SHRI KRISHNA ACADEMY

NEET,JEE & BOARD EXAM(10th,+1,+2) COACHING CENTRE
SBM SCHOOL CAMPUS, TRICHY MAIN ROAD,NAMAKKAL
CELL: 99655 31727 , 94432 31727

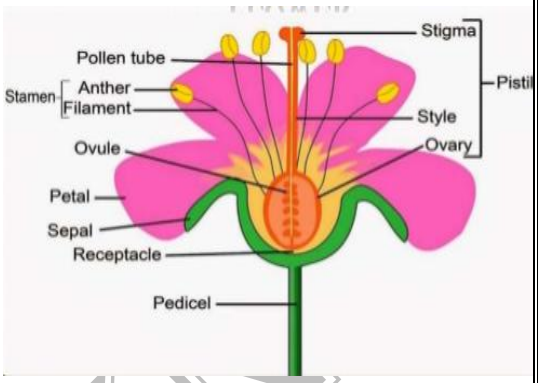
XII - BOTANY

MATERIAL

2019 – 2020

DEPARTMENT OF BOTANY

UNIT - VI
REPRODUCTION IN PLANTS
CHAPTER - 1
SEXUAL AND ASEUXAL REPRODUCTION IN PLANTS



BOOK BACK

I. CHOOSE THE CORRECT ANSWER:

1. Choose the correct statement from the following
   (a) Gametes are involved in asexual reproduction.
   (b) Bacteria reproduce asexually by budding
   (c) Conidia formation is a method of sexual reproduction
   (d) Yeast reproduce by budding
2. An eminent Indian embryologist is
   (a) S.R.Kashyap **(b) P.Maheswari** (c) M.S.Swaminathan (d) K.C.Mehta
3. **Identify the correctly matched pair**
   (a) Tuber - Allium cepa
   (b) Sucker - Pistia
   (c) Rhizome - Musa
   (d) Stolon - Zingiber
4. Pollen tube was discovered by
   (a) J.G.Kolreuter **(b) G.B. Amici** (c) E.Strasburger (d) E. Hanning
5. Size of pollen grain in Myosotis
   (a) 10 micrometer (b) 20 micrometer (c) 200 micrometer (d) 2000 micrometer
6. First cell of male gametophyte in angiosperm is
   (a) Microspore (b) megaspore (c) Nucleus (d) Primary Endosperm Nucleus
7. **Match the following**
   I) External fertilization - i) pollen grain
   II) Androecium - ii) anther wall
   III) Male gametophyte - iii) algae
   IV) Primary parietal layer - iv) stamens
   a) I-iv, II-i, III-ii, IV-iii **b) I-iii, II-iv, III-i, IV-ii** c) I-iii, II-iv, III-ii, IV-i d) I-iii, II-i, III-iv, IV-ii
8. Arrange the alyers of anther wall from locus to periphery
   a) Epidermis, middle layers, taptum, endothecium
   b) Tapetum, middle layers, epidermis, endothecium
   c) Endothecium, epidermis, middle layers, tapetum
   d) Tapetum, middle layers endothecium epidermis
9. Identify the incorrect pair
   a) sporopollenin – exine of pollen grain
   b) tapetum – nutritive tissue for developing microspores
   c) Nucellus – nutritive tissue for developing embryo
   d) obturator – directs the pollen tube into micropyle
10. **Assertion** : Sporopollenin preserves pollen in fossil deposits
    Reason : Sporopollenin is resistant to physical and biological decomposition
    a) assertion is true ; reason is false b) assertion is false; reason is true
    c) Both Assertion and reason are not true **d) Both Assertion and reason are true.**

11. Choose the correct statement(s) about tenuinucellate ovule
a) Sporogenous cell is hypodermal
b) Ovules have fairly large nucellus
c) sporogenous cell is epidermal
d) ovules have single layer of nucellus tissue
12. Which of the following represent megagametophyte
a) Ovule **b) Embryo sac** c) Nucellus d) Endosperm
13. In Haplopappus gracilis, number of chromosomes in cells of nucellus is 4. What will be the chromosome number Primary endosperm cell?
a) 8 **b) 12** c) 6 d) 2
14. Transmitting tissue is found in
a) Micropylar region of ovule b) Pollen tube wall
c) Stylar region of gynoecium d) Integument
15. The scar left by funiculus in the seed is
a) tegmen b) radical c) epicotyls **d) hilum**
16. A Plant called X possesses small flower with reduced perianth and versatile anther. The probable agent for pollination would be
a) water **b) air** c) butterflies d) beetles
17. Consider the following statement(s)
i) In Protandrous flowers pistil matures earlier
ii) In Protogynous flowers pistil matures earlier
iii) Herkogamy is noticed in unisexual flowers
iv) Distyly is present in Primula
a) i and ii are correct **b) ii and iv are correct**
c) ii and iii are correct d) i and iv are correct
18. Coelorhiza is found in
a) Paddy b) Bean c) Pea d) Tridax
19. Parthenocarpic fruits lack
a) Endocarp b) Epicarp c) Mesocarp **d) Seed**
20. In majority of plants pollen is liberated at
a) 1 celled stage **b) 2 celled stage**
c) 3 celled stage d) 4 celled stage

INTERIOR ONE MARKS:

1. Which one of the following essential features of all living things on the earth is --------
a) growth b) flower **c) reproduction** d) photosynthesis
2. Who was proposed by syngamy?
a) Hofmeister b) D.A. Johansen **c) E.Strasburger** d) Hanstein
3. Who was eminent botanist, and specialsied in plant embryology, morphology and anatomy
a) E.S. Coen **b) P. Maheswari** c) Hofmeister d) Hanstein
4. Who was published the book titled "An introduction to the Embryology of Angiosperms" in 1950
a) E. Strasburger b) D.A. Johansen **c) P. Maheswari** d) Hanstein
5. In the year became fellow of Indian Academy of science
a) 1943 b) 1945 **c) 1934** d) 1935
6. Who was the established international society for plant morphologists in 1951?
a) Hanstein **b) P. Maheswari** c) E. Strasburger d) Hofmeister

7. **Match the following**

a) conidia	-	i) planaria
b) Budding	-	ii) Marchantia
c) Fragmentation	-	iii) Yeast and Hydra
d) Gemma	-	iv) Aspergillus, and pencillium
e) Regeneration	-	v) Spirogyra

a) a-iv, b-iii, c-v, d-ii, e-i b) a-ii, b-iv, c-v, d-i, e-iii
c) a-i, b-ii, c-iii, d-iv, e-v d) a-v, b-iv, c-iii, d-ii, e-i

8. The example of binary fission is ----------
a) fungi b) yeast c) algae **d) bacteria**

9. The individuals formed by this method is morphologically and genetically identical and are called ---
a) clones b) diaspores c) cutting d) grafting

10. The unit of reproductive structure used in propagation called
a) clones **b) reproductive propagules (or) diasporas**
c) rhizome d) bulb

11. **Match the following:**

a) Vegetative adventitious buds	-	i) Musa paradisiaca
b) Adventitious roots	-	ii) Allium cepa
c) Rhizome	-	iii) Centella asiatica
d) bulb	-	iv) Ipomoea batatus
e) runner	-	v) murraya, dalbergia

a) a-i, b-ii, c-iv, d-v, e-iii **b) a-v, b-iv, c-i, d-ii, e-iii**
c) a-iv, b-iii, c-ii, d-i, e-v d) a-i, b-ii, c-iii, d-iv, e-v

12. The example of tuberous adventitious root is ----------
a) Dahlia b) Murraya c) Dalbergia d) Millingtonia

13. The Scourge of water bodies and water hyacinth (Eichhornia crassipes) is an invasive weed on water bodies like ponds, lakes and reservoirs it is popularly called ----------
a) Terror of Mumbai b) Terror of Chennai **c) Terror of Bengal** d) Terror of Delhi

14. Which one is spreads rapidly through offset all over the water body and depletes the dissolved oxygen and causes death of other aquatic organisms
a) Zingiber officinale b) Solanum tuberosum
c) Eichhornia crassipes d) Allium cepa

15. **Match the following**

a) Corm	-	i) Agave
b) Tuber	-	ii) Pistia
c) Sucker	-	iii) Colocasia
d) Bulbils	-	iv) Chrysanthemum
e) Offset	-	v) Solanum tuberosum

a) a-iv, b-iii, c-ii, d-i, e-ii b) a-ii, b-v, c-i, d-iv, e-iii
c) a-i, b-ii, c-iii, d-iv, e-v **d) a-iii, b-v, c-iv, d-i, e-ii**

16. The example of corm is --------
a) Zingiber officinale **b) Amorphophallus** c) Chrysanthemum d) Dioscorea

17. The example of stolon is ---------
a) Fragaria b) Pistia c) Eichhornia d) Agave

18. The example of adventitious buds is ----------
a) Mentha, Fragaria and Agave **b) Bryophyllum, Scilla and Begonia**
c) Pistia, Eichhornia and Lillium d) None of these

19. In Bryophyllum the leaf is succulent and notched on its margin Adventious buds develop at these notches and are called -------
a) Grafting b) Cutting **c) Epiphyllous buds** d) Budgrafting

20. Which one is bulbous plant and grows in sandy soils?
a) Begonia **b) Scilla** c) Hibiscus d) Bryophyllum

21. Which one plants, this enables to sprad rapidly
a) scilla b) begonia **c) spinifex** d) hibiscus

22. It is the method of producing a new plant by cutting the plant parts such as root, stem and leaf form the parent plant called ----------
a) Grafting **b) Cutting** c) Totipotent d) tapetum

23. The example of root cutting is ----------
a) Malus b) Begonia c) Bryophyllum d) Moringa

24. **Match the following:**
a) Stem cutting - i) citrus
b) root cutting - ii) Bryophyllum
c) Leaf cutting - iv) Bougainvillea
d) Scion cutting - v) Malus
a) a-iv, b-iii, c-ii, d-i **b) a-iii, b-iv, c-ii, d-i** c) a-i, b-ii, c-iii, d-iv d) a-iv, b-i, c-ii, d-iii

25. In this parts of two different plants are joined so that they continue to grow as one plant is called -----
a) cutting b) bud grafting **c) grafting** d) tongue grafting

26. The two plants which is in contact with the soil is called ----------
a) grafting **b) stock** c) cutting d) none of these

27. The example of scion plants is ----------
a) Mango, Apple and banana b) Citrus, banana and canna
c) Citrus, Mango and apple d) Apple, rice and banana

28. In this method, the stem of a parent plant is allowed to develop roots while still intact. When the root develops the rooted part is cut and planted to grow as a new plant is called ----------
a) layering b) cutting c) grafting d) bud grafting

29. The example of layering is ------
a) Ixora and Jasminum b) Ixora and coccinea
c) Hibiscus and Ixora d) Hibiscus and Jasminum

30. The example of vegetative propagation is ----------
a) solanum nigrum **b) solanum tuberosum**
c) solanum melangina d) datura metal

31. Air layering root emerge in these branches after ---------- months.
a) 1-4 months b) 3-4 months **c) 2-4 months** d) 1-5 months

32. the genetic ability of plant cell to produce the entire plant under suitable conditions is said to be ------
a) tissue culture **b) totipotency** c) meristem culture d) micropropagation

33. The growth of plant tissue in special culture medium under suitable controlled conditions is known as…..
a) tissue culture b) totipetency c) meristem culture d) microporpagation

34. The regeneration of a whole plant from single cell tissue or small pieces of vegetative structures through tissue culture is called ----------
a) Micropropagation b) Macropropagation c) meristem culture d) None of these
35. Which one is essential part of the flower
a) Calyx and corolla b) Calyx and Gynoecium
c) Androecium and gynoecium d) corolla only
36. The formation of haploid microspores from diploid microspore mother cell through meiosis is called
a) megasporogenesis b) sporogenous
c) Micropropagation **d) microsporogenesis**
37. All the microspores in a microsporangium remain held together called ----------
a) corpusculum **b) pollinium** c) retinaculum d) translator
38. The example of pollinium is ---------
a) Hibiscus b) banana **c) calotropis** d) apple
39. Pollinia are attached to a clamp or clip like sticky structure called ----------
a) corpusculum b) pollinium c) retinaculum d) hygroscopic
40. The filamentous or thread like part arising from each pollinium is called ----------
a) retinaculum b) corpusculum c) pollinium d) Endothecium
41. The whole structure looks like inverted letter 'y' and is called ----------
a) endothecium **b) translator** c) corpusculum d) retinaculum
42. It is generally a single layer of radially elongated cells found below te epidermis is called --------
a) endothecium b) translator c) hygroscopic d) tapetum
43. The inner tangential wall developed bands like structure is ----------
a) hemi cellulose b) pectin **c) cellulose** d) suberin
44. The inner tangential wall develops bands of a cellulose present the cells are called -------
a) hygroscopic b) epidermis c) middle layer d) invasive tapetum
45. The cells along the junction of the two sporangia of an anther lobe lack these thickenings. This region is called ----------
a) tapetum **b) stomium** c) epidermis d) endothecium
46. The hygroscopic nature of helps in the dehiscence of anther at maturity
a) tapetum **b) endothecium** c) epidermis d) pollinium
47. Two to three layers of cells next to endothecium constitute is called ----------
a) connective tissue b) epidermis **c) middle layers** d) none of these
48. **Match the following**
a) Tapetum - i) periplasmodial
b) secretory tapetum - ii) microspores
c) invasive tapetum - iii) tetrad stage
d) Anther cavity - iv) Parietal
a) a-iii,b-iv, c-i, d-ii b) a-i,b-iii, c-ii, d-iv c) a-iv,b-i, c-iii, d-ii d) a-ii,b-iii, c-iv, d-i
49. It is the innermost layer of anther wall and attains its maximum development at the tetrad stage of microsporogenesis is called ----------
a) Middle layer b) epidermis c) connective tissue **d) tapetum**
50. Which one is also controls the fertility or sterility of the microspores or pollengrains
a) tapetum b) secretory tapetum c) stomium d) endothecium
51. Intine is thin, uniform and is made up of
a) pectin, hemicelluloses, cellulose, callose b) pectin, hemicelluloses, suberin, chitin
c) pectin, suberin, cellulose, chitin d) pectin, callose, only

52. Which one together with proteins
a) cellulose and callose b) suberin and chitin
c) suberin and starch d) suberin and glycogen
53. Exine is thick and is made up of
a) cellulose only **b) cellulose, sporopollenin and pollenkitt**
c) pectin and suberin d) protein and starch
54. Which one is generally absent in germpores?
a) stomium b) tapetum **c) sporopollenin** d) secretory tapetum
55. The size of the pollen varies from myosotis
a) 5 micrometers b) 20 micrometers c) 15 micrometers **d)10 micrometers**
56. The 200 micrometers in members of the family of
a) solanaceae and fabaceae b) musaceae and solanaceae
c) cucurbitaceae and nyctaginaceae d) malvaceae and solanaceae
57. The study of pollen grains is ----------
a) palyobotany **b) palynology** c) microbiology d) biotechnology
58. Liquid nitrogen(-196^{0}C) is used to preserve pollenin viable condition for prolonged duration. This technique is called ----------
a) cryopreservation b) sporopollenin c) stomium d) tapetum
59. ---------- is used to store pollen grains (pollen banks) of economically important crops for breeding programmes
a) spropollenin b) cryopreservation c) endothecium d) middle layer
60. ---------- is a natural substance and contains high protein, carbohydrate, trace amount of minerals and vitamins.
a) Bee pollen b) bee orchid c) semi pollen d) none of these
61. Which one is used as dietary supplement and is sold as pollen tablets and syrups?
a) Bee orchid b) bee pollen c) semi pollen d) none of these
62. The study of honey pollen is called
a) paleobotany **b) mellitopalynology** c) molecular biology d) microbiology
63. Which one is undergoes genetically change which are undersirable for commercial use
a) callose **b) callus** c) auxin d) cytokinin
64. Which one shows the production of pollen by plants during different seasons?
a) pollen tube b) pollen grains **c) pollen calender** d) pollen kitt
65. Which one cause allergic reactions like asthma, bronchitis, hay ferer, allergic rhinitis etc
a) pollen tube **b) pollengrains** c) pollen calender d) pollen kitt
66. Which is commonly called carrot grass is a native of tropical America and was introduced into India as a contaminant along with cereal wheat
a**) partherium hysterophorus** b) solanum tuberosum
c) chrysanthemum sinerary pollum d) solanum durvum
67. ---------- is contributed by the tapeum and coloured yellow or orabge and is chiefly made of carotenois of flavonoids
a) pollen grain **b) pollen kitt** c) pollen chamber d) pollen tube
68. Which one is attracts insects and protects damage from UV radiation
a) pollen kitt b) pollen grain c) pollen chamber d) pollen tube
69. In 60% of the ---------- pollen is liberated in 2 celled stages.
a) algae b) fungi c) gymnosperms **d) angiosperms**
70. The intine grows a pollen tube through the ----------
a) germ tube **b) germ pore** c) germ plate d) none of these

71. Which one is represents the female reproductive part of the flower?
a) androecium b) calyx **c) gynoecium** d) corolla

72. The word gynoecium represents is ---------- of a flower
a) one or one pistils b) two or one pistils
c) three or more pistils **d) one or more pistils**

73. The ovules or megasporangia arise from the ----------
a) placenta b) pollengrain c) pollen tube d) pollen chamber

74. The number of ovules in an ovary may be one is ----------
a) paddy, maize, mango **b) paddy, wheat, mango**
c) paddy, sugarcane, maize d) wheat, sugarcane, maize

75. The number of ovules in an ovary may be many is -------
a) papaya, watermelon and orchids b) papaya, sugarcane, watermelon
c) wheat, papaya, sugarcane d) wheat, maize, orchids

76. The ovules is also called megasporangium and is protected by one or two covering called ------
a) hilum **b) integuments** c) raphe d) funiculus

77. A mature ovule consists of a stalk and a body. The stalk is ----------
a) funiculus b) raphe c) hilum d) nucellus

78. The point of attachment of funicle to the body of the ovule is known as ---------
a) raphe **b) hilum** c) nucellus d) hilum

79. In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called -------
a) raphe b) integrument c) nucellus d) hilum

80. The body of the ovule is made up of a central mass of parenchymatous tissue called ------
a) integument **b) nucellus** c) hilum d) raphe

81. The nucellus is enveloped by one or two protective covering called ----------
a) hilum b) raphe **c) integument** d) embryo sac

82. Integument enlose the nucellus completely expect at the top where is tree and forms a pore called ----
a) micropyle b) embryo sac c) hypac d) hilum

83. The ovules with one or two integuments are said to be ---------- or ------ ovules respectively
a) integuments or micropyle **b) unitegmic or bitegmic**
c) unitegmic or micropyle d) integuments or bitegmic

84. The basal region of the body of the ovule where the nucellus, the integument and the funicle meet or merge is called as ---------
a) micropyle **b) chalaza** c) hypostage d) epistage

85. There is a large, oval, sac like structure in the nucellus toward the micropylar end called -------
a) chalaza b) hypostase **c) embryosac** d) hilum

86. The another name of female gametophyte is ----------
a) embryo sac b) chalaza c) hypostage d) epistage

87. In some species the inner layer of the integuments may become specilized to perform the nutritive function for the embryo sac and is called as ----------
a) embryo sac **b) endothelium** c) epistage d) hypostage

88. The another name of endothelium is ----------
a) tenuinucellate b) chalaza c) integuments **d) integumentary tapetum**

89. If the sporogenus cell is hypodermal with a single layer of nucellar tissue around it is called ---
a) tenuinucellate b) integumentary tapetum
c) chalaza d) embryo sac

90. Ovules with subhypodermal sporogenous cellsis called ---------
a) crassinucellate b) tenuinucellate
c) hypostase d) epistage

91. The group of the cells found at the base of the ovule between the chalaza and embryo sac is called ---
a) epistase **b) hypostase** c) chalaza d) hilum

92. The thick walled cells found above the micro pylar end above the embryo sac is called ---------
a) chalaza **b) epistase** c) hypostage d) hilum

93. The ovules are classified into how many types
a) 3 b) 2 c) 4 **d) 6**

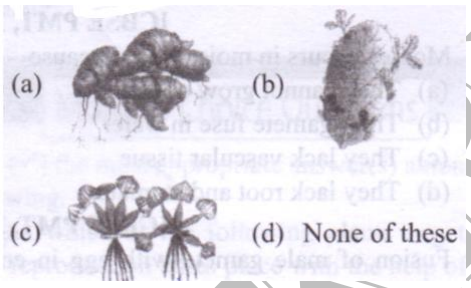
94. In this type of ovule, the micrpyle is at the distal end and the micropyle the funicle and the chalaza lie in one straight rerticalline is called ----------
a) anatropous **b) orthostropous** c) monosporic d) bisporic

95. The example of orthotropous is ----------
a) piperaceae and polygonaceae b) polygaonaceae and solanaceae
c) solanaceae and musaceae d) malvaceae and piperaceae

ADDITIONAL ONE MARKS:

1. A slender, prostrate, sub aerial branch of the stem which creeps along the ground helping in vegetative reproduction is
(a) stolon (b) sucker **(c) runner** (d) offset
2. Which one of the following statements is not correct?
(a) Offspring produced by the asexual reproduction are called clone.
(b) In potato, banana and ginger, the plantlets arise from, the internodes present in the modified stem.
(c) Water hyacinth, growing in the standing water, drains oxygen from water that leads to the death of fishes.
3. Select the incorrect match out of the following
(a) Offset - Potato
(b) Runner - Centella
(c) Stolon - Mentha
(d) Sucker - Chrysanthemum
4. Stock and scion are used in
(a) cutting **(b) grafting** (c) layering (d) micropropagation
5. Find out correct order of vegetative propagules of plants like potato, ginger, Agave, Bryophyllum and hyacinth Pistia
(a) Offset, bulbil, leaf bud, rhizome and eyes (b) Leaf bud, bulbil, offset, rhizome and eyes
(c) Eyes, rhizome, bulbil, leaf bud and offset (d) Rhizome, bulbil, leaf bud, eyes and offset
(e) Offset, bulbil, leaf bud, rhizome and eyes
6. Grafting experiments are not possible in monocotyledonous plants because they
(a) have conjoint vascular bundles (b) have less number of vascular bundles
(c) have scattered vascular bundles **(d) lack cambium cells in the vascular bundles**
7. In which of the following plants vegetative reproduction takes place with the help of bulbils?
(a) Colocasia (b) Zingiber (c) Agave (d) Vallisneria
8. A method in which roots are induced on the stem while it is still attached to the parent plant is called
(a) Layering (b) Cutting (c) Grafting (d) Vivipary

9. Syngamy refers to
   (a) Fusion of one of the sperms with secondary nucleus
   (b) Fusion of one of the sperms with the egg
   (c) Fusion of one of the sperms with the egg and other with the secondary nucleus
   (d) Fusion of one of the sperms with synergid
10. What is cross pollination?
   (a) Cleistogamy (b) Autogamy **(c) Allogamy** (d) Chasmogamy
11. Potatoes are cultivated by
   (a) Seeds (b) Foliar buds **(c) Buds on tubers** (d) Cuttings of roots
12. Ginger is multiplied vegetatively by
   (a) Rhizome (b) Tuber (c) Stem (d) Bud
13. Bryophyllum is multiplied vegetatively by
   (a) Roots **(b) Leaves** (c) Stem branch (d) Rhizome
14. Fusion of male gamete with egg in embryo sac is
   (a) Zygote **(b) Syngamy** (c) Double fertilization (d) Triple fusion
15. Which one of the following is correctly matched?
   (a) Chlamydomonas-Conidia (b) Yeast-Zoospores
   (c) Onion-Bulb (d) Ginger-sucker
16. In which of the following plants, vegetative propagation occurs by adventitious buds?



   Ans : (b)
17. Read the following statements and select the correct ones.
   (i) A piece of potato tuber having at least one eye (or node) is capable of giving rise to a new plant.
   (ii) Ginger propagates vegetatively with the help of its underground roots.
   (iii) Fleshy buds which take part in vegetative propagation are called bulbils, present in Dioscorea, Agave, etc.,
   (a) (ii) and (iii) **(b) (i) and (iii)** (c) (i), (ii) and (iv) (d) (i), (ii) and (iii)
18. Add scion is a term in relation to
   (a) Layering (b) Cutting **(c) Grafting** (d) Micro prapagation
19. Among the following which one is NOT a method of vegetative propagation?
   (a) Budding **(b) Sowing** (c) Micropropagation (d) Layering
20. Which of the following is propagated by means of cuttings?
   (a) Sugarcane (b) Coffee **(c) Citrus** (d) All of these
21. Stem cuttings are commonly used for propagation in
   (a) Rubber (b) Mangoes (c) Sugarcane **(d) Jasmine**
22. During grafting rootstock is generally derived from a plant
   (a) Efficient in water and mineral absorption (b) Resistant to diseases
   (c) That grows strong and healthy branches **(d) All of the above**
23. Clones are
   (a) Plants raised from a single parent (b) Population of plants produced vegetatively
   (c) Genetically similar to the parent plant **(d) All of the above**

24. Apomixis in plant means development of a plant
(a) From root cuttings **(b) Without fusion of gametes**
(c) From fusion of gametes (d) From stem cutting

25. Development of sporophyte without gametic fusion is known as
(a) Apomixis (b) Apospory **(c) Apogamy** (d) Parthenogenesis

26. What is micropropagation?
(a) Germination of seed with cotyledons above the soil
(b) A technique to obtain new plants by cultivating the cells or tissues in culture medium
(c) The mature stage of endosperm
(d) To manufacture hormones

27. Which one of the following is the true definition of totipotent cell?
(a) An undifferentiated cell capable of developing into an organ
(b) An undifferentiated cell capable of developing into a system or entire plant
(c) Cells that lack the capability of differentiating into an organ or system
(d) Undifferentiated cells capable of developing into complete embryo

28. Pollination is best defined as
(a) The transference of pollens from anthers to stigma
(b) The germination of pollen grains
(c) Visiting of flowers by ants
(d) The growth of pollen tube in the ovule

29. Pollination is a characteristic of
(a) Angiosperms (b) Pteridophytes (c) Bryophytes (d) All of the above

30. Self-pollination means
(a) Germination of pollens within the anther
(b) Transference of pollens from anthers to the stigma within the same flower
(c) Transference of pollens from one flower to another on the same plant
(d) Presence of male and female sex organs in the same flower

31. How is pollination brought about in maize?
(a) By insects (b) By bats **(c) By wind** (d) By water

32. Hydrophily is Best demonstrated by
(a) Nelumbium **(b) Vallisneria** (c) Nymphaea (d) Ranunculus

33. Entomophily is pollination by
(a) Water (b) Animals (c) Air **(d) Insects**

34. Insect pollinated flowers usually possess
(a) Stickly pollens with rough surface (b) Large quantities of pollens
(c) Brightly coloured pollens (d) Dry pollens with smooth surface

35. In Salvia the pollination is affected by
(a) Water **(b) Air** (c) Animals (d) Insects

36. Which of the following terms describes pollination by the agency of ants?
(a) Cheiropterophily (b) Entomophily (c) Ornithophily **(d) Myrmecophily**

37. Anther is generally composed of
(a) Two sporangia (b) Three sporangia **(c) Four sporangia** (d) One sporangium

38. In the anther wall
(a) Tapetum lies just inner to the endothecium
(b) Middle layers lie between endothecium and tapetum
(c) Endothecium lies inner to the middle layers
(d) Tapetum lies next to the epidermis

39. The odd one is
(a) Micropyle (b) Nucellus (c) Embryo sac **(d) Pollen grain**

40. Male gametophyte in angiosperms is represented by
(a) Stameans **(b) Microspore** (c) Microsporangium (d) Nucellus

41. In a pollen grain larger nucleus is
(a) Generative nucleus **(b) Vegetative nucleus**
(c) Tube nucleus (d) Prothallial nucleus

42. When the hilum, chalaza and microphyle of the ovule lie in the same longitudinal axis, it is known as
(a) Anatropous ovule (b) Amphitropous ovule
(c) Campylotropus ovule **(d) Orthotropous ovule**

43. The sequence of development of embryo sac is
(a) Archesporium → Megaspore → Megasporophyte → Embryo sac
(b) Archesporium → Megaspore → Megaspore mother cell → Embryo sac
(c) Archesporium → Megaspore mother cell → Megaspore → Embryo sac
(d) Archesporium → MMC → Embryo sac → Megaspore

44. Which one is female gametophyte?
(a) Embryo **(b) Embryo sac** (c) Endosperm (d) Synergid

45. Embryo sac is found in
(a) Endosperm (b) Embryo **(c) Ovule** (d) Seed

46. Fertilization means
(a) Transfer of male gamete to female gamete
(b) Adhesion of male and female reproduction organs
(c) Fusion of nuclei of male and female gametes
(d) The shedding of gametes from a reproductive organ

47. Double fertilization is characteristic of
(a) Angiosperms (b) Algae (c) Gymnosperms (d) Bryophytes

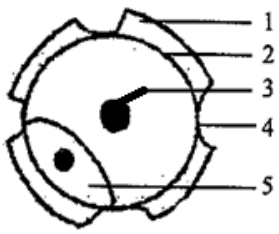
48. F.C. Steward is associated with
(a) Molecular biology (b) Genetics **(c) Tissue culture** (d) Immunology

49. Pollination by bats is
(a) Malacophily **(b) Chiropterophily** (c) Entomophily (d) Myrmecophily

50. Tapetal cells of stamens are
(a) Diploid uninucleate (b) Tetraploid binucleate
(c) Hexaploid tetranucleate **(d) Polyploid multinucleate**

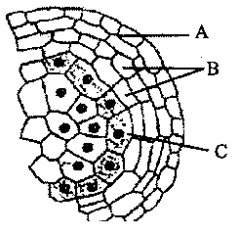
51. Ubisch bodies are secreted by
(a) Ovule **(b) Tapetum** (c) Both A and B (d) None of the above

52. In the given diagram the parts 1 to 5.



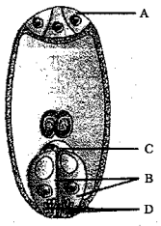
(a) 1 – intine, 2 – exine, 3 – vegetative cell, 4 – germ pore, 5 – generative cell
(b) 1 – exine, 2 – intine, 3 – vegetative cell, 4 – germ pore, 5 – generative cell
(c) 1 – exine, 2 – intine, 3 – vegetative cell, 4 – generative cell, 5 – germ pore
(d) 1 – exine, 2 – intine, 3 – germ pore, 4 – vegetative cell, 5 – generative cell

53. The given diagram shows microsporangium of a mature anther. Identify A, B and C.



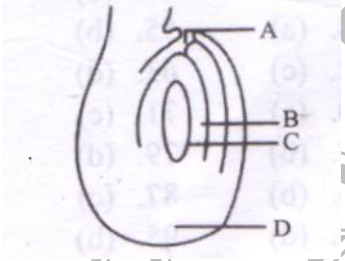
	A	B	C
a)	Middle layer	Endothecium	Tapetum
b)	Endothecium	Tapetum	Middle layer
c)	**Endothecium**	**Middle layer**	**Tapetum**
d)	Tapetum	Middle layer	Endothecium

54. Identify the parts labeled as A, B, C and D in the given figure and select the correct option.



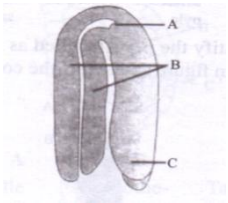
	A	B	C	D
a)	Synergids	Antipodals	Egg	Filiform apparatus
b)	**Antipodals**	**Synergids**	**Egg**	**Filiform apparatus**
c)	Antipodals	Synergids	Filiform apparatus	Egg
d)	Polar nuclei	Antipodals	filiform apparatus	Egg

55. Identify the parts labeled as A, B, C and D in the given figure and select the correct option.



	A	B	C	D
a)	Chalaza	Female gametophyte	Embryo sac	Micropyle
b)	Chalaza	Nucellus	Embryo sac	Micropyle
c)	Micropyle	Egg	Embryo sac	Chalaza
d)	**Micropyle**	**Nucellus**	**Embryo sac**	**Chalaza**

56. Identify the parts labeled as A, B, C and D in the given figure and select the correct option.



	A	B	C
a)	**Plumule**	**Cotyledons**	**Radicle**
b)	Rdicle	Cotyledons	Plumule
c)	Cotyledons	Plumule	Radicle
d)	Cotyledons	Radicle	Plumule

57. During fertilization if the pollen tube enters the ovule through integuments then it is called as…
a) Mesogamy b) Porogamy c) Chalazagamy d) Siphonogamy

58. If the cells of the nucellus in the angiosperm ovule contain 24 chromosomes when will be the number of chromosomes in the endosperm of a self - pollinated flower
a) 12 b) 24 **c) 36** d) 48

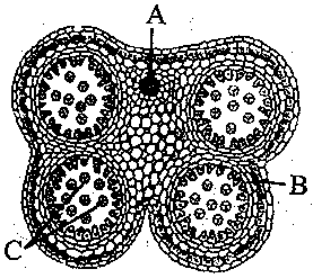
59. Which of the following is false in angiosperms
A) Egg wall - Haploid **b) Megaspore - Diploid**
c) Pollengrain - Haploid d) Endosperm - Triploid

60. Formation of liquid endosperm in coconut takes place because
a) Karyokinensis is not followed by cytokinensis
b)Karyokinensis is followed by cytokinensis
c) Formation of liquid endosperms is not dependent upon Karyokinensis and cytokinensis
d) None of the above

INTERIOR ONE MARKS:

1. Which one of the following layers of the anther wall helps in its dehiscence?
a) Epidermis b) Middle layer **c) Endothecium** d) Tapetum
2. Which one of the following statements is not true?
a) pollen grains of many species causes severe allergies
b) Stored pollen in liquid nitrogen can be used in the crop breeding programmes
c) Tapetum helps in the dehiscence of anther
d) Exine of pollen grains is made up of sporopollenin
3. **Assertion :** Endothecium layer of anther wall plays an important role in dehiscence of anther
Reason : The presence of fibrous bands and differential expansion of inner and outer tangential walls of endothecial cells cause dehiscence of anther
a) Both assertion and reason are true and reason is the correct explanation of assertion
b) Both assertion and reason are true and reason is not the correct explanation of assertion
c) Assertion is true but reason is false
d) Both assertion and reason are false
4. Which of these is not a part of the anther wall?
a) epidermis b) middle layers c) tapetum **d) nucellus**
5. Consider the following statements with respect to pollen grains
A. The exine is a thin and continuous layer made up of cellulose and pectin
B. The hard outer layer called the exine is made up of sporopollenin
C. Sporopollenin is present in germ pores
D. The exine exhibits a fascinating array of patterns and designs
Of the above statements
a) A and B alone are correct b) A and C alone are correct
c) B and D alone are correct d) B and C alone are correct
e) C and D alone are correct
6. Male gametophyte in angiosperms produces
a) single sperm and two vegetative cell b) three sperms
c) two sperms and a vegetative cell d) single sperm and a vegetative cells
7. What is the function of germ pore?
a) Initiation of pollen tube
b) Absorption of water for seed germination
c) Emergence of radicle
d) Release of male gametes
8. How many haploid nuclei are present in a mature pollen grain?
a) one **b) two** c) three d) four
9. Which part of the plant contains sporogenous tissue?
a)Pollen b)Microspores **c)Young anther** d)Stamen
10. Developing pollen is nourished by
a)Tapetum b) Endothecium c)Epidermis d)Middlelayer

11. Which of the following statements is correct?
    a)Sporopollenin can be degraded by enzyme
    b) Sporopollenin is made up of inorganic materials.
    c) Sporopollenin cn withstand high temperatures as well as strong acid sand alkalis
    d) Sporopollenin can withstand high temperatures but not strong acids
12. Sporopollenin is a constituent of pollen exine. It can be degraded by the action of
    a) enzymes b) high temperature c) strong acids **d) cannot be degraded**
13. Which one of the following statements is wrong?
    a) When pollen is shed at two-celled stage, double fertilization does not take place
    b) Vegetative cell is larger than generative cell
    c) Pollen grains in some plants remain viable for months
    d) Intine is made up of cellulose and pectin
14. The innermost wall layer of microsporangium nourishing the developing pollen grains is known as
    a) endodermis b) endothercium **c) tapetum** d) sporogenous tissue
15. Sporopollenin, an organic material is present in
    a) stigma b) style **c) exine** d) intine
16. The following is the diagram of T.S of anther, Identify the parts labeled A, B and C.



    a) A-Connective tissue, B-Endothecium, C-Pollen grain
    b) A- Endothecium, B- Connective tissue, C- Pollen grain
    c) A- Pollen grain, B- Connective tissue, C-Endothecium
    d) A- Endothecium, B- Pollen grain, C- Connective tissue
17. Find out the odd one
    a) Embryo sac b) micropyle c) nucellus **d) pollen grain**
18. Pollen grains are shed at which stage?
    a) 2-celled stage b) 3-celled stage **c) 2 or 3-celled stage** d) 1-celled stage
19. Sporopollenin, a chemical substance is found in --------
    a) intine of pollen grain **b) exine of pollen grain**
    c) endothecium of anther d) tapetum of anther
20. Exine of pollen grain is made up of
    a) pectocelulose b) lingo cellulose **c) sporopollenin** d) pollen kit
21. Tapetum is found in
    a) anther b) androecium c) ovary d) ovule
22. Functional megaspore in an angiosperm develops into an
    a) endosperm **b) embryo sac** c) embryo d) ovule
23. The megasporangium proper of an angiosperm ovule is represented by
    a) integument b) funicle **c) nucellus** d) micropyle
24. In majority of angiosperms
    a) egg has a filiform apparatus b) there are numerous antipodal cells
    c) reduction division occurs on the megaspore mother cells
    d) a small central cell is present in that embryo sac
25. Egg in female gametophyte is accompanied by
    a) antipodal cells **b) synergids** c) definitive nucleus d) tube nucleus

26. The embryo sac of angiosperms contains
a) 3 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
b) 2 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
c) 3 celled egg apparatus, 2 antipodal cells and 1 polar nuclei
d) 3 celled egg apparatus, 31 antipodal cells and 2 polar nuclei

27. The body of voule is fused with funicle at a point called
a) integuments **b) hilum** c) micropyle d) chalaza

28. The embryo sac of an angiosperm is made up of
a) 8 cells **b) 7 cells and 8 nuclei** c) 8 nuclei d) 8 cells and 7 nuclei

29. If the number of chromosomes in root cell is 14, then what will be the chromosome number in synergids?
a) 14 b) 21 **c) 7** d) 28

30. Match the items in column I with those in column II and choose the correct answer:

Column I		Column II
1. Funcile	-	A. Small opening of ovule
2. Integuments	-	B. Stalk of ovule
3. Chalaza	-	C. Protective envelopes of ovule
4. Hilum	-	D. Junction part of ovule and stalk
5. Micropyle	-	E. Basal part of the ovule

a) 1-B; 2-C; 3-E; 4-D; 5-A b) 1-A; 2-C; 3-B; 4-D; 5-E
c) 1-B; 2-C; 3-A; 4-D; 5-E d) 1-B; 2-D; 3-E; 4-A; 5-C e) 1-C; 2-D; 3-E; 4-A; 5-B

31. Synergids are
a) haploid b) diploid c) triploid d) tetraploid

32. The hilum and micropyle lie side by side and very close to each other in
a) anatropous ovule b) campylotropous ovule
c) amphitropous ovule d)circinotropous ovule

33. The diagram given by the side represents the sectional view of
a) amphitropous ovule
b) campylotropous ovule
c) anatropous ovule
d) orthotropous ovule

34. A dioecious flowering plant prevents both
a) autogamy and geitonogamy b) geitonogamy and xenogamy
c) ccleistogamy and xenogamy d) autogamy and xenogamy

35. Pollination in water hyacinth and water lily is brought about by the agency of
a) water **b) insects or wind** c) birds d) bats

36. Which one of the following statement is correct?
a) chasmogamous flowers never exhibits autogamy
b) chasmogamous flowers always exhibits geitonogamy
c) Cleistogamous flowers exhibits both autogamy and geitonogamy
d) Cleistogamous flowers always exhibits autogamy

37. Which one of the following is not a correct explanation of cross pollination?
a) The pollen grains of male flowers are transferred to the stigma of the female flowers
b) The pollen grains are transferred from one flower to another flower, of another plant of the same species
c) The pollen grains are transferred from one flower to another flower situated on the same plant
d) The pollen grains of one flower are transferred to the stigma of the same flower

38. The main advantage of cleistogamy is that it ensures
a) cross pollination **b) seed setting even in absence of pollinators**
c) protandry in flowers d) geitonogamy instead of autogamy

39. Geitonogamy invovles
a) fertilization of a flower by the pollen from another flower of the same plant
b) fertilization of a flower by the pollen from the same flower
c) fertilization of a flower by the pollen from a flower of another plant in the same population
d) fertilization of a flower by the pollen from a flower of another plant belonging to a distant population

40. Entomophilous flowers are
a) brightly coloured and produce nectar b) colourless c) inconspicous d) odourless

41. Transfer of pollen grains from one flower to another flower of the same plant is called
a) xenogamy **b) geitonogamy** c) autogamy d) allgoamy

42. Transfer of pollen grains from the anther to the stigma to another flower of the different plant is known as
a) autogamy b) geitonogamy **c) xenogamy** d) cleistogamy

43. In castor and maize plant --------
a) male and female flowers are borne by different plants
b) autogamy is prevented but not geitonogamy
c) the anthers and stigma are placed at different positions to encourage cross pollination
d) both autogamy and geitonogamy are prevented

44. Which of the following feature(s) is/are common to both wind and water pollinated flowers?
I. Pollen grains are long and ribbon-like II. Stigma is large and feathery
III. The flowers are not colourful IV. The flowers do not produce nectar
a) III and IV only b) II and III only c) I and III only d) II only e) I only

45. Select the plants pollinated by water
A. Water hyacinth B. Zostera C. Amorpophallus D. Vallisneria E. Yucca
a) A, D and E only b) B and E only c**) B and D only**
d) B, C and D only e) A, B and D only

46. In general pollen tube eners the ovule through
a) micropyle b) chalaza c) hilum d) funicle

47. In porogamy, pollen tube enters the ovule through the
a) chalazaalend b) integument **c) micropyle** d) ovary wall

48. Entry of the pollen tube with two male gametes and tube nucleus through micropyle is called
a) mesogamy **b) porogamy** c) chalazogamy d) autogamy

49. Double fertilization involves
a) fertilization of the egg by two male gametes
b) fertilization of the two eggs in the same embryo sac by two sperms brought by one pollen tube
c) fertilization of the egg and the central cell by two sperms brought by different pollen tubes
d) fertilization of the egg and the central cell by two sperms brought by the same pollen tube

50. After double fertilization a mature ovule has
a) 1 diploid and 1 haploid cell **b) 1 diploid and 1 triploid cell**
c) 2 haploid and 1 triploid cell d) 1 haploid and 1 triploid cell

51. Cotyledon of maize grain is called
a) coleoptile **b) scutellum** c) plumule d) coleorhiza

52. The coconut water from a tender coconut represents
a) free nuclear proembryo **b) free nuclear endosperm**
c) endocarp d) fleshy mesocarp

53. The arrangement of Nuclei in a typical female gametophyte of an angiosperm is
a) 3+3+2 b) 3+1+3 **c) 3+2+3** d) 2+3+3

54. Coconut water from a tender coconut is
a) innermost layers of the seed coat b) degenerated nucellus
c) immature embryo **d) free nuclear endosperm**

55. Primary endosperm nucleus (PEN) is formed by the fusion of
a) 2 polar nuclei + 1 synergid cell nucleus
b) 1 polar nucleus + 1 antipodal cell nucleus+ 1 synergid cell nucleus
c**) 2 polar nuclei + 1 male gamete nucleus**
d) 2 antipodal cell nuclei + 1 male gamete nucleus

56. Which of the following is false in angiosperms?

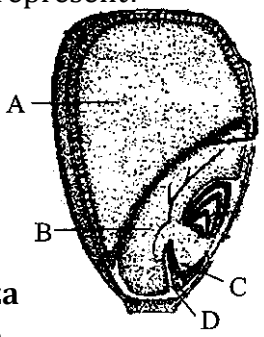
a) Egg cell	-	Haploid
b) Megaspore	**-**	**Diploid**
c) Pollen grain	-	Haploid
d) Synergid	-	Haploid
e) Endosperm	-	Triploid

57. Endosperm nucleus is
a) n b) 2n **c) 3n** d) 4n

58. Perisperm differs from endosperm in
a) being a diploid tissue
b) its formation by fusion of secondary nucleus with several sperms
c) being a haploid tissue d) having no reserved

59. Which one of the following events takes place after double fertilization?
a) The pollen grain germinates on the stigma
b) The pollen tubes enter the embryo sac
c) Two male gametes are discharged into the embryo sac
d) The PEN (Primary Endosperm Nucleus) develops into endosperm
e) The male gamete fuses with egg to form a zygote

60. The given figure shows L.S. of the seed of maize. when do A,B,C and D represent?



a) A: endosperm	B: Scutellum	C: plumule	D: coleoptile
b) A: Scutellum	B: pericarp	C: radicle	D: coleoptiles
c) A: endosperm	**B: Scutellum**	**C: radicle**	**D: coleorrhiza**
d) A: Scutellum	B: pericarp	C: plumule	D: coleorrhiza

61. A typical dicotyledonous embryo consists of
a) radicle only b) embryonal axis only
c) cotyledons only **d) radicle, embryonal axis and cotyledons**

62. A plant has 24 chromosomes in 'microspore mother cell'. The number of chromosomes in its endosperm will be
a) 36 b) 24 c) 12 d) 48

63. Select the option that contains all plants which produce non endospermic seeds

a) Gram, Pea, Bean Ground nut b) Castor, Peanut, Orchid, Wheat

c) Coconut, Walnut, Wheat, Gram d) Castor, Maize, Coconut, Orchid

64. The monocotyledonous seed consists of one large and shield shaped cotyledon known as a/an

a) coleoptile **b) scutellum** c) aleurone layer d) coleorhiza

65. Non-albuminous seed is produced in

a)maize b) castor c) wheat **d) pea**

66. Testa of a seed is produced from

a) ovary wall b) hilum **c) outer integument of ovule** d) funicle

67. In hypogeal germination de to elongation of ----------

a) hypocotyl **b) epicotyl** c) cotyledons d) both a and b

68. Development of fruit without fertilization is called

a) parthenogenesis **b) parthenocarpy** c) polyspermy d) siphonogamy

69. Which one of the following fruits is parthenocarpic?

a) Jackfruit **b) banana** c) brinjal d) apple

70. Apomixis is

a) formation of seeds by fusion of gametes

b) formation of seeds without syngamy and meiosis

c) formation of seeds with syngamy but no meiosis d) None of the above

71. Seeds without ferlization are obtained from

a) polyembryony b) parthenocarpy c) dormancy **d) apomixis**

72. Adventive polyembryony occurs in

a) pea b) brassica c) allium **d) citrus**

73. Nucellar polyembryony is reported in species of

a) citrus b) gossypium c) triticum d) brassica

74. Process in which fertilization occurs without fusion of gametes

a) amphimixis b) parthenogenesis **c) apomixis** d) none of these

75. Development of female gametophyte directly from megaspore mother cell without meiosis is called

a) apogamy **b) apospory** c) syngamy d) parthenocarpy

TWO MARKS

1. **What is reproduction?**
   - ❖ Reproduction is a vital process for the existence of a species and it also brings suitable changes through variation in the off springs for their survival on earth.
2. **Mention the contribution of Hofmeister towards Embryology.**
   1848 - Hofmeister described the structure of pollen tetrad

3. **List out two sub-aerial stem modifications with example.**

Sub aerial stem modifications are.

- These include rhizome (*Musa paradisiaca*, *Zingiber officinale* and *Curcuma longa*);
- corm (*Amorphophallus* and *Colocasia*);
- tuber (*Solanum tuberosum*);
- bulb(*Allium cepa* and *Lilium*)
- runner (*Centella asiatica*);
- stolon (*Mentha,* and *Fragaria*);
- offset (*Pistia,* and *Eichhornia*);
- sucker (*Chrysanthemum*) and
- bulbils (*Dioscorea* and *Agave*).
- The axillary buds from the nodes of rhizome and eyes of tuber give rise to new plants.

4. **What is layering?**

Layering: The stem of a parent plant is allowed to develop roots while still intact. When the root develops, the rooted part is cut and planted to grow as a new plant.

Examples: *Ixora* and *Jasminum*. Mound layering and Air layering are few types of layering

5. **What are clones?**

The individuals formed by this method is morphologically and genetically identical and are called **clones**.

6. **A detached leaf of Bryophyllum produces new plants. How?**

In *Bryophyllum*, the leaf is succulent and notched on its margin. **Adventious buds develop at these notches and are called epiphyllous buds.** They develop into new plants forming a root system and become independent plants when the leaf gets decayed.

7. **Differentiate Grafting and Layering.**

Grafting	layering
Two different plants are joined they continue to grow as one plants	The stem of a parent plant is allowed to develop roots white still intact
(i) The plant which is contact with the soil is called stock (ii) plant used for grafting is called scion . Ex: citrus, Mango apple.	The root develops the rooted part is cut and planted to grow as a how plant. Ex: Ixora, Jasminum

8. **"Tissue culture is the best method for propagating rare and endangered plant species"- Discuss.**

- The genetic ability of a plant cell to produce the entire plant under suitable condition is said to be totipotency
- This characteristics feature of a cell is utilized in horticulture, forestry and industries for propagating rare and endangered plant species.

9. **Distinguish mound layering and air layering.**

Mound layering:	Air layering:
❖ This method is applied for the plants having flexible branches. The lower branch with leaves is bent to the ground and part of the stem is buried in the soil and tip of the branch is exposed above the soil. ❖ After the roots emerge from the part of the stem buried in the soil, a cut is	❖ In this method the stem is girdled at nodal region and hormones are applied to this region which promotes rooting. This portion is covered with damp or moist soil using a polythene sheet. ❖ Roots emerge in these branches after 2-4 months. Such branches are removed from the parent plant and

made in parent plant so that the buried part grow into a new plant.	grown in a separate pot or ground.

10. **What is Mellitophily?**

Bee pollen is a natural substance and contains high protein, carbohydrate, trace amount of minerals and vitamins. Therefore, it is used as dietary supplement and is sold as pollen tablets and syrups. Further , it increases the performance of athletes, race horses and also heals the wounds caused by burns . The study of honey pollen is called Mellitopalynology

11. "Endothecium is associated with dehiscence of anther" Justify the statement.

- ❖ It is generally a single layer of radially elongated cells found below the epidermis. The inner tangential wall develops bands (sometimes radial walls also) of α cellulose (sometimes also slightly lignified). The cells are **hygroscopic**.
- ❖ This region along with the hygroscopic nature of endothecium helps in the dehiscence of anther at maturity.

12. List out the functions of tapetum.

❖ It supplies nutrition to the developing microspores.

❖ It contributes sporopollenin through **ubisch bodies** thus plays an important role in pollen wall formation.

❖ The pollenkitt material is contributed by tapetal cells and is later transferred to the pollen surface.

❖ Exine proteins responsible for '**rejection reaction**' of the stigma are present in the cavities of the exine. These proteins are derived from tapetal cells.

13. Write short note on Pollen kitt.

❖ Pollenkitt is contributed by the tapetum and coloured yellow or orange and is chiefly made of carotenoids or flavonoids. It is an oily layer forming a thick viscous coating over pollen surface. It attracts insects and protects damage from UV radiation.

14. Distinguish tenuinucellate and crassinucellate ovules.

Tenuinucellate	Crassinucellatae
❖ If the sporogenous cell is hypodermal with a single layer of nuclear tissue around it is calle4d Tenuinuclleate	❖ Ovules with subhypodermal sporogenous cell is called Crassinucellatae
❖ Ovule have very small nucellus	❖ Ovule have large nucellus

15. "Pollination in Gymnosperms is different from Angiosperms' – Give reasons.

Gymnosperm pollination	Angiosperm pollination
❖ It is called direct pollination	❖ Indirect pollination
❖ Pollens are deposited directly on the exposed ovules	❖ pollens are deposited on the stigma of the pistil

16. Write short note on Heterostyly.

Some plants produce two or three diff erent forms of fl owers that are diff erent in their length of stamens and style. Pollination will take place only between organs of the same length.

17. Enumerate the characteristic features of Entomophilous flowers.

❖ Flowers are generally large or if small they are aggregated in dense inflorescence. Example: Asteraceae flowers.

- ❖ Flowers are brightly coloured. The adjacent parts of the flowers may also be brightly coloured to attract insect. For example in *Poinsettia* and *Bougainvillea* the bracts become coloured.
- ❖ Flowers are scented and produce nectar.
- ❖ Flowers in which there is no secretion of nectar, the pollen is either consumed as food or used in building up of its hive by the honeybees. Pollen and nectar are the floral rewards for the visitors.
- ❖ Flowers pollinated by flies and beetles produce foul odour to attract pollinators.
- ❖ In some flowers juicy cells are present which are pierced and the contents are sucked by the insects.

18. Discuss the importance of Modern methods in reproduction of plants.

- ❖ Plants with desired characteristics can be multiplied rapidly in a short duration.
- ❖ Plants produced are genetically identical.
- ❖ Tissue culture can be carried out in any season to produce plants.
- ❖ Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.
- ❖ Rare and **endangered** plants can be propagated.
- ❖ Disease free plants can be produced by **meristem culture**.
- ❖ Cells can be genetically modified and transformed using tissue culture.

19. What is Cantharophily?

i) The cross pollination of flowers by beetles that feel on the pollen (or) on some of the Juicy tissues of the flower. Special suitability for cantharophily is generally not observed among flowers and beetles

ii) Canthrophily is inherent in only a few plants Eg: Cycads, Calycanthos

20. List any two strategy adopted by bisexual flowers to prevent self-pollination.

(i) Dichogamy - Inbisexual flowers anthers and stigmas mature at different time

(a) Protandry - the stamens mature earlier than the stigma of the flower

Example: Helianthus

(b) Protogyny - The stigmas mature earlier tan the stamens of the flower

Example: Aristolochia bracteata

(ii) Heterostyly - Some plants produce two (or) three different forms of flowers that are different their length od stamen and style. Pollination will take place only between organs of the same length

21. What is endothelium.

In some species (unitegmic tenuinucellate) the inner layer of the integument may become specialized to perform the nutritive function for the embryo sac and is called as **endothelium** or **integumentary tapetum**

(**Example** : Asteraceae).

22. "The endosperm of angiosperm is different from gymnosperm". Do you agree. Justify your answer.

I agree. In angiosperms endosperm produced during triple fusion. In gymnosperms, haploid endosperm produced before fertilization.

23. Define the term Diplospory.

A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division Examples. Eupatorium and Aerva

INTERIOR:

1. **What is asexual reproduction?**

The reproduction method which helps to perpetuate its own species without the involvement of gametes is referred to as asexual reproduction.

2. **What is natural methods?**

- ❖ Natural vegetative reproduction is a form of asexual reproduction in which a bud grows and develops into a new plant.
- ❖ The buds may be formed in organs such as root, stem and leaf. At some stage, the new plant gets detached from the parent plant and starts to develop into a new plant.
- ❖ Some of the organs involved in the vegetative reproduction also serve as the organs of storage and perennation.
- ❖ The unit of reproductive structure used in propagation is called reproductive propagules or diaspores.

3. Explain the terror of bongal.

Scourge of water bodies / Water hyacinth **(***Eichhornia crassipes)* is an invasive weed on water bodies like ponds, lakes and reservoirs. It is popularly called "Terror of Bengal". It spreads rapidly through off set all over the water body and depletes the dissolved oxygen and causes death of other aquatic organisms.

4. **Advantages of natural vegetative reproduction.**

- ❖ Only one parent is required for propagation.
- ❖ The new individual plants produced are genetically identical.
- ❖ In some plants, this enables to spread rapidly. Example: *Spinifex*
- ❖ Horticulturists and farmers utilize these organs of natural vegetative reproduction for cultivation and to harvest plants in large scale.

5. Define : Conventional method

Some of the artificial propagation methods have been used by man for a long time and are called **conventional methods**.

6. Define : Modern method

Now-a-days, technology is being used for propagation to produce large number of plants in a short period of time. Such methods are said to be **modern methods**.

7. What is cutting?

It is the method of producing a new plant by cutting the plant parts such as root, stem and leaf from the parent plant. The cut part is placed in a suitable medium for growth. It produces root and grows into a new plant.

Example: root cutting (*Malus*), stem cutting (*Hibiscus, Bougainvillea* and *Moringa*) and leaf cutting (*Begonia, Bryophyllum*). Stem cutting is widely used for propagation.

8. Define Grafting

Two different plants are joined so that they continue to grow as one plant. Of the two plants, the plant which is in contact with the soil is called **stock** and the plant used for grafting is called **scion**. Examples are Citrus, Mango and Apple.

9. Bud grafting

A T- shaped incision is made in the stock and the bark is lifted. The scion bud with little wood is placed in the incision beneath the bark and properly bandaged with a tape.

10. Layering

The stem of a parent plant is allowed to develop roots while still intact. When the root develops, the rooted part is cut and planted to grow as a new plant. Examples: *Ixora* and *Jasminum*. Mound layering and Air layering are few types of layering

11. What is totipotency?

The genetic ability of a plant cell to produce the entire plant under suitable conditions is said to be totipotency.

12. What is tissue culture?

The growth of plant tissue in special culture medium under suitable controlled conditions is known as **tissue culture**.

13. Micropropagation

The regeneration of a whole plant from single cell, tissue or small pieces of vegetative structures through tissue culture is called **micropropagation**.

14. Define the sexual reproduction

Sexual reproduction involves the production and fusion of male and female gametes. The former is called gametogenesis and the latter is the process of fertilization.

15. Write the three type of gametic fussion

The gametic fusion is of three types (Isogamy, Anisogamy and Oogamy). In algae external fertilization

16. What are the essential and non essential flower?

A Flower possesses four whorls- Calyx, Corolla, Androecium and Gynoecium. Androecium and Gynoecium are essential organs

17. What is microsporangenesis?

The stages involved in the formation of haploid microspores from diploid microspore mother cell through meiosis is called **Microsporogenesis**.

18. What is pollinium?

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

19. What is androecium?

Androecium is made up of stamens. Each stamen possesses an anther and a filament. Anther bears pollen grains which represent the male gametophyte.

20. Sporogenous tissue

The primary sporogeneous cells directly, or may undergo a few mitotic divisions to form **sporogenous tissue.** The last generation of sporogenous tissue functions as microspore mother cells.

21. What is corpusculum?

Pollinia are attached to a clamp or clip like sticky structure called **corpusculum**.

22. What is retinaculum?

The filamentous or thread like part arising from each pollinium is called **retinaculum**.

23. Translator

The whole structure of microsporangium looks like inverted letter 'Y' and is called **translator.**

24. What is stromium?

In the anthers of aquatic plants, saprophytes, cleistogamous flowers and extreme parasites endothecial differentiation is absent. The cells along the junction of the two sporangia of an anther lobe lack these thickenings. This region is called **stomium**.

25. Secretory tapetum

The tapetum retains the original position and cellular integrity and nourishes the developing microspores.

26. Invasive tapetum

The cells loose their inner tangential and radial walls and the protoplast of all tapetal cells coalesces to form a periplasmodium.

27. What is amoeboidal tapetum?

The cell wall is not lost. The cells protrude into the anther cavity through an amoeboid movement. This type is often associated with male sterility and should not be confused with periplasmodial type.

28. What are the character of intine?

Intine is thin, uniform and is made up of pectin, hemicellulose, cellulose and callose together with proteins.

29. What are the characters of exine?

Exine is thick and is made up of cellulose, sporopollenin and pollenkitt. The exine is not uniform and is thin at certain areas.

30. Define Sporopollenin

The wall material sporopollenin is contributed by both pollen cytoplasm and tapetum. It is derived from carotenoids. It is resistant to physical and biological decomposition. It helps to withstand high temperature and is resistant to strong acid, alkali and enzyme action.

31. Palynology

Palynology is the study of pollen grains.It helps to identify the distribution of coal and to locate oil fields. Pollen grains reflect the vegetation of an area.

32. Explain the basic technique cryopreservation

Liquid nitrogen (-196^{0}C) is used to preserve pollen in viable condition for prolonged duration. This technique is called **cryopreservation** and is used to store pollen grains (pollen banks) of economically important crops for breeding programmes.

33. Shape and Size of pollen grains

- Shape of a pollen grain varies from species to species. It may be globose, ellipsoid, fusiform, lobed, angular or crescent shaped.
- The size of the pollen varies from 10 micrometers in *Myosotis* to 200 micrometers in members of the family Cucurbitaceae and Nyctaginaceae.

34. Explain the type of bee pollen

Bee pollen is a natural substance and contains high protein, carbohydrate, trace amount of minerals and vitamins. Therefore, it is used as dietary supplement and is sold as pollen tablets and syrups.

35. What is Mellitopalynology?

The study of honey pollen is called Mellitopalynology.

36. What are uses of pollen calendar?

The production of pollen by plants during different seasons**.** This benefits the allergic persons. Pollen grains cause allergic reactions like asthma, bronchitis, hay fever, allergic rhinitis etc.,

37. Define pollenkitt

Pollenkitt is contributed by the tapetum and coloured yellow or orange and is chiefly made of carotenoids or flavonoids. It is an oily layer forming a thick viscous coating over pollen surface. It attracts insects and protects damage from UV radiation.

38. What is gynoecium?

The **gynoecium** represents the female reproductive part of the flower. The word gynoecium represents one or more pistils of a flower. The word pistil refers to the ovary, style and stigma.

39. Define funicle

A mature ovule consists of a stalk and a body. The stalk or the **funiculus** (also called funicle) is present at the base and it attaches the ovule to the placenta.

40. Define hilum

The point of attachment of funicle to the body of the ovule is known as **hilum**.

41. What is nucellus?

The body of the ovule is made up of a central mass of parenchymatous tissue called **nucellus** which has large reserve food materials.

42. Define Raphe

It represents the junction between ovule and funicle. In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called **raphe**.

43. Define unitegmic or bitegmic

The ovule with one or two integuments are said to be **unitegmic** or **bitegmic**

44. Define hypostase

Group of cells found at the base of the ovule between the chalaza and embryo sac is called **hypostase**

45. Define epistase

Thick -walled cells found above the micropylar end above the embryo sac is called **epistase**.

46. How to form a different type of ovule and its types

Based on the orientation, form and position of the micropyle with respect to funicle and chalaza. Most important ovule types are orthotropous, anatropous, hemianatropous and campylotropous.

47. Which type of voule present in all dicot and monot plant?

Anatropous: The body of the ovule becomes completely inverted so that the micropyle and funiculus come to lie very close to each other. This is the common type of ovules found in dicots and monocots.

48. Which type of ovule are called horse shoe shaped?

The distance between hilum and chalaza is less. The curvature of the ovule leads to horse-shoe shaped nucellus. Example: some Alismataceae.

49. What is bisporic?

The functional megaspore forms the female gametophyte or embryo sac. This type of development is called **monosporic** development (Example: *Polygonum*).

11. What is monosporic?

Of the four megaspores formed if two are involved in Embryo sac formation the development is called **bisporic** (Example: *Allium*).

12. **What is tetrasporic?**

Four megaspores are involved in Embryo sac formation the development is called **tetrasporic** (Example: *Peperomia*).

60. Which organized to form egg apparatus?

The four nuclei at the micropylar end of the embryo sac, three organize into an **egg apparatus**

61. What is synergids and uses?

Synergids secrete chemotropic substances that help to attract the pollen tube. The special cellular thickening called filiform apparatus of synergids help in the absorption, conduction of nutrients from the nucellus to embryo sac. It also guides the pollen tube into the egg.

62. What is pollination?

Transfer of pollen grains from the anther to a stigma of a flower is called **pollination.**

63. What is self pollination?

Self-pollination or Autogamy (Greek Auto = self, gamos = marriage):
the transfer of pollen on the stigma of the same flower is called **self-pollination or Autogamy**.

64. What is cross pollination?

Transfer of pollens on the stigma of another flower. The cross-pollination is of two types:

i. Geitonogamy
ii. Xenogamy

65. Difference between chasmogamy and cleistogamy

chasmogamy	cleistogamy
In majority of angiosperms, the flower opens and exposes its mature anthers and stigma for pollination. Such flowers are called **chasmogamous** and the phenomenon is **chasmogamy.**	pollination occurs without opening and exposing their sex organs. Such flowers are called **cleistogamous** and the phenomenon is **cleistogamy.**

66. What is cleistogamy

Pollination occurs without opening and exposing their sex organs. Such flowers are called **cleistogamous** and the phenomenon is **cleistogamy.**

67. What is monoecious?

Male and female flowers on the same plant.

Example: Coconut, Bitter gourd.

68. What is dioecious?

Male and female flowers on different plants.

Example: *Borassus*, *Carica papaya* and date palm.

69. Define : Protandry

The stamens mature earlier than the stigmas of the flowers.

Examples: *Helianthus, Clerodendrum*

70. Define : Protogyny

The stigmas mature earlier than the stamens of the flower.

Examples: *Scrophularia nodosa* and *Aristolochia bracteata*

71. What is distyly and its explain

The plant produces two forms of flowers, Pin or long style, long stigmatic papillae, short stamens and small pollengrains Thrum-eyed or short style, small stigmatic papillae, long stamens and large pollen grains. Example: *Primula .*

The stigma of the Thrum-eyed flowers and the anther of the pin lie in same level to bring out pollination. Similarly the anther of Thrum-eyed and stigma of pin ones is found in same height. This helps in effective pollination.

72. What is cheiropterophily?

Pollination carried out by bats is called cheiropterophily. Some of the common cheiropterophilous plants are *Kigelia africana*, *Adansonia digitata*.

73. What is malacophily?

Pollination by slugs and snails is called malacophily. Some plants of Araceae are pollinated by snails. Water snails crawling among *Lemna* pollinate them.

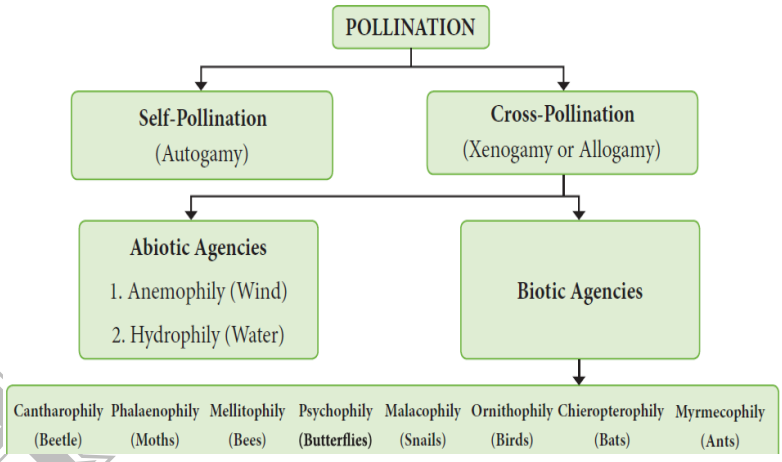
74. Explain the entomophily pollination

Pollination by insects is called **Entomophily**. Insects are chief pollinating agents and majority of angiosperms are adapted for insect pollination. It is the most common type of pollination.

75. The characteristic features of entomophilous

- Flowers are generally large or if small they are aggregated in dense inflorescence. Example: Asteraceae
- Flowers are brightly coloured. The adjacent parts of the flowers may also be brightly coloured to attract insect. For example in *Poinsettia* and *Bougainvillea* the bracts become coloured.
- Flowers are scented and produce nectar.
- Flowers in which there is no secretion of nectar, the pollen is either consumed as food or used in building up of its hive by the honeybees. Pollen and nectar are the floral rewards for the visitors.
- Flowers pollinated by flies and beetles produce foul odour to attract pollinators.
- In some flowers juicy cells are present which are pierced and the contents are sucked by
- flowers

76. Over all outline of pollination



77. Advantages and disadvantages of self pollination

Advantages

- Pollination is almost certain in bisexual flowers. When the members of the species are uncommon and are separated by large distances, the plant has to depend on self-pollination.
- If all the chances of cross-pollination fails, self-pollination will take place and prevent the extinction of the species.

Disadvantages

- Continuous self-pollination, generation after generation results in weaker progeny.
- Chances of producing new species and varieties are meager.

78. Advantages and disadvantages of cross pollination

Advantages:

- ❖ It always results in bringing out much healthier offsprings.
- ❖ Germination capacity is much better.
- ❖ New varieties may be produced.
- ❖ The adaptability of the plants to their environment is better

Disadvantages

- ❖ Depend on external agencies for the pollination and the process is uncertain.
- ❖ Various devices have to be adopted to attract pollinating agents.

79. Significance of pollination

- ❖ Pollination is a pre-requisite for the process of fertilisation. Fertilisation helps in the formation of fruits and seeds.
- ❖ It brings the male and female gametes closer for the process of fertilisation.
- ❖ Cross-pollination introduces variations in plants due to the mixing up of different genes. These variations help the plants to adapt to the environment and results in speciation.

80. Find the plant fails to reproduce sexually without moth. How can it possible support your answer.

❖ The relationship between *Yucca* and moth (*Tegeticula yuccasella*) is an example for obligate mutualism.

❖ The moth bores a hole in the ovary of the flower and lays eggs in it.

Then it collects pollen and pushes it in the form of balls down the hollow end of the stigma.

❖ Fertilization takes place and seeds develop. Larvae feed on developing seeds. Some seeds remain unconsumed for the propagation of the plant species

❖ It is interesting that the moth cannot survive without *Yucca* flowers and the plant fails to reproduce sexually without the moth

81. Which organism called pollen / nectar robbers?

Amorphophallus, flowers apart from providing floral rewards, also forms safe site for laying eggs. Many visitors consume pollen and nectar and do not help in pollination.

They are called pollen / nectar robbers.

82. What is pseudocopulation? and how to help in pollination?

In Bee orchid (*Ophyrus*) the morphology of the flower mimics that of female wasp (*Colpa*).The male wasp mistakes the flowers for a female wasp and tries to copulate. This act of pseudocopulation helps in polli nation. The pollination in Fig (*Ficus carica*) by the Wasp (*Blastophaga psenes*) is also an example for similar Plant – insect interaction.

83. Define: pollen pistil intraction

The events from pollen deposition on the stigma to the entry of pollen tube in to the ovule is called **pollen- pistil interaction.** It is a dynamic process which involves recognition of pollen and to promote or inhibit its germination and growth.

84. What is wet stigma and dry stigma?

The receptive surface of the stigma receives the pollen. If the pollen is compatible with the stigma it germinates to form a tube.

This is facilitated by the stigmatic fluid in **wet stigma** and pellicle in **dry stigma**

85. What is cap block? When disappear?

The extreme tip of pollen tube appears hemispherical and transparent when viewed through the microscope. This is called **cap block**.

As soon as the cap block disappear the growth of the pollen tube stops.

86. Write the name of different types of style

The growth of the pollen tube in the style depends on the type of style.

There are three types of style

- ❖ Hollow or open style
- ❖ solid style or closed style
- ❖ semi-solid or half closed style.

87. In monocot plant contain the which type of stele?

Hollow style (Open style):

- ❖ It is common among monocots. A hollow canal running from the stigma to the base of the style is present. The canal is lined by a single layer of glandular canal cells (Transmitting tissue).
- ❖ They secrete mucilaginous substances. The pollen tube grows on the surface of the cells lining the stylar canal.
- ❖ The canal is filled with secretions which serve as nutrition for growing pollen tubes and also controlling incompatibility reaction between the style and pollen tube.
- ❖ The secretions contain carbohydrates, lipids and some enzymes like esterases, acid phosphatases as well as compatibility controlling proteins

88. What is transmitting tissue?

The canal is lined by a single layer of glandular canal cells (Transmitting tissue). They secrete mucilaginous substances

89. Glandular canal cell secreting which types of material

The secretions contain carbohydrates, lipids and some enzymes like esterases, acid phosphatases as well as compatibility controlling proteins.

90. In dicot plant having common type of style

Solid style (Closed type):

- ❖ It is common among dicots. It is characterized by the presence of central core of elongated, highly specialized cells called transmitting tissue.
- ❖ This is equivalent to the lining cells of hollow style and does the same function. Its contents are also similar to the content of those cells.
- ❖ The pollen tube grows through the intercellular spaces of the transmitting tissue.

91. What is semi-solid type of style

This is intermediate between solid and open type. There is a difference of opinion on the nature of transmitting tissue. Some authors consider that it is found only in solid styles while others consider the lining cells of hollow style also has transmitting tissue.

92. How many enmy of pollen tube into the ovule type formed? Give explanation

There are three types of pollen tube entry into the ovule

Porogamy: when the pollen tube enters through the micropyle.

Chalazogamy: when the pollen tube enters through the chalaza.

Mesogamy: when the pollen tube enters through the integument.

93. What is obturator and their function

The growth of pollen tube towards the ovary, ovule and embryo sac is due to the presence of chemotropic substances. The pollen tube after travelling the whole length of the style enters into the ovary locule where it is guided towards the micropyle of the ovule by a structure called **obturator**

94. How to form the obturator?

The pollen tube after travelling the whole length of the style enters into the ovary locule where it is guided towards the micropyle of the ovule by a structure called **obturator**

95. What is carauncle?

he cells present at the tip of the outer integument around the micropyle develop into a fleshy structure called **caruncle**. (*Ricinus communis).*

96. What is (i) polar nuclei

The second gamete migrates to the central cell where it fuses with the **polar nuclei**

(ii) PEN

their fusion product, the secondary nucleus and forms the **primary endosperm nucleus (PEN)**.

(iii) Triple fussion

fusion of three nuclei, this phenomenon is called **triple fusion**.

97. What is post fertilization structure and events

After fertilization, several changes take place in the floral parts up to the formation of the seed The events after fertilization (endosperm, embryo development, formation of seed, fruits) are called post fertilization changes

98. Why apple is called false fruit?

The receptacle becomes fl eshy and edible around the fruit enclosing the seeds as in *Pyrus malus* (apple)

99. What is aril?

The funiculus develops into a fl eshy structure which is oft en very colourful and called **aril**. (*Myristica and Pithecellobium*)

100. What is persisperm? How do form?

Th e nucellar tissue is either absorbed completely by the developing embryo sac and embryo or small portion may remain as storage tissue. Th us the remnant of nucellar tissue in the seed is called **perisperm**. Example: Black pepper and beet root.

101. What is aleurone tissue and its function?

- Aleurone tissue consists of highly specialised cells of one or few layers which are found around the endosperm of cereals (barley and maize).
- Aleurone grain contains sphaerosomes.
- During seed germination cells secrete certain hydrolytic enzymes like amylases, proteases which digest reserved food material present in the endosperm cells

102. Write the function of endosperm

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

103. How do form coconut milk

Coconut milk is a basic nutrient medium which induces the differentiation of embryo (embryoids) and plantlets from various plant tissues. Coconut water from tender coconut is free-nuclear endosperm and white kernel part is cellular.

104. What is seed ? and their types

- The fertilized ovule is called seed .
- seed possesses an embryo, endosperm and a protective coat.
- Seeds may be endospermous (wheat, maize, barley and sunflower) non endospermous. (Bean, Mango, Orchids and cucurbits).

105. What is amphimixis?

Reproduction involving fertilization in flowering plants is called amphimixis

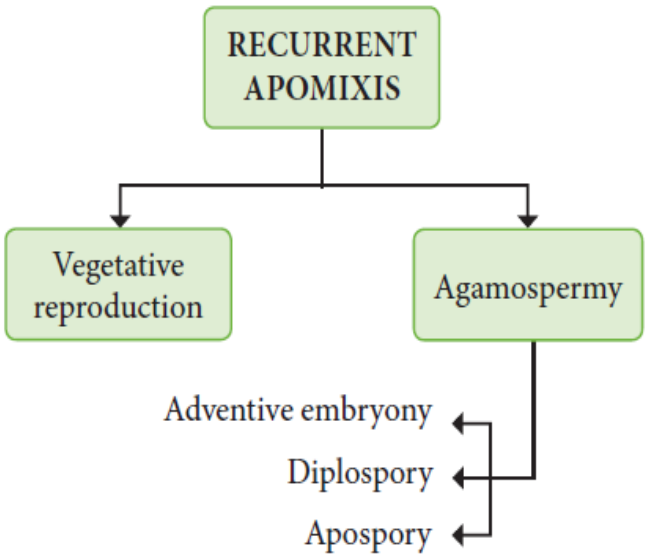
106. What is apomixes?

Reproduction does not involve union of male and female gametes is called apomixis

107. What is nonrecurrent apomixes?

Haploid embryo sac developed after meiosis, develops into a embryo without fertilization.

108. Write the outline classification of recurrent apomixes



109. What is agamosperm?

Embryos are formed by eliminating meiosis and syngamy.

110. What is adventives embryony?

An Embryo arises directly from the diploid sporophytic cells either from nucellus or integument. It is also called **sporophytic budding** because gametophytic phase is completely absent. Adventive embryos are found in *Citrus* and *Mangifera*

111. What is apospory?

Megaspore mother cell undergoes the normal meiosis and four megaspores formed gradually disappear. A nucellar cell becomes activated and develops into a diploid embryo sac. This type of apospory is also called somatic apospory. Examples *Hieracium* and *Parthenium.*

112. What is polyembryony?

More than one embryo in a seed is called polyembryony .

The first case of polyembryony was reported in certain oranges by Anton van Leeuwenhoek in the year1719. Polyembryony is divided into

113. Based on the origin how many type of polyembryony is present

Polyembryony is divided into four categories based on its origin.

- **Cleavage polyembryony** (Example: Orchids)
- **Formation of embryo by cells of the Embryo sac other than egg** (Synergids – *Aristolochia*; antipodals – *Ulmus* and endosperm – *Balanophora*)
- **Development of more than one Embryo sac within the same ovule.** (Derivatives of same MMC, derivatives of two or more MMC- Casuarina
- **Activation of some sporophytic cells of the ovule** (Nucellus/ integuments-*Citrus and Syzygium*).

114. Practical application of polyembryony

The seedlings formed from the nucellar tissue in *Citrus* are found better clones for Orchards. Embryos derived through polyembryony are found virus free.

115. How do form parthenocarpic fruit

Fruit like structures may develop from the ovary without the act of fertilization. Such fruits are called **parthenocarpic fruits**. Invariably they will not have true seeds. Many commercial fruits are made seedless. Examples: Banana, Grapes and Papaya.

116. In nitsch classification how many type of parthenocarpy is present

Nitsch in 1963 classified the parthenocarpy into following types:

- **Genetic Parthenocarpy**: Parthenocarpy arises due to hybridization or mutation Examples: *Citrus,Cucurbita*.
- **Environmental Parthenocarpy**:

  Environmental conditions like frost, fog, low temperature, high temperature etc., induce Parthenocarpy. For example, low temperaturefor 3-19 hours induces parthenocarpy in Pear.
- **Chemically induced Parthenocarpy:**

  Application of growth promoting substances like Auxins and Gibberellins induces parthenocarpy.

117. Write the significance of parthenocarpy fruit

The seedless fruits have great significance in horticulture.

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

FIVE MARKS

BOOK BACK:

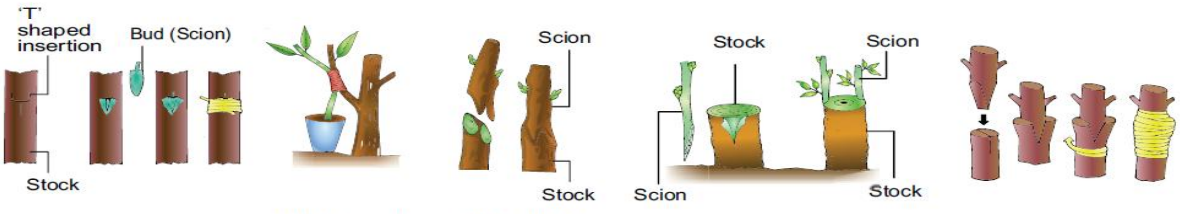
1. Explain the conventional methods adopted in vegetative propagation of higher plants.

Conventional methods

The common methods of conventional propagation are cutting, grafting and layering.

a. Cutting: It is the method of producing a new plant by cutting the plant parts such as root, stem and leaf from the parent plant. The cut part is placed in a suitable medium for growth. It produces root and grows into a new plant. Depending upon the part used it is called as root cutting (*Malus*), stem cutting (*Hibiscus, Bougainvillea* and *Moringa*) and leaf cutting (*Begonia, Bryophyllum*). Stem cutting is widely used for propagation.

b.Grafting: In this, parts of two different plants are joined so that they continue to grow as one plant. Of the two plants, the plant which is in contact with the soil is called **stock** and the plant used for grafting is called **scion** Examples are Citrus, Mango and Apple. There are different types of grafting based on the method of uniting the scion and stock. They are bud grafting, approach grafting, tongue grafting, crown grafting and wedge grafting.



a) Types of Grafting

i. Bud grafting:

A T- shaped incision is made in the stock and the bark is lifted. The scion bud with little wood is placed in the incision beneath the bark and properly bandaged with a tape.

ii. Approach grafting:

In this method both the scion and stock remain rooted. The stock is grown in a pot and it is brought close to the scion. Both of them should have the same thickness. A small slice is cut from both and the cut surfaces are brought near and tied together and held by a tape. After 1-4 weeks the tip of the stock and base of the scion are cut off and detached and grown in a separate pot.

iii. Tongue grafting

A scion and stock having the same thickness is cut obliquely and the scion is fit into the stock and bound with a tape.

iv. Crown grafting.

When the stock is large in size scions are cut into wedge shape and are inserted on the slits or clefts of the stock and fixed in position using graft wax.

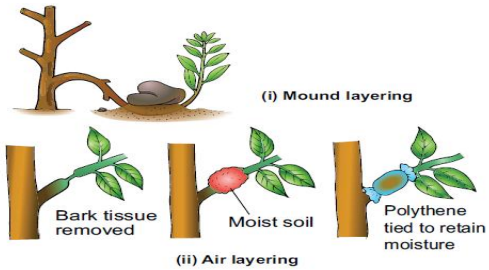
v. Wedge grafting

In this method a slit is made in the stock or the bark is cut. A twig of scion is inserted and tightly bound so that the cambium of the two is joined.

c. Layering:

In this method, the stem of a parent plant is allowed to develop roots while still intact. When the root develops, the rooted part is cut and planted to grow as a new plant. Examples: *Ixora* and *Jasminum*. Mound layering and Air layering are few types of layering.

i. Mound layering: This method is applied for the plants having flexible branches. The lower branch with leaves is bent to the ground and part of the stem is buried in the soil and tip of the branch is exposed above the soil. After the roots emerge from the part of the stem buried in the soil, a cut is made in parent plant so that the buried part grow into a new plant.



b) Types of Layering

ii. Air layering:

In this method the stem is girdled at nodal region and hormones are applied to this region which promotes rooting. This portion is covered with damp or moist soil using a polythene sheet. Roots emerge in these branches after 2-4 months. Such branches are removed from the parent plant and grown in a separate pot or ground.

2. **Highlight the milestones from the history of plant embryology.**
Milestones in Plant Embryology :

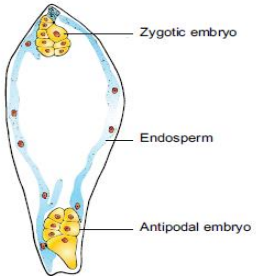
- **1682** - Nehemiah Grew mentioned stamens as the male organ of a fl ower.
- **1694** - R.J.Camerarius described the structure of a fl ower, anther, pollen and ovule
- **1761** - J.G. Kolreuter gave a detailed account on the importance of insects in pollination
- **1824** - G.B.Amici discovered the pollen tube.
- **1848** - Hofmeister described the structure of pollen tetrad
- **1870** - Hanstein described the development of embryo in *Capsella* and *Alisma*
- **1878** - E.Strasburger reported polyembryony
- **1884** - E.Strasburger discovered the process of Syngamy.
- **1898** - S.G.Nawaschin and L. Guignard independently discovered Double fertilization
- **1904** – E.Hanning initiated embryo culture.
- **1950** - D.A. Johansen proposed classifi cation for embryo development
- **1964** - S.Guha and S.C.Maheswari raised haploids from *Datura* pollen grains
- **1991** - E.S.Coen and E. M. Meyerowitz proposed the ABC model to describe the genetics of initiation and development of fl oral parts
- **2015** - K.V.Krishnamurthy summarized the molecular aspects of pre and post fertilization reproductive development in fl owering plants

3. **Discuss the importance of Modern methods in reproduction of plants.**
- Plants with desired characteristics can be multiplied rapidly in a short duration.
- Plants produced are genetically identical.
- Tissue culture can be carried out in any season to produce plants.
- Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.
- Rare and **endangered** plants can be propagated.
- Disease free plants can be produced by **meristem culture**.
- Cells can be genetically modified and transformed using tissue culture.

4. **What is polyembryony. How it can commercially exploited.**
Occurrence of more than one embryo in a seed is called polyembryony . The first case of polyembryony was reported in certain oranges by Anton van Leeuwenhoek in the year 1719. Polyembryony is divided into four categories based on its origin.
a. **Cleavage polyembryony** (Example: Orchids)
b. **Formation of embryo by cells of the Embryo sac other than egg** (Synergids – *Aristolochia*; antipodals – *Ulmus* and endosperm – *Balanophora*)
c. **Development of more than one Embryo sac within the same ovule.** (Derivatives of same MMC, derivatives of two or more MMC – *Casuarina*)
Activation of some sporophytic cells of the ovule (Nucellus/ integuments-*Citrus and Syzygium*).

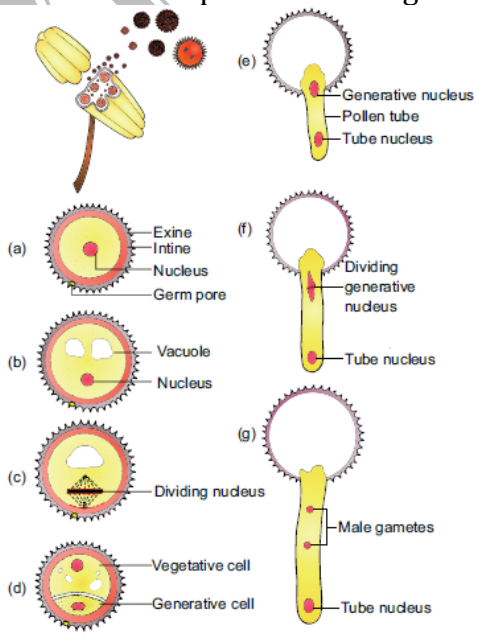
Practical applications

The seedlings formed from the nucellar tissue in *Citrus* are found better clones for Orchards. Embryos derived through polyembryony are found virus free.



5. Discuss the steps involved in Microsporogenesis.

- The microspore is the first cell of the male gametophyte and is haploid. The development of male gametophyte takes place while they are still in the microsporangium.
- The nucleus of the microspore divides to form a **vegetative** and a **generative** nucleus. A wall is laid around the generative nucleus resulting in the formation of two unequal cells, a large irregular nucleus bearing with abundant food reserve called vegetative cell and a small generative cell.
- At this 2 celled stage, the pollens are liberated from the anther. In some plants the generative cell again undergoes a division to form two male gametes.
- In these plants, the pollen is liberated at 3 celled stage. In 60% of the angiosperms pollen is liberated in 2 celled stage.
- Further, the growth of the male gametophyte occurs only if the pollen reaches the right stigma. The pollen on reaching the stigma absorbs moisture and swells.
- The intine grows as pollen tube through the germ pore. In case the pollen is liberated at 2 celled stage the generative cell divides in the pollen into 2 male cells (sperms) after reaching the stigma or in the pollen tube before reaching the embryo sac.
- The stages in the development of male gametophyte is given in



6. Give a concise account on steps involved in fertilization of an angiosperm plant.

The fusion of male and female gamete is called **fertilization**. Fertilization in angiosperms is **double fertilization** type.

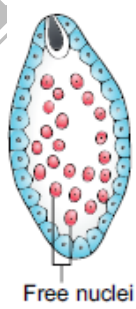
Events of fertilization

- The stages involved in double fertilization are:- germination of pollen to form pollen tube in the stigma; growth of pollen tube in the style; direction of pollen tube towards the micropyle of the ovule; entry of the pollen tube into one of the synergids of the embryo sac, discharge of male gametes; syngamy and triple fusion.
- The events from pollen deposition on the stigma to the entry of pollen tube in to the ovule is called **pollen- pistil interaction.** It is a dynamic process which involves recognition of pollen and to promote or inhibit its germination and growth.

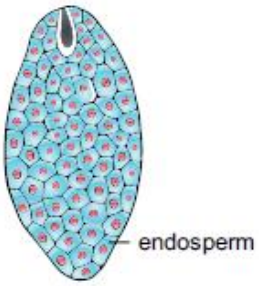
7. What is endosperm. Explain the types?

The primary endosperm nucleus (PEN) divides immediately after fertilization but before the zygote starts to divide, into an endosperm. The primary endosperm nucleus is the result of triple fusion (two polar nuclei and one sperm nucleus) and thus has 3n number of chromosomes. It is a nutritive tissue and regulatory structure that nourishes the developing embryo. Depending upon the mode of development three types of endosperm are recognized in angiosperms. They are nuclear endosperm, cellular endosperm and helobial endosperm (Figure 1.21).

Nuclear endosperm: Primary Endosperm Nucleus undergoes several mitotic divisions without cell wall formation thus a free nuclear condition exists in the endosperm. Examples: *Coccinia*, *Capsella* and *Arachis*



Cellular endosperm: Primary endosperm nucleus divides into 2 nuclei and it is immediately followed by wall formation. Subsequent divisions also follow cell wall formation. Examples: *Adoxa, Helianthus* and *Scoparia*



Helobial endosperm: Primary Endosperm Nucleus moves towards base of embryo sac and divides into two nuclei. Cell wall formation takes place leading to the formation of a large micropylar and small chalazal chamber. The nucleus of the micropylar chamber undergoes several free nuclear division whereas that of chalazal chamber may or may not divide. Examples : Hydrilla and Vallisneria.

The endosperms may either be completely consumed by the developing embryo or it may persist in the mature seeds. Those seeds without endosperms are called non-endospermous or ex- albuminous seeds. Examples: Pea, Groundnut and Beans. Those seeds with endosperms are called endospermous or albuminous seeds. The endosperms in these seeds supply nutrition to the embryo during seed germination. Examples: Paddy, Coconut and Castor.

Ruminate endosperm: The endosperm with irregularity and unevenness in its surface forms ruminate endosperm. Examples :Areca catechu, Passiflora and Myristica

8. Differentiate the structure of Dicot and Monocot seed.

Dicot	Monocot
❖ Two cotyledons in the embryo ❖ Plumule is terminal, cotyledons are lateral ❖ No sheath ❖ Albuminous or exalbuminous. ❖ Germination-usually hypogeal or epigeal. ❖ Plumule is pushed upwards by the actively growing epicotyls or hypocotyl ❖ Radicle produced the primary root which persists and bears many lateral roots	❖ One cotyledons in the embryo ❖ Plumule is lateral, cotyledons is terminal ❖ Plumule and radicle are surrounded by coleptile and coleorhiza respectively. ❖ Mostly albuminous ❖ Germination-usually hypogeal ❖ Plumule goes upward with the Plumule sheath. ❖ Primary root formed from radicle soon perists and is replaced by a tuft of adventitious fibrous roots.

9. Give a detailed account on parthenocarpic. Add a note on its significance.

- As mentioned earlier, the ovary becomes the fruit and the ovule becomes the seed after fertilization.
- However in a number of cases, fruit like structures may develop from the ovary without the act of fertilization.
- Such fruits are called **parthenocarpic fruits**. Invariably they will not have true seeds. Many commercial fruits are made seedless.
- Examples: Banana, Grapes and Papaya. Nitsch in 1963 classified the parthenocarpy into following types:

Genetic Parthenocarpy: Parthenocarpy arises due to hybridization or mutation Examples: *Citrus,Cucurbita*.

Environmental Parthenocarpy:

Environmental conditions like frost, fog, low temperature, high temperature etc., induce Parthenocarpy. For example, low temperature for 3-19 hours induces parthenocarpy in Pear.

Chemically induced Parthenocarpy: Application of growth promoting substances like Auxins and Gibberellins induces parthenocarpy.

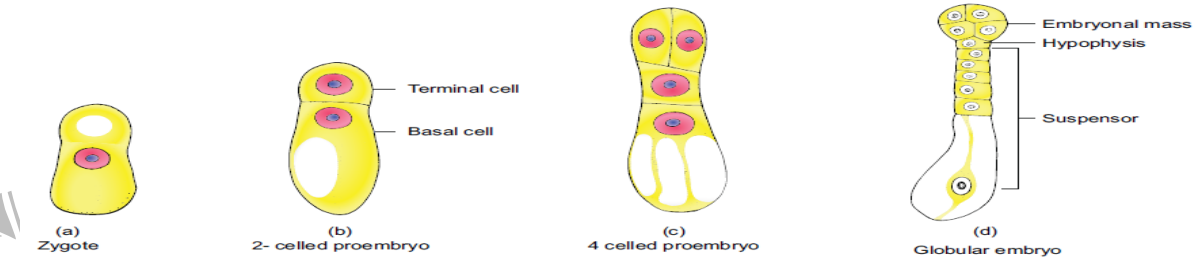
Significance

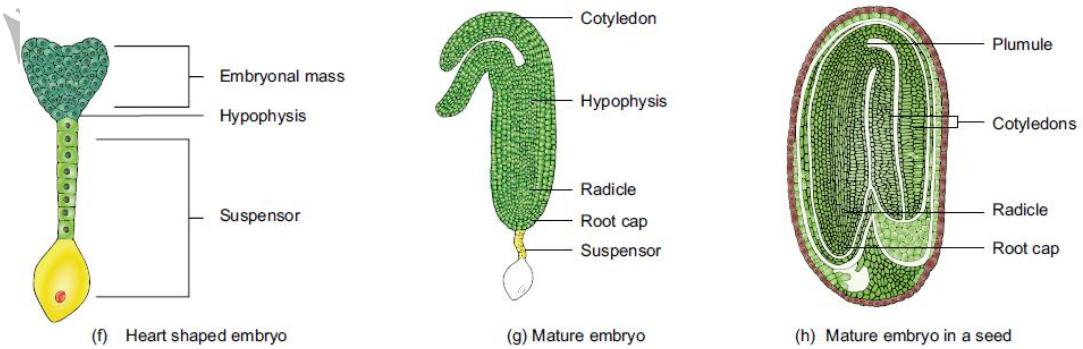
- The seedless fruits have great significance in horticulture.
- The seedless fruits have great commercial importance.
- Seedless fruits are useful for the preparation of jams, jellies, sauces, fruit drinks etc.
- High proportion of edible part is available in parthenocarpic fruits due to the absence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

INTERIOR :

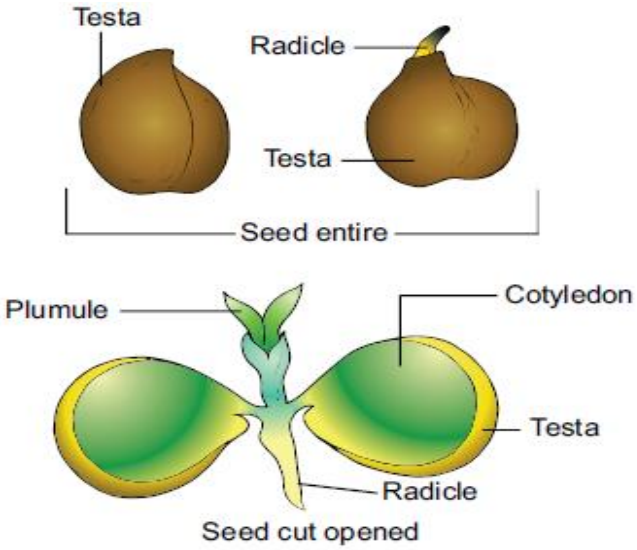
1. Write the development of dicot embryo

- The Stages involved in the development of Dicot embryo (*Capsella bursa-pastoris* – Onagrad or crucifer type)
- The embryo develops at micropylar end of embryo sac.
- The zygote undergoes transverse division to form upper or terminal cell and lower or basal cell. Further divisions in the zygote during the development lead to the formation of embryo.
- Embryo undergoes globular, heart shaped stages before reaching a mature stage. The mature embryo has a **radicle,** two **cotyledons** and a **plumule**.





2. Explain the structure of dicot seed

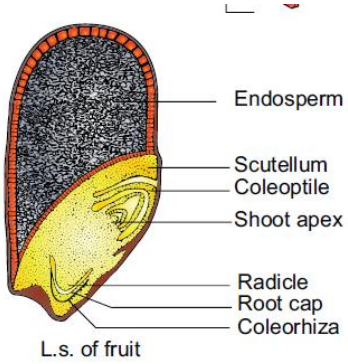


- The mature seeds are attached to the fruit wall by a stalk called **funiculus**.
- The funiculus disappears leaving a scar called **hilum**. Below the hilum a small pore called **micropyle** is present. It facilitates entry of oxygen and water into the seeds during germination.
- Each seed has a thick outer covering called seed coat. The seed coat is developed from integuments of the ovule.
- The outer coat is called **testa** and is hard whereas the inner coat is thin, membranous and is called **tegmen**.
- In Pea plant the tegmen and testa are fused. Two cotyledons laterally attached to the embryonic axis are present. It stores the food materials in pea whereas in other seeds like castor the endosperm contains reserve food and the cotyledons are thin.
- The portion of embryonal axis projecting beyond the cotyledons is called **radicle** or embryonic root.
- The other end of the axis called embryonic shoot is the **plumule**.
- Embryonal axis above the level of cotyledon is called **epicotyl** whereas the cylindrical region between the level of cotyledon is called **hypocotyls**.
- The epicotyl terminates in plumule whereas the hypocotyl ends in radicle.

3. Explain the structure of monocot seed

- The seed of paddy is one seeded and is called **Caryopsis**. Each seed remains enclosed by a brownish husk which consists of glumes arranged in two rows.
- The seed coat is a brownish, membranous layer closely adhered to the grain. Endosperm forms the bulk of the grain and is the storage tissue.
- It is separated from embryo by a definite layer called **epithelium**. The embryo is small and consists of one shield-shaped cotyledon known as **scutellum** present towards lateral side of embryonal axis.
- A short axis with plumule and radicle protected by the **root cap** is present. The plumule is surrounded by a protective sheath called **coleoptile**.

- The radicle including root cap is also covered by a protective sheath called **coleorhiza**. The scutellum supplies the growing embryo with food material absorbed from the endosperm with the help of the epithelium



L.s. of fruit

4. Write the tabulated of post fertilization process

Parts before fertilization	**Transformation after fertilization**
Sepals, petals, stamens, style and stigma	Usually wither and fall off
Ovary	Fruit
Ovule	Seed
Egg	Zygote
Funicle	Stalk of the seed
Micropyle (ovule)	Micropyle of the seed(facilitates O_2 and water uptake)
Nucellus	Perisperm
Outer integument of ovule	Testa (outer seed coat)
Inner integument	Tegmen (inner seed coat)
Synergid cells	Degenerate
Secondary nucleus	Endosperm
Antipodal cells	Degenerate