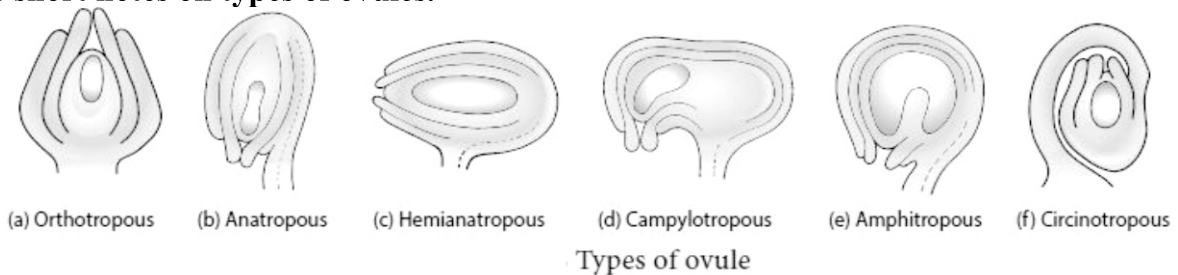
The innermost layer of anther wall.

It is derived partly from the peripheral wall layer and partly from the connective tissue of the anther lining the anther locule.

It attains maximum development at the tetrad stage of microsporogenesis.

**2. Explain pollination in salvia, (Lever Mechanism).**

- ❖ Flower of salvia is adapted for Bee Pollination.
- ❖ Flower is protandrous and corolla is bilabiate with 2 stamens.
- ❖ A lever mechanism helps in pollination.
- ❖ Each anther has an upper fertile lobe and lower sterile lobe.
- ❖ Lower sterile lobe separated by a long connective which helps the anthers to swing freely.
- ❖ When a bee visits a flower, it sits on the lower lip which acts as a platform.
- ❖ It enters the flower to suck the nectar by pushing its head into the corolla.
- ❖ During the entry of the bee into the flower the body strikes against the sterile end of the connective.
- ❖ This makes the fertile part of the stamen to descend and strike at the back of the bee.
- ❖ The pollen gets deposited on the back of the bee.
- ❖ When the bee visits the another flower, the pollen is rubbed on stigma. Thus pollination is completed.

**3. Give short notes on types of ovules.****Orthotropous:**

The micropyle is at the distal end. The micropyle, funicle and chalaza lie in one straight vertical line. E.g. Piperaceae, Polygonaceae.

**Anatropous:**

The body of the ovule completely inverted. The micropyle and funicle come to lie very close to each other. E.g. Dicot and Monocot plants.

**Hemianatropous:**

The body of the ovule is placed transversely at right angles to the funicle. E.g. Primulaceae.

**Campylotropous:**

The body of ovule at the micropylar end is curved and more or less bean shaped. The embryo sac is slightly curved. Eg. Leguminosae.

**Amphitropous:**

The distance between hilum and chalaza is less. Curvature of ovule leads to horse-shoe shaped. E.g. Some Alismataceae.

**Circinotropous:**

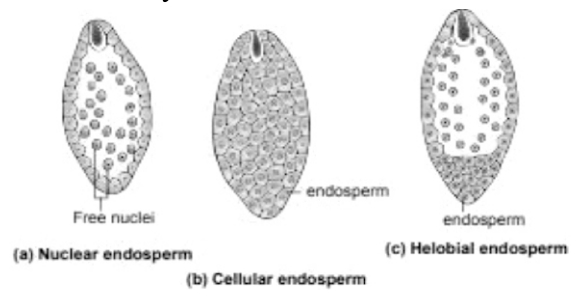
Funicle is very long and surrounds the ovule. E.g. Cactaceae.

**4. What is endosperm? Explain the types.**

The primary endosperm nucleus (PEN) divides immediately after fertilization into an endosperm.

**Nuclear Endosperm:**

- ❖ PEN undergoes several mitotic divisions without cell wall formation.
- ❖ Thus a free nuclear condition exists in the endosperm. Eg. *Coccinia*, *Capsella*, *Arachis*.

**Cellular endosperm:**

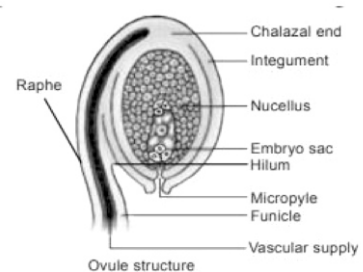
- ❖ PEN divides into two nuclei and it is immediately followed by wall formation. E.g. *Adoxa*, *Helianthus*.

**Helobial endosperm:**

- ❖ PEN moves towards base of embryo sac and divides into two nuclei.
- ❖ Large micropylar chamber.
- ❖ Small chalazal chamber.
- ❖ Micropylar chamber nucleus undergoes several free nuclear division.
- ❖ Chalazal chamber may or may not divide. E.g. *Hydrilla*, *Vallisneria*.

**5. With a suitable diagram explain the structure of an ovule.**

- ❖ Ovule also called **Megasporangium**.
- ❖ It is provided by one or two covering called integuments.
- ❖ The stalk or **funiculus** is present at the base of ovule.
- ❖ The point of attachment of funicle to the body of the base of ovule.
- ❖ The funicle is adnate to the body of the ovule forming a ridge called **raphe**.  
The body of ovule is made up of central mass of parenchymatous tissue known as **nucellus**. It has large reserve food materials.
- ❖ The nucellus is enveloped by protective coverings called integuments.
- ❖ The nucellus, the integument and the funicle meet at the basal region is called as **chalaza**.
- ❖ The micropylar end of the nucellus contains large oval, sac-like structure called **embryosac**.

**6. Differentiate the structure of Dicot and Monocot Seed.**

| Dicot Seed                  | Monocot Seed               |
|-----------------------------|----------------------------|
| Two cotyledons              | One cotyledon              |
| Coleoptile are absent       | Coleoptile are present     |
| Coleorhiza are absent       | Coleorhiza are present     |
| Scutellum is absent         | Scutellum present          |
| E.g. <i>Cicer arietinum</i> | E.g. <i>Oryza sativa</i> . |

**7. Give a detailed account on parthenocarpy add a note on its significance.**

- ❖ Formation of fruit from the ovary without fertilization is called Parthenocarpy.
- ❖ Parthenocarpic fruits do not have true seeds. E.g. Grapes, Banana, Papaya.

**Significance of parthenocarpy:**

- ❖ The seedless fruits have great significance in horticulture.
- ❖ The seedless fruits have great commercial importance.
- ❖ They are useful for the preparation of jams, Jellies, sauces, fruit drinks.
- ❖ High proportion of edible part due to the absence of seeds.



## 2. Classical Genetics

### One Mark Questions:

1. Polygenic inheritance – **skin colour in human**.
2. Extra nuclear inheritance is a consequence of presence of genes in – **Mitochondria and chloroplast**.
3. “Gametes are never hybrid”. This is a statement of – **Law of segregation**.
4. The dominant epistasis ratio is – **12 : 3 : 1**.
5. Fruit colour in squash is example of – **Dominant epistasis**.
6. Test cross involves – **crossing the F1 hybrid with a double recessive genotype**.
7. The term genetics was first introduced – **Bateson**.
8. The process in which the F1 hybrid is crossed with any one of the parental genotype is – **Back cross**.
9. Name of the scientist who reported lethal gene in Snapdragon – **E.Baur**.
10. Sickle cell anemia is an example for **pleiotropy**.
11. In each cross of the F1 plant reveals the character of – **Female**.
12. Ratio of complementary genes – **9: 7**.
13. When dominant and recessive alleles express itself together it is called – **codominance**.
14. Genes for cytoplasmic male sterility in plants are generally located in – **Mitochondrial genome**.
15. The genotype of a plant showing the dominant phenotype can be determined by – **Test cross**.
16. Nilsson-Ehle found red: White ratio in kernel colour of wheat in F2 generation of polygenic inheritance is – **63: 1**.

### Two Mark Questions:

#### **1. Define Atavism.**

An ancestral trait reappears after having been lost through reemergence of sexual reproduction in the flowering plant.

#### **2. What is back cross?**

Back cross is a cross of F1 hybrid with anyone of the parental genotypes.

#### **3. What is lethal genes or alleles?**

An allele which has the potential to cause the death of an organism is called a lethal alleles or genes.

#### **4. Define – law of dominance.**

The characters are controlled by discrete units called factors which occur in pairs. In a dissimilar pair of factors one member of the pair is dominant and the other recessive.

#### **5. Define – genetics.**

The branch of biological science. Which deals with the mechanism of transmission of characters from parents to off springs.

#### **6. What is meant by heredity?**

Heredity is the transmission of characters from parents to off springs.

### Three Mark Questions:

#### **1. What is pleiotropy?**

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

The pleiotropic gene influences a number of characters simultaneously and such genes are called pleiotropic gene.

#### **2. Differentiate incomplete dominance and codominance.**

| <b>Incomplete dominance</b>                                       | <b>Codominance</b>                                      |
|---|---|
| The phenotype of F1 hybrid does not resemble either of the parent | The phenotype of F1 hybrid resemble both the parents    |
| F1 hybrid possess new phenotype                                   | New phenotype is not produced                           |
| E.g. Mirabilis jalapa   | E.g. Red and white flower of camellia, ABO blood group. |

**3. What are reasons for Mendel's successes in his breeding experiment?**

- ❖ He followed scientific methods and kept accurate and detailed quantitative data.
- ❖ His experiment was carefully planned and he used large samples.
- ❖ The parents selected by Mendel were pure breed lines and the purity was tested by self-crossing the progeny for many generations.

**4. Give the names of scientists who rediscovered Mendelism.**

- ❖ Hugo de Vries – Holland
- ❖ Carl Correns – Germany
- ❖ Erich von Tschermak – Austria.

**5. What is extra chromosomal inheritance or extra nuclear inheritance?**

- ❖ DNA is the universal genetic material.
- ❖ Genes located in nuclear chromosomes follow Mendelian inheritance, but certain traits are governed by the chloroplast or mitochondrial genes.

**6. What are multiple alleles?**

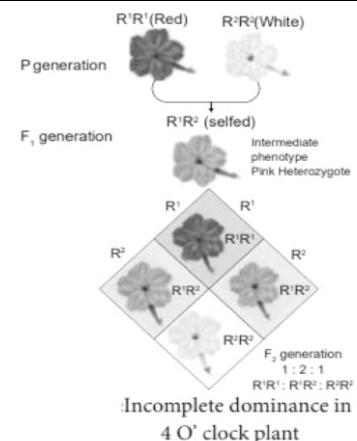
When any of the three or more allelic forms of a gene occupy the same locus in a given pair of homologous chromosomes are called multiple alleles.

**Five Mark Questions:****1. Differentiate Discontinuous variation from continuous variation.**

| Discontinuous variation  | Continuous variation   |
|--|--|
| Within a population there are some characteristics which show a limited form of variation                | This variation may be due to the combining effects of environmental and genetic factors.                 |
| These characteristics are controlled by one or two major genes which may have two or more allelic forms. | Inheritance of phenotype is determined by the combined effects of many genes, and environmental factors. |
| Genes do not show additive effect  | Genes show additive effect.  |
| Individuals show differences without any intermediate forms.   | Intermediate forms are available.  |
| Phenotypic expression is not affected by environmental condition.  | Phenotypic expression is affected by environmental condition.  |
| It is also called qualitative inheritance.   | It is also called quantitative inheritance.  |
| E.g. Style length in primula   | E.g. Human height skin colour.   |

**2. Explain the incomplete dominance with an example.**

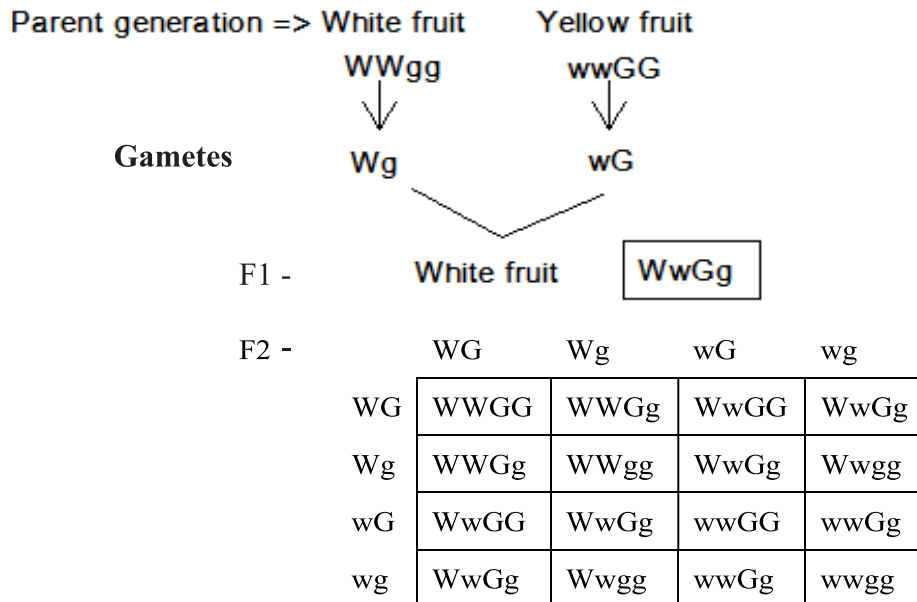
- ❖ The German Botanist Carl Correns's experiment with *Mirabilis jalapa*. The pure breeding homozygous red ( $R^1 R^1$ ) is crossed with homozygous white ( $R^2 R^2$ ). The phenotype of the  $F_1$  hybrid is heterozygous pink ( $R^1 R^2$ ).
- ❖ When one allele is not completely dominated by another allele it shows incomplete dominance.
- ❖ When pink coloured plants of  $F_1$  generation were interbred in  $F_2$  both phenotypic and genotypic ratios were found to be identical as 1:2:1 (1 red : 2 Pink : 1 White).
- ❖ The phenotypic and genotypic ratios are same 1:2:1.

**3. Describe dominant epistasis with an example.**

- ❖ In the summer squash the fruit colour locus has a dominant allele "W" for white colour and a recessive allele "w" for coloured fruit.
- ❖ "W" Allele is dominant that masks the expression of any colour. In other locus hypostatic allele "G" is for yellow fruit and its recessive allele "g" for green fruit.
- ❖ When the white fruit with genotype (WWgg) is crossed with yellow fruit with genotype (wwGG). The  $F_1$  plants have white fruit and are heterozygous (WwGg).



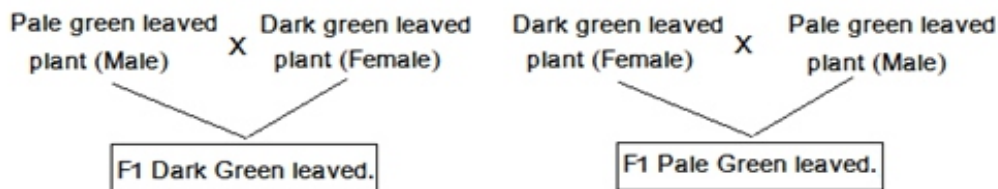
- ❖ When F1 heterozygous plants are crossed they give rise to F2 with the phenotypic ratio of 12 White : 3 Yellow : 1 Green.
- ❖ Homozygous recessive  $ww$  = coloured fruit (4/16)
- ❖ Double recessive  $wwgg$  = green fruit (1/16)
- ❖ Only "G" in genotype = yellow fruit (3/16)



- ❖ Phenotypic ratio 12 : 3 : 1 = White fruit : Yellow fruit : Green fruit.
- ❖ Dominant epistasis in Summer squash.

#### 4. Describe chloroplast inheritance.

- ❖ It is found in 4.0'clock plant (*Mirabilis jalapa*)
- ❖ When the pollen of dark green leaved plant (male) is transferred to the stigma of pale green leaved plant (female) and pollen of pale green leaved plant transferred to the stigma of dark green leaved plant the F1 generation of both the crosses must be identical as per Mendelian inheritance.
- ❖ In each cross, the F1 plant reveals the character of the plant which is used as female plant.
- ❖ It is due to the chloroplast gene found in the ovum of the female plant which contributes the cytoplasm during fertilization since the male gamete contribute only the nucleus but not cytoplasm.



#### 5. What are the seven characters studied by Mendel?

1. Stem length → Tall – Dwarf
2. Pod length → Inflated – constricted.
3. Seed shape → Round – Wrinkled.
4. Seed colour → Yellow – Green
5. Flower position → Axial – Terminal
6. Flower colour → Purple – White
7. Pod colour → Green – Yellow.

### 3. CHROMOSOMAL BASIS OF INHERITANCE

#### One Mark Questions:

1. An allohexaploidy contains- **Two copies of three different genomes**
2. A pair of chromosomes extra with diploid - **tetrasomy**
3. One chromosome extra to the diploid – **trisomy**
4. One chromosome loses from diploid - **monosomy**
5. Two individual chromosomes lose from diploid - **double monosomy**
6. Accurate mapping of genes can be done by three point test cross because increases
- Possibility of recombination frequency**
7. Due to incomplete linkage in maize, the ratio of parental and recombinants are **96.4: 3.6**
8. The point mutation sequence for transition, transition, transversion and transversion in DNA are **A to G, C to T, C to G and T to A**
9. If haploid number in a cell is 18. The double monosomic and trisomic number will be **34 and 37**
10. Changing the codon AGC to AGA represents **missense mutation**
11. How many map units separate two alleles A and B if the recombination frequency is 0.09? **9 cM**
12. When two different genes came from same parent they tend to remain together. This phenomenon is **Coupling**
13. Phenotypic ratio of Coupling is **7:1:1:7**
14. Crossing over occurs at **pachytene** stage
15. The alkaloid used to induce polyploidy is **Colchicine**
16. Removal of introns and joining of exons in a defined order during transcription is called **Splicing**
17. If one strand of DNA has the nitrogenous base sequence as ATCTG, what would be the complementary RNA strand sequence? **UAGAC**
18. Removal of RNA polymerase III nucleoplasm will affect the synthesis of **tRNA**
19. DNA dependent RNA polymerase catalyzes transcription on one strand of the DNA which is called the **Template strand**
20. The correct flow of genetic information is  
**DNA → RNA → Protein**
21. Initiation codon is **AUG**
22. A eukaryotic gene contains two kinds of base sequences which of these plays an important role in protein synthesis? **Exons**
23. Codon – anticodon interactions occurs by **Hydrogen bonds**
24. Which of the following RNA polymerases is responsible for the transcription of protein coding genes in eukaryotes? **RNA Poly II**
25. How is RNA molecules transported out of the nucleus?  
**Through membrane pores in an energy dependent process**
26. During translation the codon in mRNA is actually “read” by **anticodon in t- RNA**
27. A complex of ribosome attached to a single strand of RNA is known as **Polysome**
28. What is true about tRNA? **It looks like clover leaf in the 3D structure**
29. Which one of the following hydrolysis internal phosphodiester bonds in a polynucleotide chain? **Exonuclease**
30. DNA element with ability to change position is called **Transposon**
31. Spliceosomes are not found in cells of **Bacteria**
32. During DNA replication Okazaki fragments are used to elongate **the lagging strand away from replication fork**
33. Alterations of single base pairs of DNA is **Point Mutation**
34. In paddy the diploid number of chromosome is 12, what is the actual number of chromosomes seen if double monosomy occurs- **10**

35. Increase in temperature increases the rate of mutation this is due to unbinding of **Hydrogen bonds** between nucleotides
36. The term mutation was introduced by **Hugo de Vries**
37. Who developed the concept of gene mapping? **Alfred Sturtevant**
38. The correct sequence of crossing over mechanism involves **Synapsis >Tetrad> crossing over >Terminalization** .

**Two Marks Question:**

**1. What is meant by synteny?**

The two genes that are sufficiently far apart on the same chromosome are called unlinked genes or syntenic genes. Such condition is known as **synteny**.

**2. Define gene 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.

**4. Define Indel mutation**

Addition or deletion mutations are actually additions or deletions of nucleotide pairs also collectively, they are termed **indel mutations**

**5. What is meant by missense mutation?**

The mutation where the codon for one amino acid is changed into a codon for another amino acid is called **Missense or non-synonymous mutations**.

**6. What is meant by Nonsense mutation?**

The mutations where codon for one amino acid is changed into a termination or stop codon is called **Nonsense mutation**.

**7. Write a note on Sharbati Sonora**

**Sharbati Sonora** is a mutant variety of wheat, which is developed from Mexican variety (Sonora-- 64) by irradiating of gamma rays.

**8. Write a short note on Castor Aruna**

**Castor Aruna** is mutant variety of castor which is developed by treatment of seeds with thermal neutrons in order to induce very early maturity (120 days )

**9. What is meant by chromosomal aberrations?**

The genome can also be modified on a larger scale by altering the chromosome structure or by changing the number of chromosomes in a cell. These large-scale variations are termed as **chromosomal aberrations**.

**10. What is meant by ploidy?**

The chromosome number of somatic cells are changed due to addition or elimination of individual chromosome or basic set of chromosomes. This condition is known as **ploidy**.

**11. What is meant by Nullisomy?**

Loss of a pair of homologous chromosomes or two pairs of homologous chromosomes from the diploid set are called **Nullisomy**( $2n-2$ )

**12. What is TATA BOX ?**

In Eukaryotes transcription start site contains about 25 bp(basepairs) upstream sequence TATAAT known as **TATA or Hogness box**

**13. What is Replication fork**

**Replication fork** is the site of separation of parental DNA strands where new daughter strands are formed.

**14. Name the Enzymes involved in Eukaryotic DNA Replication**

- ❖ Helicase
- ❖ Topoisomerase
- ❖ DNA Pol  $\alpha$  (alpha), DNA Pol  $\delta$  (delta) and DNA Pol  $\epsilon$  (Epsilon)

**15. Differentiate Template Strand and Coding Strand.**

| Template strand   | Coding strand   |
|---|---|
| The strand of DNA which is oriented in 3' → 5' direction that serves as a template for the synthesis of mRNA is called <b>template strand</b> | The strand of DNA which is oriented in 5' → 3' not transcribed is called the <b>Coding Strand</b> |

**16. What is splicisomes?**

**SPLICISOMES** are spherical particles which is a multiprotein complex approximately 40 – 60 nm in diameter. They have many small nuclear ribonucleic acids (snRNAs) and small nuclear ribonuclear protein particles (snRNPs) which identify and helps in the removal of introns

**17. What is Transposons/jumping genes**

**Transposons** are the DNA sequences which can move from one position to another position in a genome. This was first reported in 1948 by American Geneticist Barbara McClintock as “mobile controlling element” (Ac / Ds) in Maize.

**Three Mark Questions:****1. Write the salient features of Sutton and Boveri concept or Write the salient features of chromosomal theory of inheritance.**

- ❖ Somatic cells are derived from zygote. These somatic cells are consists of two identical set of chromosomes.
- ❖ In this chromosomes one is received from male parent and another one is received from female parent. It is called as homologous chromosomes.
- ❖ Chromosomes are maintaining the individuality of an organism. Gene locations are identified in the chromosome by the process of meiosis.

**2. Mention the uses of genetic mapping**

- ❖ It is used to determine gene order. It is used to calculate the distances between genes.
- ❖ They are useful in predicting results of dihybrid and trihybrid crosses.
- ❖ It allows the geneticists to understand the overall genetic complexity of particular organism

**3. 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.

**4. Differentiate Linkage and Crossing over.**

| SL NO | LINKAGE  | CROSSING OVER  |
|-------|--|--|
| 1     | The genes present on chromosome stay close together  | It leads to separation of linked genes   |
| 2     | It involves same chromosome of homologous chromosome | It involves exchange of segments between non-sister chromatids of homologous chromosome.     |
| 3     | It reduces new gene combinations                     | It increases variability by forming new gene combinations. lead to formation of new organism |

**5. What is Tailing? What is its purpose?**

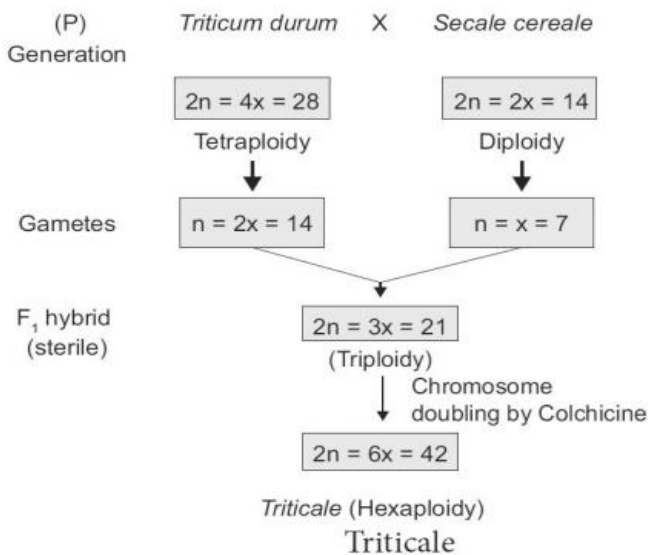
The 3' end of hnRNA is cleaved by an endonuclease and a string of adenine nucleotides is added to the 3' end of hnRNA (pre mRNA) is known as Poly (A) tail - Polyadenylation. This process is called **Tailing or polyadenylation**.

Purpose of Tailing

- ❖ Translation of RNA transcript is facilitated.
- ❖ Helps in the synthesis of Polypeptides.
- ❖ It enhances the mRNA stability in the cytoplasm.

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

The man-made cereal is Triticale.



## 7. What is RNA- editing?

Chemical modification such as base modification, nucleotide insertion or deletions and nucleotide replacements of mRNA results in the alteration of amino acid sequence of protein that is specified is called **RNA editing**.

### Five Mark Questions:

#### 1. What are the Importance of Crossing Over?

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

#### 2. What is the Significance of Ploidy?

- ❖ Many polyploidies are more vigorous and more adaptable than diploids
- ❖ Many ornamental plants are autotetraploids and have larger flowers and longer flowering duration than diploids.
- ❖ Autopolyploid usually have higher in fresh weight due to more water content.
- ❖ Aneuploidy are useful to determine the phenotypic effects of loss or gain of different chromosomes.
- ❖ Many angiosperms are allopolyploids and they play a role in the evolution of plants.

#### 3. What is Point Mutation and explain its Types.

**Point mutation** refers to alterations of single base pairs of DNA or of a small number of adjacent base pairs.

#### Types of point mutations

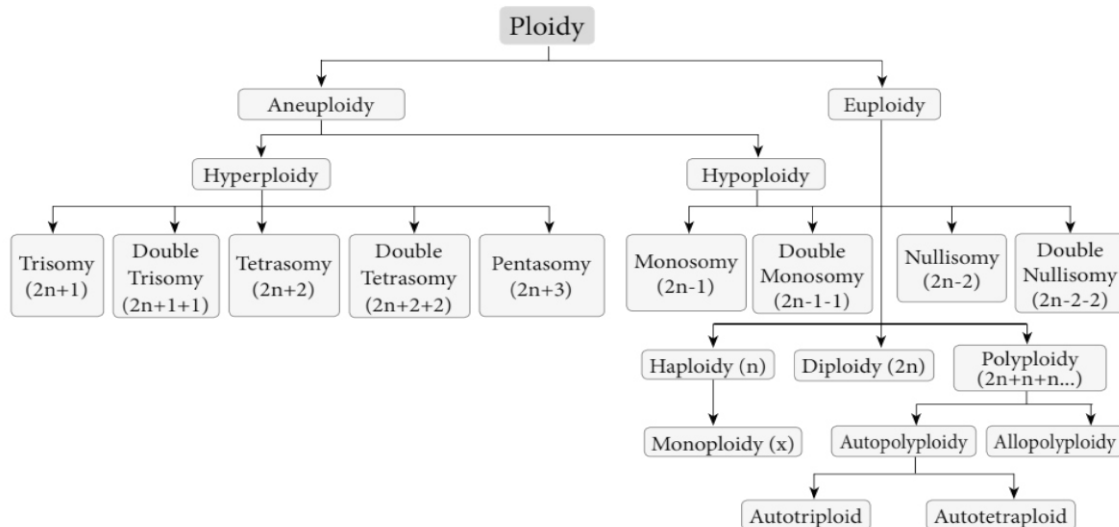
- ❖ Point mutation in DNA are categorized into two main types. They are base pair **substitutions** and base pair **insertions or deletions**.
- ❖ **Base substitutions** are mutations in which there is a change in the DNA such that one base pair is replaced by another. Types: Transitions and Transversions.
- ❖ Addition or deletion mutations are actually additions or deletions of nucleotide pairs. Collectively, they are termed **indel mutations**.
- ❖ The mutation that changes one codon for an amino acid into another codon for that same amino acid are called **Synonymous or silent mutations**.
- ❖ The mutation where the codon for one amino acid is changed into a codon for another amino acid is called **Missense or non-synonymous mutations**.

- ❖ The mutations where codon for one amino acid is changed into a termination or stop codon is called **Nonsense mutation**
- ❖ Mutations that result in the addition or deletion of a single base pair of DNA that changes the reading frame for the translation process, as a result of which there is complete loss of normal protein structure and function are called **Frame shift mutations**.

#### 4. Write the importance of *Arabidopsis thaliana*.

- ❖ It is a model plant for the study of genetic and molecular aspects of plant development.
- ❖ It belongs to mustard family the first flowering plant, where its entire genome is sequenced.
- ❖ The two regions of the nuclear organizer ribosomal DNA which codes for the ribosomal RNA are present at the extremity of chromosomes 2 and 4
- ❖ It is Diploid plant having small genome with  $2n = 10$  chromosomes. Several generations can be produced in one year.
- ❖ In 1982, *Arabidopsis* has successfully completed its life cycle in Microgravity i.e. space.

#### 5. Draw the Flow Chart of PLOIDY



### 4. Principles and Processes of Biotechnology

#### One Marks Questions:

1. **Restriction enzymes** are Essential tools in genetic engineering and cleaves DNA at specific sites.
2. Plasmid confer **resistance to antibiotics**.
3. **EcoRI** cleaves DNA at GAATTC.
4. Genetic engineering is hybridization of DNA of one organism to that of the others
5. The correct sequence of recombinant DNA technology is

**Isolation of genetic material(DNA) → Cutting of DNA at specific location using restriction enzyme → Amplification of the gene → Insertion of recombinant DNA into host cells**

6. A palindromic base sequence in DNA 5' GAATTC3' 3' CTTAAG 5' can be easily cut in middle by some particular restriction enzymes
7. pBR 322, BR stands for **Boliver and Rodriguez**
8. **Enzymes** are used as Biosensors
9. **Exonuclease** cuts the DNA at terminus
10. **Endonuclease** cuts DNA at middle
11. **Alkaline Phosphate** adds or removes phosphate in DNA
12. **DNA Ligase** binds the DNA fragments



13. Ethidium Bromide is used in **Agrose Gel Electrophoresis** **IVDP - KRISHNAGIRI**
14. **Ti-Plasmid** (*Agrobacterium tumefaciens*) causes crown gall disease.
15. An analysis of chromosomal DNA using the southern hybridisation technique does not use **Polymerase Chain Reaction**
16. An antibiotic gene in a vector usually helps in the selection of **Transformed cells**
17. The characteristics of Bt cotton are **High yield and resistant to boll worms**
18. **PHAs and PHB** are group of degradable biopolymers
19. 'psy' gene is obtained from the plant *Narcissus pseudonarcissus*.
20. **GFP** is frequently used Reporter gene by genetists
21. Example of Biopharming is **Golden rice**
22. **Alkaline Phosphatase** enzyme is purified from bacteria and calf intestine
23. The study of fermentation, its practical uses are called **Zymology**
24. The enzyme **Polygalacturonase** responsible for the ripening process of tomato
25. The term biotechnology was coined by **Karl Ereky**.

### Two Mark Question:

#### 1. Define Single cell protein

**Single cell proteins** are dried cells of microorganism that are used as protein supplement in human foods or animal feeds.

#### 2. What are the enzymes used in DNA recombinant technology

- ❖ Restriction endonuclease
- ❖ DNA ligase
- ❖ Alkaline Phosphatase

#### 3. What is meant by cloning vehicles?

- A **Vector** is a small DNA molecule capable of self-replication.
- Used as a carrier and transporter of DNA fragment for cloning experiments.
- Vector is also called cloning vehicle

#### 4. What is meant by Bioremediation?

It is the process of using organisms to remove or reduce pollutants from the Environment.

#### 5. Define fermentation

**Fermentation** refers to the metabolic process in which organic molecules are converted into acids, gases, or alcohol in the absence of oxygen or electron transport chain.

#### 6. Name the chemicals used for gene transfer

Chemicals like **polyethylene glycol (PEG)** and **dextran sulphate** induce DNA uptake into plant protoplasts

#### 7. What are the materials used to grow microorganism like Spirulina?

Spirulina like microorganisms are easily growing in straw, molasses, animal manure and sewage.

#### 8. Differentiate Exonuclease and Endonuclease

| SL NO | EXONUCLEASE   | ENDONUCLEASE  |
|-------|---|---|
| 1     | Exonucleases are enzymes which remove nucleotides one at a time from the end of a DNA molecule. | Endonucleases are enzymes which break the internal phosphodiester bonds within a DNA molecule |
| 2     | e.g. Bal 31, Exonuclease III.   | e.g. Hind II, EcoRI, PvuI, BamHI, TaqI  |

#### 9. What are the types of vectors?

- i) Cloning Vector
- ii) Expression Vector.

#### 10. What is meant by restriction Site?

A restriction enzyme or restriction endonuclease is an enzyme that cleaves DNA into fragments at or near specific recognition sites in DNA, This site is known as **Restriction sites**.

**Three Mark Questions:****1. What do you know about pBR 322?**

- ❖ pBR 322 plasmid is a reconstructed plasmid.
- ❖ P – plasmid
- ❖ B&R- Boliver & Rodriguez,
- ❖ 322- Number of plasmids developed from their laboratory.

**2. Name any three microorganism which is used for single cell protein**

- ❖ **Bacteria**—*Methylophilus methylotrophus*, *Cellulomonas*, *Alcaligenes*
- ❖ **Fungi**—*Agaricus campestris*, *Saccharomyces cerevisiae* (yeast), *Candida utilis*
- ❖ **Algae** - *Spirulina*, *Chlorella*, *Chlamydomonas*

**3. Write any three properties of vectors**

- ❖ It should be small in size and of low molecular weight, less than 10 Kb in size.
- ❖ Vector must contain an origin of replication so that it can independently replicate within the host.
- ❖ It should contain a suitable marker such as antibiotic resistance, to permit its detection in transformed host cell

**4. What is meant by Biopiracy?**

**Biopiracy** can be defined as the manipulation of intellectual property rights laws by corporations to gain exclusive control over national genetic resources, without giving adequate recognition or remuneration to the original possessors of those resources.

Example : Turmeric, Neem and Basmati rice.

**5. Describe Biological hydrogen production by algae**

The biological hydrogen production with algae is a method of photo biological water splitting. In normal photosynthesis the alga, *Chlamydomonas reinhardtii* releases oxygen. When it is deprived of sulfur, it switches to the production of hydrogen.

**6. What is meant by screening?**

After the introduction of r-DNA into a suitable host cell, it is essential to identify those cells which have received the r-DNA molecule. This process is called **screening**.

**Five Mark Questions:****1. Write the applications of Single Cell Protein.**

**Single cell proteins** are dried cells of microorganism that are used as protein supplement in human foods or animal feeds. E.g. *Chlorella*, *Spirulina*

- ❖ 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.

**2. 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 up to 120 days.
- ❖ Affecting pollinating insects and yield.
- ❖ Ineffective against aphids and whitefly.

**3. List out the merits and demerits of genetically modified Food.****Merits**

- High yield without pest
- 70% reduction of pesticide usage
- Reduce soil pollution problem

**Demerits**

- Affect liver, kidney function and causes cancer



- Hormonal imbalance and physical disorder
- Anaphylactic shock and allergies.

#### 4. Compare the various types of 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          |

#### 5. Write the advantages of herbicide tolerant crops.

- ❖ It improves the crop yielding.
- ❖ It reduces the herbicides.
- ❖ It improves the soil fertility.
- ❖ It reduces the environmental toxicity.
- ❖ It conserves the soil living microorganisms.

### 5. Plant Tissue Culture

#### One Mark Questions:

1. Father of tissue culture **Gottlieb Haberlandt**.
2. Who proposed the concept of totipotency **Gottlieb Haberlandt**.
3. He was the first to demonstrate the growth of stem cells in an artificial environment **Gottlieb Haberlandt**.
4. Experiment plant is **Lamium purpureum**.
5. The plant tissue required to grow in the culture medium is **explant**.
6. The time duration for sterilization process by using autoclave is **15 to 30 minutes** and the temperature is **121°C**.
7. Sterilization of culture room by using **2% Sodium hypochloride or 95% Ethanol**.
8. Sterilization of explants by using **0.1% mercuric chloride, 70% ethanol**.
9. Gelling agent used in tissue culture medium **agar**.
10. Agar is a **complex mucilaginous polysaccharide**.
11. B5 medium found by **Gamborg et.al (1968)**.
12. Culture medium commonly used in plant tissue culture is **Murashige and Skoog nutrient medium**.
13. PH of culture medium up to **5.6 to 6.0**
14. Optimum temperature for plant tissue culture is **25°C ± 2°C**
15. Culture medium with tissue **1000 lux** light illumination, **16 hours of light** duration needed.
16. Optimum humidity for tissue culture is **50-60%**.
17. The culture medium is narrated by an **automatic shaker**.
18. Growth hormone **auxin** added to MS growth medium.
19. **Callus** is a mass of unorganized growth of plant cells or tissues.
20. Callus **12 hours of light** and **12 hours of dark** at **25°C** is induced.
21. **Protoplasts** are cells without a cell wall but bounded by plasma membrane.
22. **20% sucrose** solution to retain their viability of protoplast.
23. Protoplast fusion factor **polyethylene glycol (PEG) and Ca++ ion**.
24. **Fluorescein di acetate** is used to test the viability of protoplast.
25. Protoplast cultures are kept at **25°C temperature, 1000-2000 lux** light intensity.
26. **Cybrid** is fusion product of protoplasts without nucleus of different cell

27. Culture of single cells or small aggregated of cells in vitro in liquid medium is known as **cell suspension culture**.
28. Indole alkaloids are obtained from **Catharanthus roseus** plant.
29. Codeine, an analgesic derived from the plant **Papaver somniferum**.
30. Antimalarial drug **quinine** obtained from **Cinchona officinalis** tree.
31. Capsaicin, which causes rheumatic pain, is obtained from the plant **Capsicum annum**.
32. Cardiac medicinal use digoxin is obtained from the plant **Digitalis purpuria**.
33. Vincristine is an anticancer drug obtained from the plant **Catharanthus roseus**.
34. Direct embryogenesis from callus tissue is called somatic **fertilization**.
35. Embryos are used to produce **artificial seeds**.
36. **Agrose extract (or) sodium alginate** is used to produce artificial seeds.
37. Formation of shoot and root from callus is called **organogenesis**.
38. **Artificial seeds** help to conserve plant biodiversity.
39. Virus free plants are obtained from **shoot meristem culture**.
40. In less time available through smaller seedlings are more in number crop and tree **micropropagation techniques**
41. **Plant micro propagation** helps to maintain similar genetic character of plants.
42. In less time available through smaller seedling are more in number crop and tree **micro propagation techniques**.
43. Cryopreservation also known as **Cryo-Conservation**.
44. **-196°C liquid nitrogen** is used in cryopreservation.
45. The cryoprotectant agents are dimethylsulphoxide, Glycerol or Sucrose.
46. **ELSI** – is a project to solve problems related to genomic research.
47. Ordinance for release of genetically modified organism (or) products under circumstances **GEAC** is a body established to lay down.

#### **Two Mark Questions:**

##### **1. What is tissue culture?**

Growing plant protoplasts. Cells, tissues or organs away from their natural environment, under artificial condition is known as tissue culture.

##### **2. What is totipotency?**

The development of whole plant from isolated cells or tissues in in vitro condition is called Totipotency.

##### **3. Name of the different types of medium used in plant tissue culture?**

- |                 |                  |
|-----------------|------------------|
| 1. M.S.Medium   | 2. B5 Medium     |
| 3. White medium | 4. Nitsch medium |

##### **4. What are the basic concept of plant tissue culture?**

- |                      |                       |
|----------------------|-----------------------|
| 1. Totipotency       | 2. Differentiation    |
| 2. Redifferentiation | 3. Dedifferentiation. |

##### **5. What is meant by explant?**

A tissue taken from a selected plant is transferred to a culture medium often to establish a new plant.

##### **6. What is agar?**

A complex mucilaginous polysaccharide obtained from marine algae used as solidifying agent in media preparation.

##### **7. 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.

##### **8. What is callus?**

Callus is a mass of unorganized growth of plant cells or tissues in invitro culture medium.

##### **9. What are called embryoids?**

The callus cell undergoes differentiation and produces somatic embryos known as embryoids.

**10. What is hardening?**

The gradual exposure of in vitro plant lets in humid chambers then grow under normal field conditions are called hardening.

**11. What are types of plant tissue Culture based on the explants?**

1. Organ culture      2. Meristem culture
- 3 Protoplast culture    4. Cell culture

**12. What is cybrid?**

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

**13. What are bioethics?**

The study of ethical issues emerging from advances in biology and medicine is called bioethics.

**14. What are patents?**

It is a special right to the discoverer / inventor that has been granted by the government through legislation for trading new articles.

**Three Mark Questions:****1. What is organogenesis?**

- ❖ The morphological changes occur in the callus leading to the formation of shoot and root is called organogenesis.
- ❖ The differentiation of shoots from callus is called caulogenesis.
- ❖ The differentiation of roots from callus is called rhizogenesis.

**2. What is somatic embryogenesis?**

Somatic embryogenesis is the formation of embryos from the callus tissue directly and these embryos are called embryoids.

**3. What are the application of somatic embryogenesis?**

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

**4. What is Cryopreservation?**

The protoplasts tissues organelles. Organs are subjected to preservation by cooling to very low temperature of  $-196^{\circ}\text{C}$  using liquid nitrogen are called cryopreservation.

**5. What is called cryoprotectants?**

Before cryopreservation process the protective agents like dimethyl sulphoxide, Glycerol or sucrose are added these protective agents are called cryoprotectants.

**Five Mark Questions:****1. Explain the intellectual property right (IPR)**

- ❖ It also includes other types of rights, such as trade secrets, publicity rights, moral rights and right against unfair competition.
- ❖ The discoverer has the full rights on his property.
- ❖ It should not be neglected by the others without legal permission.
- ❖ The right of discoverer must be protected and it does by certain laws framed by a country.
- ❖ The IPR is protected by different ways like patents, copyright, trade secrets and trademarks, designs and geographical indications.

**2. What are the secondary metabolites produced by cell suspension culture?**

Alkaloids, Flavonoids, Terpenoids, Phenolic Compounds and recombinant proteins.

**3. What do think the future of biotechnology will look like?**

- ❖ It will lead to a new scientific revolution.
- ❖ This revolution will change people's lives and future.
- ❖ Like industrial and computer revolution, biotechnological revolution will also promise major changes in many aspects of modern life.

**4. Explain the basic concepts involved in plant tissue culture?**

**Totipotency:** Plant cells have the inherent genetic potential to develop into a complete individual plant it provided 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 stage leading to the formation of callus is called dedifferentiation.

#### 5. Explain the steps involved in protoplasmic fusion:

Protoplasts are cells without a cell wall, but bounded by a cell membrane or plasma membrane. Using protoplasts it is possible to regenerate whole plant from single cells and also develop somatic hybrids.

##### Isolation of protoplasts:

- ❖ Leaf tissue is immersed in 0.5% macerozyme, 2% onozuka cellulose 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 to 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.

#### 6. 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.

#### 7. What are the applications of plants tissue culture?

- ❖ Improved hybrid productions through somatic hybridizations.
- ❖ Synthetic seeds help in conservation of plant 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.

#### 8. Write about the secondary metabolites and its plant resources.

| Secondary metabolites | Plant source         | Uses                     |
|-----------------------|----------------------|--------------------------|
| Digoxin               | Digitalis purpurea   | Cardiac tonic            |
| Codeine               | Papaver somniferum   | Analgesic                |
| Capsaicin             | Capsicum annum       | Rheumatic pain treatment |
| Vincristine           | Catharanthus roseus  | Anti-Carcinogenic        |
| Quinine               | Cinchona officinalis | Antimalarial             |

#### 9. Explain the technique involved in plant tissue culture.

##### i. Laboratory Facilities.

- ❖ Wasting facility for glassware and ovens for drying glassware.

- ❖ Medium preparation room with autoclave, electronic balance and PH meter.
- ❖ Transfer area sterile room with laminar air flow bench.
- ❖ A high efficiency particulate is (HEPA) filter to maintain aseptic condition.

#### ii. Sterilization:

- ❖ Sterilization is the technique employed to get rid of microbes such as bacteria and fungi in the enhance medium, vessels and explants.

#### iii. Media Preparation:

- ❖ The growth medium is growth regulators and culture conditions such as temperature, PH, light and humidity. Growth media 4 types of media are used.
- ❖ MS nutrient medium, b) B5 Medium, c) White medium and d) Nitsch's medium.
- ❖ A medium may be solid or semisolid or liquid for solid or liquid for solidification a gelling agent such as agar is added.

#### iv. Culture condition:

- ❖ PH of culture medium 5.6 to 6.0.
- ❖ Temperature  $-25^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for optimal growth.
- ❖ Light intercity -16 hours of photoperiod with approximately 1000 lux.
- ❖ Aeration provided by automatic shaker.

#### v. Induction of callus:

- ❖ Inoculation is the transferring the explants to sterile glass tube containing nutrient medium.
- ❖ Callus is a moss of unorganized growth of plant cells or tissues in invitro culture medium.

#### vi. Embryogenesis or embryoids:

- ❖ The callus cells undergo differentiation and produces somatic embryos known as embryoids. The embryoids are sub-culture to produce plantlets.

#### vii. Hardening:

- ❖ The plantlets developed in vitro are transferred to green house chamber.
- ❖ Then the planets expose to normal environmental conditions.

## 6. PRINCIPLES OF ECOLOGY

### One Mark Questions:

1. Father of ecology is **Alexander von Humboldt**.
2. Father of modern ecology **Eugene P.Odum**.
3. Father of Indian ecology **R.Misra**.
4. The study of reciprocal relationship between living organisms and their environment is called **Ecology**.
5. The term ecology was introduced by **Reiter**.
6. The widely accepted definition of ecology was given by **Ernest Haeckel**.
7. The basic unit of ecological hierarchy is **Individual organism**.
8. Autoecology otherwise known as **Species ecology**.
9. Synecology otherwise known as **community ecology**.
10. A specific physical place or locality occupied by an organism or any species is called **Habitat**.
11. A specific place in an ecosystem where an organism lives and performs its functional role is called **Niche**.
12. Environment of any community is called **Biotope**.
13. The habitat and niche of any organism is called **Ecotope**.
14. Taxonomically different species occupying similar habitats(Niche) in different Geographical regions are called **Ecological equivalents**.
15. The term Niche was coined by **Roswell Hill Johnson**.
16. The term Niche was probably first to use by **Grinell**.
17. Flowers are blossom before the break of dawn (4 – 5 am) the plants are **Poppy, Chicory , dog rose**.



18. Flowers open up with the onset of dusk (5 – 6 pm) are **Evening primrose**.
19. The visible part of light is made up wavelength from about **400nm – 700nm**.
20. The rate of photosynthesis is maximum at **Blue (400-500nm) and Red(600-700nm)**.
21. The rate of photosynthesis is less strongly absorbed plants by **Green 500-600nm**.
22. Light loving plants are called Heliophytes ex: **Angiosperms**.
23. Shade loving plants are called **Sciophytes** ex: **Bryophytes and Pteridophytes**.
24. To study about helps to reconstruct past climates of our planet and flora & fauna and ecosystem is called **Palaeoclimatology**.
25. Who classified the world vegetation based on temperature in 4 types is –**Raunkiaer**.
26. Megatherms (Temperature more than 240°C) example – **Tropical rain forest**.
27. Mesotherms Temperature 170 °C and 240°C example-**Tropical deciduous forest**.
28. Microtherms (Temperature 70 °C and 170°C) example – **Coniferous forest**.
29. Hekistothermus( Temperature less than 70°C) example –**Alpine vegetation**.
30. Eurythermal example – **Zostera and Artemisia tridentate**.
31. Stenothermal example – **Terrestrial Angiosperms - mango, palm**.
32. Water covers on the earth surface is **more than 70%**.
33. The change in the temperature profile with increasing depth in a water body is called **Thermal stratification**.
34. Epilimnion – **The upper layer of warmer water**.
35. Metalimnion – The middle layer with a zone of gradual decrease in temperature.
36. Hypolimnion – **The bottom layer of colder water**.
37. Heavy rainfall occurs throughout the year – **Evergreen forests**.
38. Heavy rainfall occurs during winter and low rainfall during summer **Sclerophyllous forests**.
39. The amount of water salinity in inland water (fresh water bodies) – **5%**
40. The amount of water salinity in hypersaline (lagoons water) –**30 - 35%**
41. Euryhaline – organisms live in water wide range of salinity  
Ex: **Marine algae and Marine angiosperms**.
42. Stenohaline - organisms live in water small range of salinity  
Ex: **Plants of estuaries**.
43. Plants can tolerate cadmium and storing in to cells -**Soyabean and Tomato**.
44. Plants can remove cadmium from contaminated soil is **Phytoremediation**.
45. The plants remove cadmium from contaminated soil are **Rice & Eichhornia**.
46. The composition of gases in atmosphere **nitrogen -78%, Oxygen -21%, Carbondioxide – 0.03%, Argon & other gases – 0.93%**
47. The instrument used to measure the speed of wind – **Anemometer**.
48. Which flameless and subterranean fire – **Ground fire**.
49. Which consumes herbs and shrubs the fire is – **Surface fire**.
50. Which burns the forest canopy the fire is – **crown fire**.
51. A fungus indicates the burnt up and fire disturbed areas- **Pyronema**.
52. Indicators of fire – **Pteris and pyronema**.
53. The structural defense by plant against fire is **Rhytidome**.
54. The study of soil is called **Pedology**
55. The study of formation soil is called **Pedogenesis**.
56. Soils formed by weathering of rocks – **Residual soil**.
57. Soil transported by various agencies – **Transported soils**.
58. The best PH range of the soil for cultivation of crop plants is **5.5 to 6.8**.
59. A soil horizon usually absent in agricultural and deserts - **O horizon**.
60. Top soil – often rich in humus and minerals - **A horizon**.
61. Sub soil – often poor in humus and rich in minerals - **B horizon**.
62. Which soil is ideal for cultivation – **Loamy soil**.
63. Agricultural soil otherwise known as **Loamy soil**.
64. Total soil water content is **Holard**.

65. Water available to plant is **Chresard**.
66. Water not available to plants is **Echard**.
68. Bacterium forms nodules in the roots of leguminous plants – **Rhizobium**
69. Rhizobium bacterium fixes atmospheric nitrogen into **nitrate**.
70. Water ferns ex: **Azolla**.
71. Anabaena present in coralloid roots of **Cycas**.
72. Roots of terrestrial plants and fungal hyphae – **Mycorrhiza**.
73. Epiphytes ex: **Vanda**.
74. Vanda have hygroscopic roots contain special types of spongy tissue is called **Velamen**.
75. Sun dew plants ex: **Drosera**.
76. Pitcher plants are ex: **Nepenthes**.
77. Venus fly trap ex: **Dionaea**.
78. Bladderwort ex: **Utricularia**.
79. Highly poisonous cardiac glycosides produces – **Calotropis**.
80. Tobacco plants produces–**Nicotine**.
81. Coffee plants produce – **Caffeine**.
82. Cinchona plants produce – **Quinine**.
83. Total stem parasite is **Cuscuta**.
84. Total root parasites is **Balanophora ,Orobancha , Rafflesia**.
85. A partial stem parasite – **Viscum & Loranthus**.
86. A partial root parasite – **Santalum**.
87. The parasitic plants produce roots – **Haustorial roots**.
88. **Penicillium notatum** produces **penicillin** to inhibit the growth of bacteria **Staphylococcus**.
89. Trichoderma inhibits the growth of fungus **Aspergillus**.
90. **Juglans nigra** secretes an alkaloid **Juglone** inhibits the growth of seedlings of **Apple, Tomato and Alfalfa**.
91. Mimicry ex :**Phyllium frondosum, Carausium morosus**
92. Free floating hydrophyte – **Eichhornia, Pistia, wolffia**
93. Smallest flowering plants – **Wolffia**.
94. Rooted floating hydrophyte – **Nymphaea, Marsilea**.
95. Aquatic water ferns – **Marsilea**.
96. Seeds show highest longevity in plant kingdom – **Lotus**.
97. Submerged floating hydrophytes – **Ceratophyllum**.
98. Rooted submerged floating hydrophytes – **Vallisneria, Hydrilla**.
99. Rooted emergent hydrophytes are – **Sagittaria ,Ranunculus**
100. The root caps are replaced by Root pockets – **Eichhornia**.
101. Heterophylly – ex :**Sagittaria, Ranunculus**.
102. The plants complete their life cycle single season are not true Xerophytes are – **Aregmone, Mollugo ,Tribulus , Tephrosia**
103. Succulents drought enduring plants store water in their parts During dry period – **Opuntia, Aloe ,Bryophyllum , Begonia**
104. Non -Succulents drought resistant plants true xerophytes - **Casuarina ,Nerium , Zizyphus Acacia**
105. Phylloclade ex. – **Opuntia**.
106. Cladode ex. – **Asparagus**.
106. Phyllode - **Acacia melanoxylon**.
107. Trichophyllus plants are – **Cucurbits, Melotheria and Mukia**.
108. In some of plants the stipules are modified into spines **Euphorbia, Acacia,Ziziphus, Capparis**
109. The entire leaves are modified in to spines – **Opuntia**.
110. The entire leaves are reduced to scales – **Asparagus**.

111. Multilayered, sunken stomata present in – **Nerium**.
112. Epiphytes plants have 2 types of roots – **Clinging root, Aerial root**.
113. Epiphytes plants Aerial root absorb moisture from atmosphere with help of a spongy tissue called **Velamen**.
114. Epiphytic plants the **fruits and seeds are very small**.
115. Plants which grow on soils with high concentration of salts – **Halophytes**.
116. Halophytes example : **Rhizophora, Sonneratia and Avicennia**
117. A special type of negatively geotropic roots called **Pneumatophores**.
118. Pneumatophores & breathing roots are special character of **Halophytes**.
119. Viviparous mode of seed germination seen in **Halophytes**.
120. Mangrove forest in tamilnadu - **Nagapattinam, Thanjavur, Thirvarur**.
121. Gaja cyclone at **November 2018**.
122. Seeds are minute very small and light – **Orchids**.
123. Winged seeds ex: **Maple, Gyrocarpus, Dipterocarpus, Terminalia**.
124. Seeds and fruits have feathery appendages in – **Vernonia, Asclepias**.
125. Seeds dispersal through censer mechanisms – **Aristolochia and poppy**.
126. Hydrochory ex: **Nelumbo, Coconut, Nymphaea, Heritiera littoralis**.
127. Fruits and seeds have hooks – **Xanthium**.
128. Fruits and seeds have sticky glandular hairs – **Boerhaavia and cleome**.
129. The surface of the fruits are seeds have spines – **Aristida**.
130. Ripened fruits to explode suddenly and seeds are thrown out with great force example: **Impatiens ( Balsam) , Hura**.
131. Certain long pods explode with a loud noise like cracker , scattering in seed ex. – **Bauhinia vahlii**.
132. Camels foot climber ex. - **Bauhinia vahlii**.
133. Human aided seed dispersal – **Seed Ball**.
134. Seed dispersal is an ancient **Japanese technique**.
135. **Atelochory or Achory** is prevent the seed dispersal mechanism.
136. World forest day – **March 21**.
137. Earth day – **April 22**.
138. World bio diversity day – **May 22**.
139. World environment day – **June 05**.
140. International Ozone day – **September 16**.

### **Two Marks Question:**

#### **1. Definition of ecology**

The study of the reciprocal relationship between living organisms and their environment

#### **2. what is ecological hierarchy? Write the ecological levels?**

The interaction of organisms with their environment.

Individual organism → population → community → Ecosystem → Landscape  
→ Biome → Biosphere.

#### **3. What is Autecology ?**

The ecology of an individual species and is also called Species ecology/Autecology.

#### **4. What is Synecology?**

1. ecology of a population or community with one or more species.
2. It is also called community ecology/synecology.

#### **5. What is Ecotope?**

The habitat and niche of any organism is called Ecotope.

#### **6. What is Ecological equivalents?**

Taxonomically different species occupying similar habitats in different geographical regions are called Ecological equivalents.

#### **7. What is Heliophytes?**

Light loving plants ex: Angiosperms.

#### **8. What is Sciophytes?**

Shade loving plants ex: Bryophytes, Pteridophytes.



**9. What is Latitude?**

Angle which ranges from 0° at the equator to 90°.

**10. What is Altitude?**

How high a place is located above the sea level.

**11. What is phytoremediation?**

Rice and Eichhornia tolerate Cadmium by binding it to their proteins and used to remove cadmium from contaminated soil is called phytoremediation.

**12. What is Albedo Effect ? write their effects.**

Emission of dust and aerosols or liquid particles is reflecting the solar radiation entering the atmosphere.

**Effects:**

- ❖ 1. It reduce the temperature limits Photosynthesis & respiration.
- ❖ 2. Responsible for Acid rain.
- ❖ 3. Destroy the Ozone.

**13. What is Seed ball?**

1. Seed in a mixture of clay and soil humus.
2. Ancient Japanese technique.

**14. What is Co -evolution?**

The interaction between organisms ,when continues for generations involve Reciprocal changes in genetic and morphological characters.

**15. What is Mimicry?**

The plants Ophrys an orchids flowers looks like a female insect to attract the male insect to get pollinated is called Mimicry.

**16. What is pneumatophores ?**

In halophytes negatively geotropic roots called pneumatophores with Pneumathodes to get sufficient aeration. ex: Avicennia.

**17. What is Vivipary?**

Seed germinate in the fruits while on the mother plant is called vivipary. ex: Avicennia.

**18. Sandy soil is not suitable for cultivation explain why?**

1. Sandy soil have poor water holding capacity.
2. No humus and minerals

**Three Mark Questions:**

1. Distinguish between habitat and niche.

| Habitat  | Niche  |
|--|--|
| A specific physical space occupied by an organism. | A functional space occupied by an organism in the same eco-system. |
| Same habitat may be shared by many organisms.      | A single niche is occupied by a single species.                    |
| Habitat specificity is exhibited by organism.      | Organisms may change their niche with time and season.             |

**2. What is applied ecology or environmental technology? Give its important?**

Application of the science of ecology is otherwise called as applied ecology or environmental technology.

**Importance:** 1. To manage and conserve natural resources.

2. Conservative and management of ecosystem, forest biota etc.

**3. What is paleoclimatology?**

- ❖ Helps to reconstruct past climates of our planet and flora, fauna and ecosystem in which they lived.
- ❖ Example. Air bubbles trapped in ice for ten thousands of years with fossilized pollen, coral, plant and animal debris.

**4. What is thermal stratification? Mention their layers.**

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

**Epilimnion:** The upper layer of warmer water.

**Metolimnion:** The middle layer with a one of gradual decrease in temperature.

**Hypolimnion:** The bottom layer of colder water.

**5. How is rhytidome act and the structural defence by plants against fire?**

- ❖ It is structural defence by plants against fire.
- ❖ The outer bark of trees which extends to the last formed periderm is called Rhytidome.
- ❖ It is composed of multiple layers of suberized periderm, cortical and phloem tissues.
- ❖ It protects the stem against fire, water loss, invasion of insects and prevents infections by microorganisms.

**6. What is phylloclades? Give an example.**

All the internodes in the stem are modified into a fleshy leaf structure called phylloclades.  
Example: Optunia.

**7. What is cladode? Give an example.**

The single or occasionally two internodes modified into fleshy green structure called cladode.  
Example- Asparagus.

**8. What is phyllode? Give an example.**

In some the petiole is modified into a fleshy leaf like structure called phyllode.  
Example. Acacia melanoxylon.

**Five Mark Questions:****1. Explain the types of Hydrophytes with examples.**

- a) **Free floating hydrophytes** – plants float freely on the surface of water but not contact with soil ex: Eichhornia.
- b) **Rooted floating hydrophytes** – plants the root fixed in mud, leaves, and flowers float on the surface of water ex: Nelumbo.
- c) **Submerged hydrophytes** – plants are completely sub merged not contact with soil and air ex: Ceratophyllum.
- d) **Rooted - sub merged hydrophytes** - plants are completely sub merged in water rooted in soil, not in contact air. ex: Hydrilla.
- e) **Amphibious hydrophytes** - plants adopted to both aquatic and terrestrial life.  
Ex: Ranunculus, Typha

**2. Different interactions of plants**

|                         | Interaction type     | Combination |     | Effects  | Examples                           |
|-------------------------|----------------------|-------------|-----|--|------------------------------------|
| I                       | Positive interaction |             |     |  |                                    |
| 1                       | Mutualism            | (+)         | (+) | Both species benefited                           | Lichen, Mycorrhiza.                |
| 2                       | commensalism         |             |     | One species benefitted<br>other nor harmed       | Orchids, Lianas                    |
|                         |                      | (+)         | (0) |  |                                    |
| 2. Negative interaction |                      |             |     |  |                                    |
| 4                       | Predation            | (+) (-)     |     | One species benefitted,<br>other species harmed. | Drosera , Nepanthes.               |
| 5                       | Parasitism           | (+) (-)     |     | One species benefitted<br>other species harmed   | Cuscuta, Duranta.<br>Viscum etc.   |
| 6                       | Competition          | (-) (-)     |     | Harmful for both                                 | Grassland species                  |
| 7                       | Amensalism           | (-) (0)     |     | Harmful for one other<br>species unaffected.     | Penicillium And<br>Staphylococcus. |
| (+) Benefitted          |                      | (-) Harmed  |     | (0) Unaffected                                   |                                    |

**3. Morphological adaptations of Epiphytes?**

- ❖ Root system two types Clinging roots and Aerial roots.
- ❖ Clinging roots fix the epiphytes on the surface.
- ❖ Aerial roots green hang downwardly absorb moisture from atmosphere with spongy tissue velamen.
- ❖ Stem succulent and pseudo bulb or tuber.
- ❖ Leaves, are lesser may be fleshy and leathery.
- ❖ Myrmecophily occurrence to prevent the predators.
- ❖ fruits and seeds are very small, dispersed by wind, insects, birds.

**4. Morphological adaptations of Halophytes?**

- a) Herbaceous are mostly bushy.
- b) In addition to the normal roots, stilt roots developed.
- c) Negatively geotropic roots called pneumatophores with pneumatophodes.  
ex: Breathing roots, Avicennia.
- d) presence of thick cuticle on the aerial part.
- e) leaves are thick, succulent and glossy.

**7. Ecosystem****One Mark Questions:**

1. Solar energy used by green plants for photosynthesis – **2-10%**.
2. Biocoenosis – **Karl Mobius**.
3. Microcosm – **S.A Fobres**.
4. Geobiocoenosis – **V.VDokuchaev, G.F. Morozov**.
5. Holocoen – **Friederichs**.
6. Biosystem – **Thienemann**.
7. Bioenert body – **Vernadsky**.
8. The team ecosystem was proposed by **A.GTansley**.
9. Define Ecosystem as the structural and functional unit of Ecology - **Odum – 1962**.
10. Self-sustaining and self-regulatory eco system – **Pond Ecosystem**.
11. Ten percentage law was proposed by **Lindeman 1942**.
12. First invaded plant's in a barren area- **Pioneers**.
13. Plant developing in a barren area – **Primary succession**.
14. In forest ecosystem the pyramid of number is somewhat different in shape. – **Inverted**.
15. How many types of forest in India – **16**.
16. What can both plants and animals are called – **Carnivores**.
17. Grey carbon – **Carbon stored in fossil fuel**.
18. Blue carbon – **Carbon stored in the atmosphere and oceans**.
19. Brown carbon – **carbon stored in industrialized forests**.
20. Black carbon – **carbon emitted from gas, diesel engine and coal fired power plants**.
21. Omnivores – **Those eats both plants and animals**.
22. Benthic – **Bottom zone of the pond**.
23. Guano – **It is an accumulated excrement of sea birds and bats**.
24. Food web – **interlocking pattern of food chain**.
25. Food chain – **Refers movement of energy from produces up to top carnivores**.

**Two Mark Questions:****1. Food Chain.**

The moment of energy from producers up to top carnivorous is known as food chain.

**2. Food web.**

The interlocking pattern of a number of food chain form a web like arrangement called food web.

**3. Decomposition.**

Decomposition is a process in which the detritus dead plant's, animals are breakdown into simple organic matter by the decomposers.

**4. Photosynthetically active radiation? (PAR)**

The amount of light available for photosynthesis of plant called photo synthetically active radiation.

Which form 400 – 700 nm in wave length.

**Three Mark Questions:****1. Ten Percent law.**

Proposed by Lindeman.

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

**2. Significance of food webs.**

- ❖ Food web is constructed to describe pieces instruction called direct interaction.
- ❖ It can be used to illustrate indirect interaction among different species.
- ❖ It can be used to study bottom – up or Top –down control of community structure.
- ❖ It can be used to reveal different patterns of energy transfer in terrestrial and aquatic ecosystems.

**3. Pyramid of energy is always upright. Why?**

- ❖ The bottom of the pyramid of energy is occupied by the producers.
- ❖ There is a gradual decrease in energy transfer at successive tropic levels from producers to upper levels.
- ❖ Therefore, the pyramid of energy is always upright.

**4. How ecosystem is affected by human activities?**

- ❖ Habitat destruction.
- ❖ Deforestation and overgrazing.
- ❖ Over harvesting of plant material.
- ❖ Pollution of land water and air.

**Five Mark Questions:****1. Write the significance of plant succession? Any five.**

- ❖ Dams can be protected by preventing siltation.
- ❖ It gives information about the techniques to be used during reforestation and afforestation.
- ❖ It helps in the maintenance of pastures.
- ❖ Primary succession involves the colonization of habitat of an area devoid of life.
- ❖ Secondary succession involves the reestablishment of a plant community in disturbed area or habitat.
- ❖ Forest and vegetation that becomes across all over the world are the result of plant succession.

**2. How to protect the ecosystem? Any Five.**

- ❖ Buy and use only eco-friendly products and recycle them.
- ❖ Grow more trees.
- ❖ Reduce the use of natural resources.
- ❖ Reduce consumption of water and electricity.
- ❖ Maintain your cars and vehicles properly.
- ❖ Create awareness about ecosystem production among your friends and family members.

**3. Write the characteristic of ecological succession?**

- ❖ It is resultant of changes of abiotic and biotic factors.
- ❖ It transforms unstable community into a stable community.
- ❖ It progresses from simple food chain to complex food web.
- ❖ It modifies the lower and simple life form to the lighter life forms.
- ❖ It creates inter-dependence of plants and animals.

**4. Differentiate Primary succession and secondary succession.**

| <b>Primary Succession</b>                                    | <b>Secondary Succession.</b>                       |
|--|--|
| Developing in a barren area.                                 | Developing in disturbed area.                      |
| Initiated due to a biological or any other external factors. | Starts due to external factors only                |
| No soil, while primary succession starts.                    | Its start's where soil covers is already present.  |
| Pioneer species come from outside environment                | Pioneer species develop from existing environment. |
| It takes more time to complete                               | It takes comparatively less time to complete.      |

**8. Environmental Issues****One Mark Questions:**

1. World ozone day – **September – 16.**
2. The plant indicator of sulphur-di-oxide – **Lichens.**
3. Long term method to store carbon – **Biochar.**
4. An alien invasive species – **Eichornia crassipes.**
5. Forest man of India – **Jadav Molai Payeng.**
6. Chipko movement was launched for the protection – **Forest.**
7. Coral bleaching is observed at **Gulf of Mannar.**
8. Agricultural practices like burning result in emission of  $\text{CO}_2$ .
9. The decline in the thickness of the ozone layer restricted area is called – **Ozonehole.**
10. The Electrical gadget like refrigerators and air conditioner release gases. – **Chlorofluorocarbons.**
11. SCATSAT – **Weather, fore casting, cyclone prediction and tracking services in India. (Sep-2016).**
12. INSAT 3DR – **Disaster Management (Sept – 2016)**
13. CARTOSAT – **2 – Earth Observation (Jan-2018).**
14. GSAT – **6A – Communication (March – 2018).**
15. CARTOSAT – **2 – To watch border surveillance (Jan – 2018)**

**Two Mark Questions:****1. Name of the greenhouse gases.**

- ❖ Carbon dioxide –  $\text{CO}_2$ .
- ❖ Methane –  $\text{CH}_4$ .
- ❖ Nitrous Oxide –  $\text{N}_2\text{O}$ .
- ❖ Chloro fluorocarbon CFC.

**2. Afforestation.**

The conversion of Non – forested lands into forests by planting suitable trees to retrieve the vegetation.

**3. Social forest.**

- ❖ The management of forests and afforestation on barren lands.
- ❖ The purpose of helping the environmental social and rural development and benefits.

**4. Green house effects?**

- ❖ The gases that capture radiant heat form sun.
- ❖ The atmosphere that increase the temperature of the earth.

**5. Major activities of forestry extension centre.**

- ❖ Training on trees growing methods.
- ❖ Publicity and propaganda regarding tree growing.
- ❖ Formation of demonstration plots.

**6. Silvopasture.**

- ❖ The production of wood plants combined with pasture is referred to silvopasture system.
- ❖ The trees and shrubs may be used. Primary to produce fodder for livestock.

**7. Protein Bank.**

The various multipurpose trees are planted in and around farm lands and range mainly for fodder production.

- E.g. *Acacia nilotica*.  
*Albizia lebbek*.  
*Azadirachta indica*.

**Three Mark Questions:****1. Chipko movement.**

- ❖ The tribal women of Himalayas protested against the exploitation of forests in 1972.
- ❖ The transformed into chipko movement by Sundarlal Bahuguna in Mandal village of Chamoli District in 1974.
- ❖ The people protested by hanging trees together which were filled by a sports goods company.

**2. CCS.**

CCS- Carbon Capture and Storage. The technology of capturing carbon dioxide and inject it deep into the underground rocks to a depth of 1 km or more for storage.

**3. Global warming effect on plants.**

- ❖ Low agricultural productivity in the tropics.
- ❖ Increase of vectors and epidemics.
- ❖ Water crisis and decreased irrigation.

**4. Remote sensing.**

The process of detecting and monitoring the physical characteristics of an area.

**5. Environmental benefits of rain water harvesting.**

- ❖ The underground water raising and water conservation.
- ❖ Reduces soil erosion.
- ❖ Reduces flood hazards.

**6. Plant indicators.**

- ❖ The presence or absence of certain plants indicate the state of environment by their response.
  - ❖ The plant species or plant community acts as a measure of environmental conditions, it is referred as Biological indicators or phyto indicators or plant indicators.
- E.g. *Lichen* –  $\text{SO}_2$   
*Petunia* – Nitrate.  
*Gladiolus* – Fluoride.

**Five Mark Questions:****1. Effect of ozone depletion.**

- ❖ The causes of emphysema, skin cancer and reduce immune systems in human beings.
- ❖ Juvenile mortality of animals, increased incidence of mutation.
- ❖ The photosynthesis will be inhibited due to leading to food crisis.
- ❖ The increased atmospheric  $\text{CO}_2$  resulting in global warming.
- ❖ The change in climate.

**2. Afforestation objectives.**

- ❖ The increases forest cover.
- ❖ Planting more trees. Increases  $\text{O}_2$  production and air quality.
- ❖ Rehabilitation of degraded forests.
- ❖ Raising bamboo plantations.
- ❖ Plantation of medicinal plants. Regeneration of indigenous herb / shrubs.
- ❖ Awareness creation, monitoring and evaluation.

**3. Effects of Deforestation.**

- ❖ The removal of forest cover increases soil erosion, decreases soil fertility, dry area leads to the formation of deserts.



- ❖ It triggers adverse climatic conditions and alters water cycle in ecosystem.
- ❖ It decreases the Biodiversity significantly as their habitats.
- ❖ Loss of livelihood for forest dwellers and rural people.
- ❖ Increased global warming and account for one – third of total CO<sub>2</sub> emission.

**4. What is global warming? Write their effects of Global warming.**

- ❖ The increased concentration of greenhouse gases due to increase global temperature.

**Effect of Global warming:**

- ❖ The polar ice cap and glaciers begin to melt.
- ❖ The sea level rise submergence of many coastal cities.
- ❖ Drastic change in weather patterns bringing more floods or droughts in some area.
- ❖ Species ranges get redefined.

## 9.Plant Breeding

**One Mark Questions:**

1. **Beauveria** species is an Entomo-pathogenic fungus that grows naturally in soils throughout the world.
2. Who was coined the term Green Revolution – **William S.Gaud.**
3. Norman E. Borlaug the name related with – **Green revolution.**
4. First man made cereal in allopolyploidy – **Triticale.**
5. Rice with salinity tolerance and pest resistance – **atomita-2.**
6. Svalbard seed bank, the storage rooms are kept at **–18°C**
7. Which selection methods takes longer time in bringing about desired variation – **Natural Selection.**
8. Which one of Chilli variety resistance to a disease – **Pusa Sadabahar**
9. Example for Bio fertilizer for micronutrients – **Bacillus.**
10. *Tephrosia purpurea* is – **Green Manure.**
11. Objectives of plant breeding – to increase yield / vigour, tolerance to environmental condition salinity.
12. Who was called father of green revolution in India – **Dr.M.Swaminathan.**
13. Dwarfing gene of wheat is – **Norin 10.**
14. Importing better varieties and plants from outside and acclimatizing them to local environmental called – **Introduction.**

**Two Mark Questions:**

**1. Differentiate Primary introduction from secondary introduction.**

| Primary Introduction  | Secondary Introduction   |
|---|--|
| When the introduced variety is well adapted to the new environment without any alternation to the original genotype | When the introduced variety is subjected to selection to isolate a superior variety and hybridized with a local variety to transfer one local variety to transfer one or few characters to them. |

**2. Write a note on Heterosis.**

The superiority of the F<sub>1</sub> hybrid in performance over its parents is called heterosis or hybrid vigour.

**3. What is the Bio-Pesticides.**

Bio-Pesticides are biological agents used for the control of plants pests.

**4. What is called pure line selection?**

It is a collection of plants obtained as a result of repeated self-pollination from a single homozygous individual.

**5. What is called Bio fortification?**

Breeding crops with higher levels of vitamins and minerals or higher protein and healthier fats.

**6. Define seed coating?**

- ❖ Seed coating is a thicker form of covering of seed and may contain fertilizer, growth promoters, rhizobium inoculum, nutritional elements and repulsive agents.
- ❖ Chemical, pesticides added to the seed by adhesive agents cause increased seed performance and seed germination.

**7. What is the uses of seed hardening?**

- ❖ It increase the yield, root growth and vigour of seed germination.
- ❖ The uniformity of seedling emergence.

**8. What happen nitrogen fixing bacterium when applied to the soil?**

Undergoes multiplication and fixes the atmospheric nitrogen in the soil. Rhizobium is best suited for the paddy fields which increase the yield by 15-40%.

**Three Mark Questions:****1. How are microbial inoculants used to increase the soil fertility?**

They are efficient in fixing nitrogen, solubilizing phosphate and decomposing cellulose.

**2. List out the new breeding techniques involved developing new traits in plant breeding.**

Genetic engineering, plant tissue culture, protoplasmic fusion, molecular marking and DNA finger printing.

**3. What are the different types of hybridization?**

1. Intravarietal 2. Intervarietal 3. Interspecific 4. Intergeneric hybridization.

**4. What is the seaweed liquid fertilizer?**

It contains cytokinin, gibberellins and auxin apart from macro and micro nutrients. Most seaweed based fertilizers are made from kelp which grows to length of 150 meters. It is organic and also ecofriendly.

**5. What is the Svalbard seed bank?**

The seeds are stored in four ply sealed envelopes and then placed into plastic containers on metal shelving racks. The storage rooms are kept at  $-18^{\circ}\text{C}$  and limited access to  $\text{O}_2$  will ensure low metabolic activity and delayed seed ageing.

**6. Why Azolla is quite significant for increasing the yield of rice field in now a days?**

Azolla is a free – floating water fern that fixes the atmospheric nitrogen in association with nitrogen fixing Blue green algae, Anabaena, Azolla. It is used as a bio fertilizer for wetland rice cultivation and is known to contribute 40-60 Kg / ha / crop.

**7. Briefly describe the Nel Jayaraman.**

He was a disciple of Dr. Nammalvar and state coordinator of “Save our rice campaign” Tamil Nadu. In 2006, he organized a first ever traditional paddy seed festival in his farm as an individual. The seed festival in May 2016 at Adhirangam was 10th in a row and in which 156 different traditional varieties were distributed to more than 7000 farmers across Tamil Nadu. In 2011, he received the state award for best organic farmer for his contribution to organic farming, and in the year 2015, he received the National Award for best Genome savior.

**Five Mark Question:****1. What are the objectives of plant breeding?**

- ❖ To increase yield, vigour, and fertility of the crops.
- ❖ To increase tolerance to environmental condition, salinity, temperature, and drought.
- ❖ To prevent the premature falling of buds fruits etc.
- ❖ To improve synchronous maturity.
- ❖ To develop resistance to pathogens and pests.

**2. What is the Hybridization? And explain steps.**

Hybridization is the method of production new crop varieties in which two or more plant of unlike genetically constitution is all crosses together that result in a progeny called hybrid.

**Steps in Hybridization:**



- ❖ **Selection of parents:** Male and Female plants of the desired characters are selected.
- ❖ **Emasculation:** Removal of anthers to prevent self-pollination before dehiscence of anther.
- ❖ **Bagging:** The stigma of the flower is protected against any undesirable pollen grains, by covering it with a bag.
- ❖ **Crossing:** Transfer of pollen grains from selected male flower to the stigma of the female emasculated flower.
- ❖ **Harvesting seeds and raising plants:** The pollination leads to fertilization and finally seed formation take place. The seeds are grown into new generation which are called hybrids.

### 3. Explain the different methods of seed protection.

- ❖ **Seed Treatment:** In agriculture and horticulture seed treatment or seed dressing is a chemical typically antimicrobial or antifungal, with which seeds are treated prior to planting.
- ❖ **Seed Hardening:** Is a physiological pre conditioning of the seed by soaking of seed in water or chemical solution for definite duration in proper ratio and shade drying to bring back the seed to original moisture content.
- ❖ **Seed Pelleting:** The process of enclosing seed in a filter inert material using an adhesive with bioactive chemical. Seed pelleting increase the weight, size and shape of seed by allowing percale maturing and spacing of seed in the field.
- ❖ **Seed coating:** Thicker form of covering of seed and may contain fertilizer, growth promoters, rhizobium inoculum, nutritional elements the seed by adhesive. Chemical pesticides added to the seed by adhesive agents because increased seed performance and seed germination.
- ❖ **Bio-Priming of seeds:** is a process of biological seed treatment that refers to combination of seed hydration and inoculation of seed with beneficial organism to protect seed.

### 4. Explain the traditional method of seed protection.

- ❖ In traditional method seeds are coated with fingered soil, chili powder, neem leaf powder, powder of bitter gourd, drumstick extract and stored for short duration.
- ❖ Paddy seeds are immersed in salt water in the ration of 1:10 to remove the floating chaffy seed and then dried in shade for one-two years of storage.
- ❖ Sorghum seeds were treated with lime coater for 10 days and then the seeds are dried and stored.
- ❖ Chickpea were treated with citronella leaf oil, cotton seed oil, soya bean oil, castor seed oil (500 ml of oil for 100 Kg of seed)
- ❖ Sunflower seeds were kept inside the dried fruit of sponge gourd after removing the seeds.

### 5. List the ways by which seed can be stored for longer duration.

- ❖ **Conventional methods of seed storage:** Includes storage in Bamboo structure, mud and earthen structure, wooden structure and underground structure. In village level storage is done in large level in concrete / cement soils, Metal or plastic drums and metal silos.
- ❖ **Modern method of seed storage:**
  - a. **Seed storage in cryopreservation:** Storage of cells, tissue, embryo or seeds by ultra-low temperature in liquid nitrogen at  $-196^{\circ}\text{C}$
  - b. **Seed storage in gene bank:** In gene bank seed storage is the preservation of seed under controlled environment condition which will prolong the viability of the seeds for leaf periods. The temperature, relative humidity and seed moisture content.
  - c. **Svalbard seed bank:** The seeds are stored in four ply sealed envelope, and then placed into plastic note containers on metal shelving rocks. The storage room are kept at  $-18^{\circ}\text{C}$ . The low temperature and limited access to  $\text{O}_2$  will ensure low metabolic activity and delayed seed ageing.

**6. Explain the green manuring.**

- ❖ The growing of green manure crops and the use of these crops directly in the field by ploughing.
- ❖ One of the main objectives of the green manuring is to increase the content of nitrogen in the soil. Also it helps in improving the structure and physical properties of the soil E.g. *Crotalaria juncea*, *Tephrosia purpurea*.
- ❖ The green manuring can be practiced as green in – situ manuring or green leaf manuring.
- ❖ Green in – situ manuring refers to the growing of green manuring crops in the border rows or as intercrops along with the main crops. E.g. sun hemp, cowpea, Green gram etc.
- ❖ Whereas green leaf manuring is the application of green leaves and twigs of trees. Shrubs, plants growing in waste lands and field bunds of – *Cassia fistula*, *Sesbania grandiflora* etc.

**10. Economically useful plants and Entrepreneurial Botany****One Mark Questions:**

1. An example for semi dwarf variety of wheat – **Sonalika**
2. Chillies are of good source of vitamin – **A, C and E**.
3. The king of bitters – **Nilavembu**.
4. The king of spices – **Black Pepper**.
5. The Queen of spices – **Cardamom**.
6. The flour is traditionally used as a cosmetic, especially for the skin is – **Green gram**.
7. Nilavembu belongs to the family – **Acanthaceae**.
8. The folk system of medicine is tradition in – **India**
9. In Tamil Nadu the mostly cultivated in latex is – **Hevea brasiliensis**.
10. **Phyllanthus amarus** is effective against hepatitis B virus.

**Two Marks:****1. Name of the humors that are responsible for the health of human beings.**

1. Vatham, 2 Pitham and 3. Kapham

**2. Give definition for organic farming?**

Organic farming is an alternative agricultural system in which plants crops are cultivated in natural ways by using biological inputs to maintain soil fertility and ecological balance there by minimizing pollution and wastage.

**3. Define Bonsai?**

Bonsai is Japanese art form using miniature trees grown in containers that mimic the shape and scale of full size trees.

**4. What is called Terrarium?**

It is a collection of small plants, growing in a transparent, sealed container. Terrariums are easy to make, low maintenance gardens, and it can survive indefinitely with minimal water.

**5. Differentiate bio-medicines and botanical medicines.**

| Bio-medicine  | Botanical medicines   |
|---|---|
| Medicinally useful molecules obtained from plants that are marketed as drugs are called bio-medicine. | Medicinal plants which are marketed as powders or in other modified forms are known as botanical medicines. |

**6. What is called Stevia rebaudiana? And write their uses?**

Stevia is a Sweetener and a sugar substitute, extracted from the leaves of *Stevia rebaudiana*. It has no calories and is 200 times sweeter than sugar. The steviol glycoside is the chemical that is responsible for sweetness in stevia.

**7. Write short notes on uses of coffee.**

1. Drinking coffee in moderation provides the health benefits.
2. Caffeine enhances releases of acetylcholine in brain, which in turn enhances efficiency.
3. It can lower the incidence of fatty liver disease cirrhosis, cancer.

**8. Write notes on medicinal uses Ocimum.**

The leaves are stimulant, antiseptic, anti-hypertensive and antibacterial and expectorant used in bronchitis. Decoction of roots is given as a diaphoretic in malarial fever.

**9. What is the uses of Aloin(Aloe vera)?**

It has a Cooling effect and moisturizing characteristics and hence used in preparation of creams, lotions, shampoos, shaving creams. It is used in gerontological applications for rejuvenation of aging skin. Products prepared from aloe leaves have multiple properties such as emollient, anti-bacterial, antioxidant, antifungal and antiseptic.

**10. Which is called as the king of Bitters? Mention their medicinal importance.**

Andrographis paniculata (Nilavembu) known as the king of bitters. Andrographis is a potent hepato-protective and is widely used to treat liver disorders. Concoction of Andrographis paniculata and eight other herbs (Nilavembu Kudineer) is effectively used to treat malaria and dengue.

**Three Mark Questions:****1. What is the uses of Tectona grandis?**

It was the chief railway carriage and wagon wood in India. Ship building and bridge-building depends on teak wood. It is also used in making boats, toys, play wood, doors frames and doors.

**2. Write the Economic importance of rice.**

1. Rice is the easily digestible calorie rich cereal food.
2. Various rice products such as flaked rice(aval) puffed rice (Pori) are used as breakfast.
3. Rice bran oil used in culinary and industrial purposes.
4. Husks are used as fuel, and in manufacture of packing material and fertilizer.

**Five Marks Questions:****1. Enumerate the uses of turmeric.**

1. It is an important constituent of curry powders.
2. Turmeric is used as a coloring agent in pharmacy, confectionary and food industry.
3. It is also used for dyeing leather, fiber, paper and toys.
4. curcumin is a very good anti-oxidant which may help fight various kinds of cancer. It has anti-inflammatory, anti-diabetic. Anti-bacterial, antifungal and anti-viral activities.
5. Its stops platelets from clotting in arteries, which leads to heart attack.

**2. What are the king and queen of spices? Explain about them and their uses.****King of the spices – Black pepper:**

**Uses:** It is used for flavoring in the preparation of sauces, soups, curry powder and pickles. It is used in medicine as an aromatic stimulant for enhancing salivary and gastric secretion and also as a stomachic. Pepper also enhances the bio-absorption of medicines.

**Queen of spices – Cardamom:**

**Uses:** The seeds have a pleasing aroma and a characteristic warm, slightly pungent taste. It is used for Flavouring confectionaries, bakery products and beverages. The seeds are used in the preparation of curry powder, pickles, and cakes. Medicinally, it is employed as a stimulant and carminative.

**3. How will you prepare an organic pesticide for your home garden with the vegetables available from your kitchen?**

- ❖ Mix 120 g of hot chillies with 110g of garlic or onion, chop them thoroughly.
- ❖ Blend the vegetables together manually or using an electric grinder until it forms a thick paste. Add the vegetable paste to 500 ml of warm water. Give the ingredients a stir to thoroughly mix them together.
- ❖ Pour the solution into a glass container and leave it undisturbed for 24 hrs. It possible, keep the container in a sunny location.

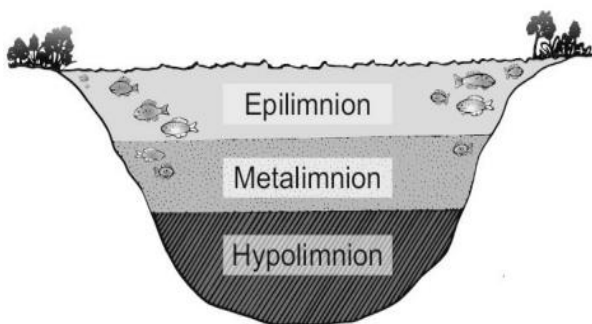
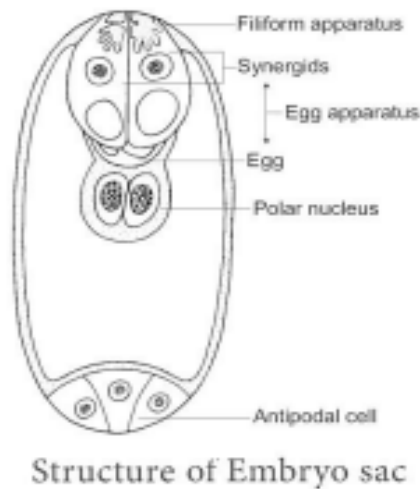
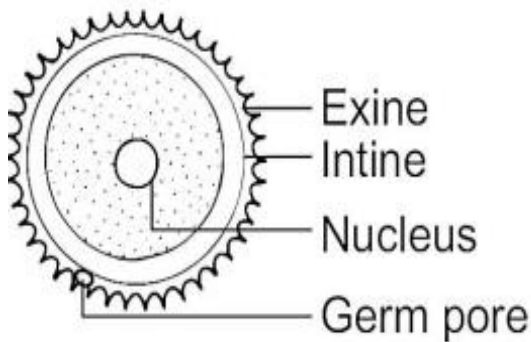
- ❖ Strain the mixture, pour the solution through strainer, remove the vegetables and collect the vegetable fused water and pour into another container. This filtrate is the pesticide either discard the vegetables or use it as a compost.
- ❖ Spray your plants with the pesticide. Treat the infected plants every 4 or 5 days with the solution. After 3 or 4 treatments, the pest will be eliminated.

#### 4. Write the following medicinal plants used a useful part and their uses.

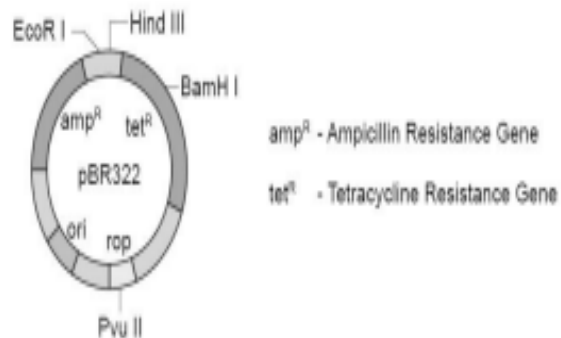
| Botanical Name        | Plant part used  | Medicinal uses  |
|-----------------------|------------------|---|
| Ocimum sanctum        | Leaves and roots | The leaves are stimulant, antiseptic, antihypertensive            |
| Phyllanthus           | Fruit            | It is a potent rejuvenator, and immune modulator.                 |
| Acalypha indica       | Leaves           | Powdered leaves are used to cure bed sores and infected wounds.   |
| Aegle marmelos        | Fruit            | The ripen fruit is used to treat problems of stomach indigestion. |
| Cissus quadrangularis | Stem and root    | Used in bone fractures.   |

#### IMPORTANT DIAGRAMS:

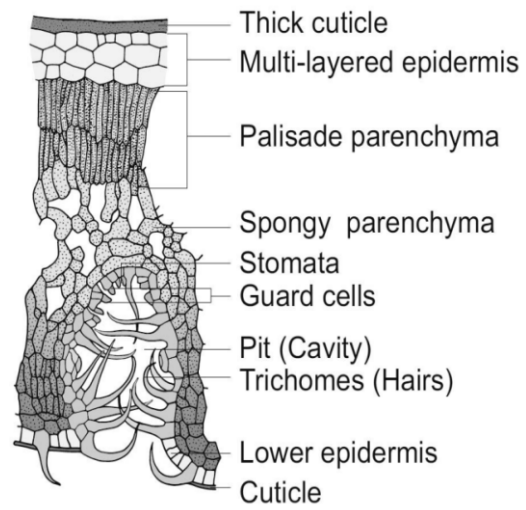
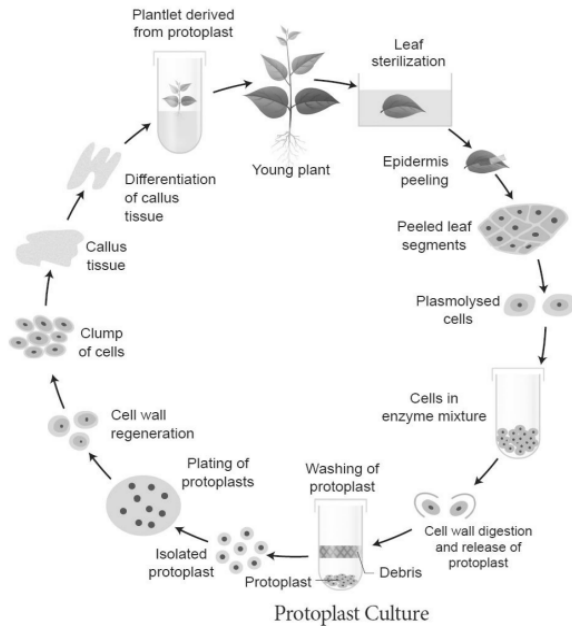
Pollen grain



Thermal stratification of pond



pBR 322



T.S. of Nerium leaf