Sexual Reproduction in Flowering Plants

Chapter 24

FACT/DEFINITION TYPE QUESTIONS

1. Flowers are highly modified _____.
(a) Root (b) Shoot
(c) Stem (d) Leaves

2. A typical flower has _____different kinds of whorl.
(a) two (b) three
(c) four (d) five

3. Anther is typically
(a) tetrasporangiate (b) bisporangiate
(c) trisporangiate (d) monosporangiate

4. The functions of tapetum is to
(a) produce ubisch bodies.
(b) produce pollen grains.
(c) provide nourishment to the developing pollen grains.
(d) store and protect pollen grains.

5. Microsporogenesis occurs
(a) on margins of leaves.
(b) inside the ovule.
(c) inside the anther.
(d) in essential floral organs.

6. Exine of pollen grain is formed of
(a) callose (b) pecto-cellulose
(c) ligno-cellulose (d) sporopollenin

7. One of the most resistant known biological material is.
(a) lignin (b) hemicellulose
(c) sporopollenin (d) lignocellulose

8. Pollen grain is liberated at
(a) one celled stage.
(b) two celled stage.
(c) three celled stage.
(d) two or three celled stage.

9. Pollen grains can be stored in liquid nitrogen at _____.
(a) 70°C (b) 100°C
(c) –196°C (d) 0°C

10. Ovule is
(a) megasporangium
(b) megasporophyll
(c) integumented megasporangium
(d) rolled megasporophyll

11. Ovules are attached to a parenchymatous cushion called
(a) nucellus (b) obturator
(c) conducting tissue (d) placenta

12. The point at which funiculus touches the ovule is
(a) chalaza (b) hilum
(c) raphe (d) endothelium

13. Egg apparatus consists of
(a) egg cell and antipodal cells.
(b) egg cell and central cell.
(c) egg cell and two synergids.
(d) egg cell and one synergid.

14. The most common type of ovule is _____ .
(a) orthotropous (b) hemitropous
(c) anatropous (d) campylotropous

15. Filiform apparatus is found in
(a) synergids (b) anther wall
(c) secondary nucleus (d) egg cell

16. Polygonum type of embryo sac/typical female gametophyte of angiosperms is
(a) 7-celled, 7-nucleate (b) 7-celled, 8-nucleate
(c) 8-celled, 7-nucleate (d) 8-celled, 8-nucleate

17. Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called
(a) geitonogamy (b) xenogamy
(c) autogamy (d) cleistogamy

18. Cleistogamous flowers are
(a) wind pollinated (b) self-pollinated
(c) cross-pollinated (d) insect pollinated

19. Both chasmogamous and cleistogamous flowers are present in
(a) *Helianthus* (b) Lommelina
(c) *Rosa* (d) Gossypium

20. Pollination by water occurs in
(a) *Vallisneria* (b) *Zostera*
(c) *Satvia* (d) All of these

21. Bees are important to agriculture as they
(a) produce wax (b) perform pollination
(c) prevent pollination (d) produce honey

22. Vegetative fertilization involves fusion of
(a) two polar nuclei
(b) a male gamete and a synergid
(c) a male gamete and antipodal cell
(d) nucleus of a male gamete and secondary nucleus

23. During double fertilization in plants, one sperm fuses with the egg cell and the other sperm fuses with
(a) synergids cell (b) central cell
(c) antipodal cell (d) nucellar cell

24. Endosperm is generally
(a) diploid (b) triploid
(c) haploid (d) polyploid

25. Milky water of green coconut is
(a) liquid chalaza
(b) liquid nucellus
(c) liquid endosperm
(d) liquid female gametophyte

26. Scutellum is present in the embryo of
(a) pea (b) *Ranunculus*
(c) *Triticum* (d) None of these

27. Perisperm is a
(a) degenerate part of synergids.
(b) peripheral part of endosperm.
(c) degenerate part of secondary nucleus.
(d) remnant of nucellus.

28. False fruits (thalamus also contributes to fruit formation) are found in
(a) apple and pear (b) strawberry
(c) cashewnut (d) All of these

29. Seeds are adoptively important because
(a) they maintain dormancy.
(b) they protect young plants during vulnerable stages.
(c) they store food for young plants and facilitate disperal.
(d) All of the above

30. The seed in which endosperm is used by embryo is called _____ seed.
(a) single (b) albuminous
(c) endospermic (d) non-endospermic

31. Apomixis is the
(a) development of plants in darkness.
(b) development of plants without fusion of gametes.
(c) inability to perceive stimulus for flowering.
(d) effect of low temperature on plant growth.

32. Nucellar polyembryony is reported in species of
(a) Brassica (b) Gossypium
(c) Triticum (d) Citrus

STATEMENT TYPE QUESTIONS

33. Which of the following statement is correct for the pollen tube?
(a) It shows chemotactic movement.
(b) It shows only tip growth.
(c) It is composed of three non-cellular zones.
(d) It shows radial cytoplasmic streaming.

34. Which of the following statement is **incorrect** about emasculation?
(a) During emasculation process, stigma is removed.
(b) Emasculated flowers are bagged in order to prevent self-pollination.
(c) Emasculation is the removal of stamens before the maturation of selected bisexual flowers.
(d) It is one of the steps for artificial hybridization.

35. Which one of the following statement is **incorrect**?
(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.

36. Which of the following statement about sporopollenin is **incorrect**?
(a) Exine is made up of sporopollenin.
(b) Sporopollenin is one of the resistant organic materials.
(c) Exine has apertures called germ pores where sporopollenin is present.
(d) Sporopollenin can withstand high temperatures and strong acids.

37. 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.

38. Which one of the following statement is correct?
(a) Sporogenous tissue is haploid.
(b) Endothecium produces the microspores.
(c) Tapetum nourishes the developing pollen.
(d) Hard outer layer of pollen is called intine.

39. Which one of the following statement is correct?
(a) Geitonogamy involves the pollen and stigma of flowers of different plants.
(b) Cleistogamous flowers are always autogamous.
(c) Xenogamy occurs only by wind pollination.
(d) Chasmogamous flowers do not open at all.

40. Which of the following statement(s) is/are correct about self-incompatibility ?
(i) It is a device to prevent inbreeding.
(ii) It provides a biochemical block to self-fertilization.
(iii) It ensures cross-fertilization.
(iv) It is governed by pollen-pistil interaction.

(v) It is governed by series of multiple alleles.
(vi) It prevents self-pollen (from the same flower of other flowers of the same plant) from fertilizing the ovules by inhibiting pollen germination of pollen tube growth in the pistil.
(a) (i), (ii) and (iii) (b) (i), (iv) and (v)
(c) All of the above (d) None of the above

41. Which of the following statement(s) is/are **incorrect** ?
(i) Endosperm formation starts prior to first division of zygote.
(ii) Angiospermic endosperm is mostly 3N while gymnospermic one is N.
(iii) The most common type of endosperm is nuclear.
(iv) Coconut has both liquid nuclear (multinucleate) and cellular endosperm.
(v) Milky water of green tender coconut is liquid female gametophyte.
(a) (i) and (ii) (b) Only (iii)
(c) Only (v) (d) Only (ii)

42. Which of the following statements are correct for a typical female gametophyte of a flowering plant?
(i) It is 8-nucleate and 7-celled at maturity.
(ii) It is free-nuclear during the development.
(iii) It is situated inside the integument but outside the nucellus.
(iv) It has an egg apparatus situated at the chalazal end.
(a) (i) and (iv) (b) (ii) and (iii)
(c) (i) and (ii) (d) (ii) and (iv)

43. Study the following statements and select the correct option.
(i) Tapetum nourishes the developing pollen grains.
(ii) Hilum represents the junction between ovule and funicle.
(iii) In aquatic plants, such as water hyacinth and water lily, pollination is by water.
(iv) The primary endosperm nucleus is triploid.
(a) (i) and (ii) are correct but (iii) and (iv) are incorrect.
(b) (i), (ii) and (iv) are correct but (iii) is incorrect.
(c) (ii), (iii) and (iv) are correct but (i) is incorrect.
(d) (i) and (iv) are correct but (ii) and (iii) are incorrect.

44. Seeds are adaptively important because
(i) they maintain dormancy.
(ii) they protect young plants during vulnerable stages.
(iii) they store food for young plants, and facilitate dispersal.
Identify the correct reasons.
(a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (ii) (d) All of the above

45. Which of the given statements are true?
(i) During the development of a dicot embryo heart shaped embryo is followed by globular enlarge.
(ii) The part of the embryonal axis above the level of cotyledons is epicotyl while the part below the level of cotyledons is hypocotyl.
(iii) Monocot seeds possess a single cotyledon represented by scutellum.
(a) (i) and (ii) (b) (ii) and (iii)
(c) (i) and (iii) (d) (i) (ii) and (iii)

ASSERTION/REASON TYPE QUESTIONS

In the following questions, a statement of Assertion is followed by a statement of Reason.
(a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

46. **Assertion :** If a pollen mother cell has 42 chromosomes, the pollen has only 21 chromosomes.
Reason : Pollens are formed after meiosis in pollen mother cell.

47. **Assertion :** Endosperm is a nutritive tissue and it is triploid.
Reason: Endosperm is formed by fusion of secondary nucleus to second male gamete. It is used by developing embryo.

48. **Assertion :** Photomodulation of flowering is a phytochrome regulated process.
Reason : Active form of phytochrome (PFR) directly induces floral induction in shoot buds.

49. **Assertion :** Insects visit flower to gather honey.
Reason : Attraction of flowers prevents the insects from damaging other parts of the plant.

50. **Assertion :** Chasmogamous flowers require pollinating agents.
Reason : Cleistogamous flowers do not expose their sex organs.

MATCHING TYPE QUESTIONS

51. Match the biotic agent of cross pollination given in column-I with their feature given in column-II and select the correct answer using the codes given below.

Column-I	Column-II
A. Zoophily	I. Pollination by birds
B. Ornithophily	II. Pollination by insects
C. Entomophily	III. Pollination by bats
D. Chiropterophily	IV. Pollination by animals

(a) A – III; B – II; C – I; D – IV
(b) A – I; B – II; C – III; D – IV
(c) A – IV; B – I; C – II; D – III
(d) A – IV; B – II; C – I; D – III

52. Match the parts of gynoceium given in column I with their definition given in column II. Choose the correct combination from the options given below.

	Column-I		Column-II
A.	Funicle	I.	Mass of cells within ovule with more food
B.	Hilum	II.	Basal part of ovule
C.	Integument	III.	One or Two protective layers of ovule
D.	Chalaza	IV.	Region where body of ovule fuses with funicle
E.	Nucellus	V.	Stalk of ovule

(a) A – I; B – II; C – III; D – IV; E – V
(b) A – V; B – IV; C – III; D – II; E – I
(c) A – IV; B – II; C – I; D – III; E – V
(d) A – I; B – III; C – V; D – II; E – IV

53. Match the items given in column-I with their examples given in column-II and choose the correct option given below.

	Column-I (Items)		Column-II (Examples)
A.	Ovary	I.	Groundnut, mustard
B.	Ovule	II.	Guava, orange, mango
C.	Wall of ovary	III.	Pericarp
D.	Fleshy fruits	IV.	Seed
E.	Dry fruits	V.	Fruit

(a) A – V; B – IV; C – III; D – II; E – I
(b) A – I; B – II; C – III; D – IV; E – V
(c) A – I; B – III; C – II; D – IV; E – V
(d) A – V; B – IV; C – I; D – II; E – III

54. Match the items given in column-I with those given in column-II and choose the correct option given below.

	Column-I		Column-II
A.	Parthenocarpy	I.	Inactive state
B.	Polyembryony	II.	Meiosis and syngamy are absent
C.	Apomixis	III.	Occurrence of more than one embryo
D.	Dormancy	IV.	Seedless fruit

(a) A – I; B – II; C – III; D – IV
(b) A – IV; B – III; C – II; D – I
(c) A – IV; B – I; C – II; D – III
(d) A – III; B – II; C – I; D – IV

55. Match the items given in column-I with those given in column-II and chose the correct option given below.

	Column-I		Column-II
A.	Tapetum	I.	Irregular in shape with abundant food reserve
B.	Exine	II.	Acts as nutritive layer
C.	Pollenkit	III.	Thick, rigid protective layer
D.	Vegetative cell	IV.	Involve in the formation of microspores
E.	Sporogenous tissue	V.	Oily and sticky layer, help in pollination.

(a) A – II; B – III; C – V; D – IV; E – I
(b) A – I; B – III; C – II; D – IV; E – V
(c) A – II; B – III; C – I; D – IV; E – V
(d) A – II; B – IV; C – V; D – I; E – III

56. Match the items given in column-I with their examples given in column-II and identify the correct option.

	Column-I		Column-II
A.	Coleorhiza	I.	Grapes
B.	Food storing tissue	II.	Mango
C.	Parthenocarpic fruit	III.	Maize
D.	Single seeded fruit developing from monocarpellary superior ovary	IV.	Radicle
E.	Membranous seed coat	V.	Endosperm

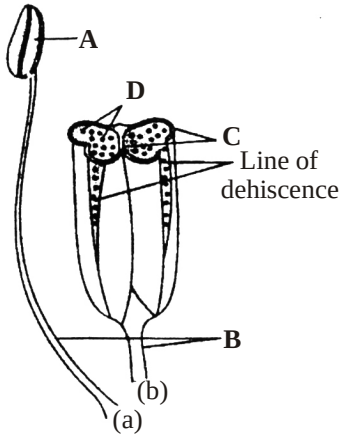
(a) A – III; B – I; C – IV; D – II; E – V
(b) A – IV; B – II; C – V; D – I; E – III
(c) A – V; B – I; C – III; D – IV; E – II
(d) A – IV; B – V; C – I; D – II; E – III

57. Which of the following is a mismatched pair?
(a) Microsporangium – Pollen sac
(b) Megasporangium – Ovule
(c) Microsporophyll – Stamen
(d) Megasporophyll – Filament

58. Which of the following is a mismatched pair?
(a) Storage of pollen grains – –196°C
(b) Pollen allergy – Carrot grass
(c) Chasmogamous flowers – Exposed anthers and stigmas
(d) Xenogamy – Self-pollination

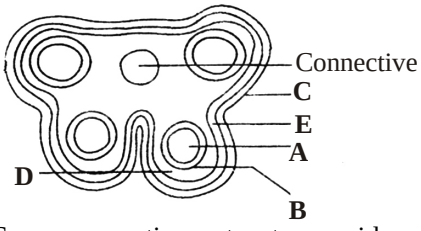
DIAGRAM TYPE QUESTIONS

59. The given figure shows a typical stamen (a) and three dimensional cut section of an anther. Identify A to D respectively marked in the figures (a & b)



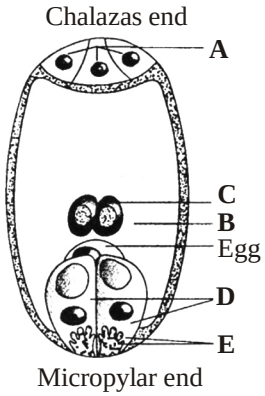
(a) Anther, Petiole, Pollen sac and Megaspore
(b) Anther, Petiole, Megasporangium and Pollen grains
(c) Anther, Pedicel, Megasporangium and Pollen grains
(d) Anther, Filament, Pollen sac and Pollen grains

60. The given diagram refers to a T. S. of anther. Identify A to E respectively



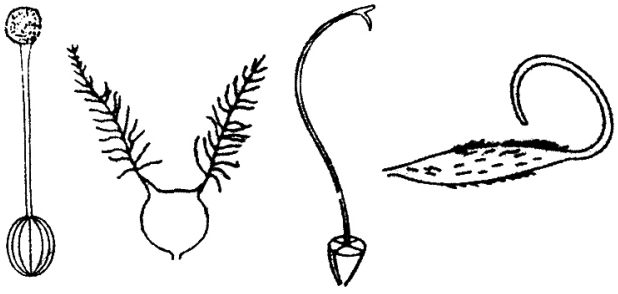
(a) Sporogenous tissue, tapetum, epidermis, middle layer, endothecium
(b) Sporogenous tissue, epidermis, tapetum, middle layer, endothecium
(c) Sporogenous tissue, epidermis, middle layer, tapetum, endothecium
(d) Sporogenous tissue, tapetum, middle layer, epidermis, endothecium

61. Identify A, B, C, D and E structures marked in the given figure of a mature embryo sac.



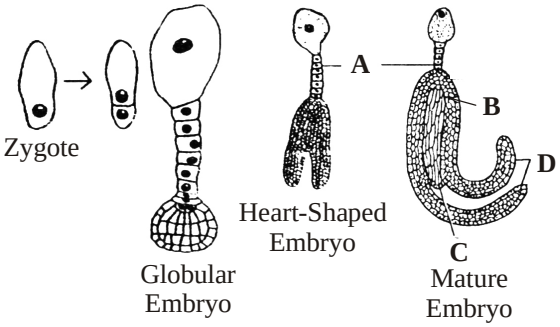
	A	B	C	D	E
(a)	Antipodal cells	Central cell	Polar nuclei	Synergids	Acrosome
(b)	Antipodal cells	Central cell	Polar nuclei	Synergids	Filiform apparatus
(c)	Synergids	Central cell	Polar nuclei	Antipodal cells	Filiform apparatus
(d)	Synergids	Megaspore mother cell	Polar nuclei	Synergids	Filiform apparatus

62. Which of the following figure, showing types of gynoecium, is associated with wind pollination ?



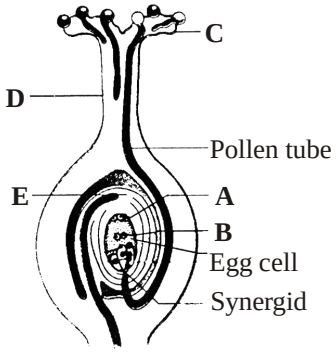
(a) (b) (c) (d)

63. Diagram given below shows the stages in embryogenesis in a typical dicot plant (*Capsella*). Identify the structures A to D respectively



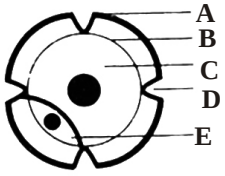
(a) Suspensor, Radicle, Plumule, Cotyledons
(b) Hypophysis, Radicle, Plumule, Cotyledons
(c) Suspensor, Plumule, Radicle, Cotyledons
(d) Suspensor, Radicle, Plumule, Hypocotyls

64. The given figure represent the L.S of a flower showing growth of pollen tube. Few structures are marked as A, B, C, D & E. Identify A, B, C, D and E respectively.



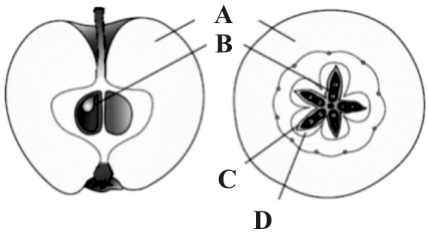
(a) Antipodal cells, Polar nuclei, Stigma, Style, Chalaza
(b) Antipodal cells, Polar nuclei, Style, Stigma, Chalaza
(c) Antipodal cells, Polar nuclei, Stigma, Chalaza, Style
(d) Antipodal cells, Polar nuclei, Chalaza, Stigma, Style

65. In the given figure of pollen grain tetrad, identify the parts marked as A, B, C, D and E.



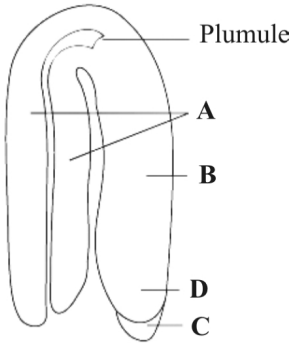
(a) A - Germ pore, B - Generative cell, C - Intine, D - Exine, E - Vegetative cell
(b) A - Germ pore, B - Generative cell, C - Exine, D - Intine, E - Vegetative cell
(c) A - Intine, B - Exine, C - Germ pore, D - Generative cell, E - Vegetative cell
(d) A - Exine, B - intine, C - Vegetative cell, D - Germ pore, E - Generative cell

66. Identified A, B, C and D in the given figure of false fruit of apple.



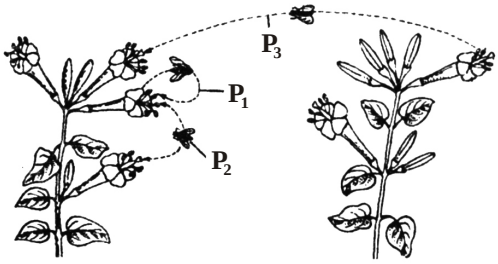
(a) A – Mesocarp; B – Endocarp; C – Seed; D – Thalamus
(b) A – Seed; B – Thalamus; C – Mesocarp; D – Endocarp
(c) A – Thalamus; B – Seed; C – Endocarp; D – Mesocarp
(d) A – Mesocarp; B – Endocarp; C – Seed; D – Thalamus

67. Choose the option showing the correct labelling A, B, C and D in the given figure of a dicot embryo.



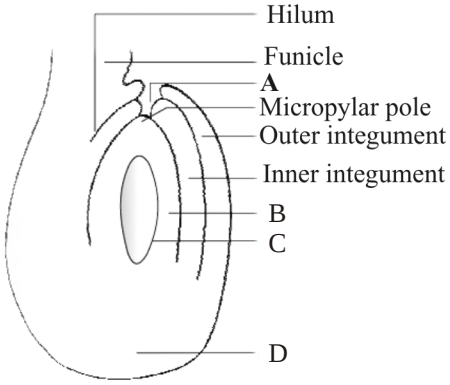
(a) A – Hypocotyl; B – Cotyledons; C – Root cap; D – Radicle
(b) A – Cotyledons; B – Hypocotyl; C – Root cap; D – Radicle
(c) A – Cotyledons; B – Hypocotyl; C – Radicle; D – Root cap
(d) A – Cotyledons; B – Radicle; C – Hypocotyl; D – Root cap.

68. The given diagram shows two plants of the same species. Identify the type of pollination indicated as P_1, P_2 and P_3.



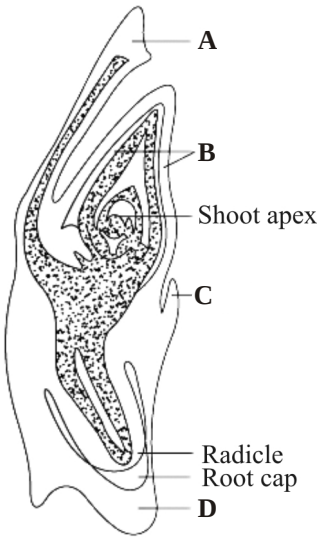
	P1	P2	P3
(a)	Allogamy	Chasmogamy	Cleistogamy
(b)	Autogamy	Xenogamy	Geitonogamy
(c)	Autogamy	Geitonogamy	Xenogamy
(d)	Geitonogamy	Allogamy	Autogamy

69. The given figure shows a diagrammatic view of a typical anatropous ovule, in which some parts are typical anatropous ovule, in which some parts are marked as A, B, C, & D. Identify the correct labelling of A, B, C & D from the options given below.



(a) A – Chalazal pole; B – Micropyle; C – Embryo sac; D –Nucellus
(b) A – Micropyle; B – Chalazal pole; C – Embryo sac; D – Nucellus
(c) A – Micropyle; B – Chalazal pole; C – Nucellus; D – Embryo sac
(d) A – Micropyle; B – Nucellus; C – Embryo sac; D – Chalazal pole

70. The given figure shows the L.S. of a monocot embryo. Choose the correct labelling for A, B, C and D marked in the figure from the options given below.



(a) A – Coleoptile; B – Scutellum; C – Epiblast; D – Coleorhiza
(b) A – Scutellum; B – Coleoptile; C – Coleorhiza; D – Epiblast
(c) A – Scutellum; B – Epiblast; C – Coleoptile; D – Coleorhiza
(d) A – Scutellum; B – Coleoptile; C – Epiblast; D – Coleorhiza

CRITICAL THINKING TYPE QUESTIONS

71. The largest cell in a embryo sac is
(a) egg (b) central cell
(c) synergid (d) antipodal cell

72. Which one of the following is not related to other three?
(a) Archaegonium (b) Oogonium
(c) Ovule (d) Antheridium

73. In a fertilized ovule, *n*, 2*n* and 3*n* conditions occur respectively in
(a) antipodal, egg and endosperm.
(b) egg, nucellus and endosperm.
(c) endosperm, nucellus and egg.
(d) antipodals, synergids and integuments.

74. Seed coat is not thin, membranous in
(a) coconut (b) groundnut
(c) gram (d) maize

75. Which of the following floral parts forms pericarp after fertilization ?
(a) Nucellus (b) Outer integument
(c) Ovary wall (d) Inner integument

76. Product of sexual reproduction generally generates
(a) prolonged dormancy.
(b) new genetic combination leading to variation.
(c) large biomass.
(d) longer viability of seeds.

77. Sequence of development during the formation of embryo sac is
(a) Archesporium → Megaspore → Megaspore mother cell → Embryo sac.
(b) Megasporocyte → Archesporium → Megaspore → Embryo sac.
(c) Megaspore → Megaspore mother cell → Archesporium → Embryo sac.
(d) Archesporium → Megaspore mother cell → Megaspore → Embryo sac.

78. Which of the following processes is necessary for the complete development of male gametophyte?
(a) One meiotic cell division and two mitotic cell divisions.
(b) One meiotic cell division and one mitotic cell division.
(c) Two meiotic cell divisions and one mitotic cell division.
(d) Two mitotic cell divisions.

79. Megaspores are produced from the megaspore mother cells after
(a) meiotic division.
(b) mitotic division.
(c) formation of a thick wall.
(d) differentiation.

80. How many meiotic division are required for the formation of 100 functional megaspores?
(a) 100 (b) 50
(c) 75 (d) 25

81. The total number of nuclei involved in double fertilization in angiosperms are
(a) two (b) three
(c) four (d) five

82. Unisexuality of flowers prevents
(a) geitonogamy but not xenogamy.
(b) autogamy and geitonogamy.
(c) autogamy but not geitonogamy.
(d) both geitonogamy and xenogamy.

83. Albuminous seeds store their reserve food mainly in
(a) perisperm (b) endosperm
(c) cotyledons (d) hypocotyl

84. Pollination occurs in
(a) bryophytes and angiosperms.
(b) pteridophytes and angiosperms.
(c) angiosperms and gymnosperms.
(d) angiosperms and fungi.

85. An advantage of cleistogamy is that
(a) it leads to greater genetic diversity.
(b) seed dispersal is more efficient and wide spread.
(c) each visit of pollinator brings hundreds of pollen grains.
(d) seed set is not dependent upon pollinators.

86. Point out the odd one from the given options.
(a) Nucellus (b) Embryo sac
(c) Micropyle (d) Pollen grain

87. While planning for an artificial hybridization programme if the female parent have unisexual flowers, then which of the following steps would not be relevant?
(a) Bagging of female flower.
(b) Dusting of pollen on stigma.
(c) Emasculation.
(d) Collection of pollen.

88. In the embryos of a typical dicot and a grass, true homologous structures are
(a) coleorhiza and coleoptile.
(b) coleoptile and scutellum
(c) cotyledons and scutellum
(d) hypocotyl and radicle

89. Total number of meiotic division required for forming 100 zygotes/100 grains of wheat is
(a) 100 (b) 75
(c) 125 (d) 50

90. The endosperm found in angiospermic seed is different from that of gymnosperms in the sense that, in the former
(a) it is formed before fertilization while in the latter it is formed after fertilization.
(b) it is formed after fertilization.
(c) it is cellular while in the latter it is nuclear.
(d) it is nutritive while in the latter it is protective.

91. For artificial hybridization experiment in bisexual flower, which of the following sequences is correct ?
(a) Bagging → Emasculation → Cross-pollination → Rebagging
(b) Emasculation → Bagging → Cross-pollination → Rebagging
(c) Cross-pollination → Bagging → Emasculation → Rebagging
(d) Self-pollination → Bagging → Emasculation → Rebagging

92. If a diploid female plant and a tetraploid male plant are crossed, the ploidy of endosperm shall be
(a) tetraploid (b) triploid
(c) diploid (d) pentaploid

93. In a seed of maize, scutellum is considered as cotyledon because it
(a) protects the embryo.
(b) contains food for the embryo.
(c) absorbs food materials and supplies them to the embryo.
(d) converts itself into a monocot leaf.

94. How many pollen grains will be formed after meiotic division in ten microspore mother cells?
(a) 10 (b) 20
(c) 40 (d) 80

95. Multinucleate condition is present in
(a) quiescent centre
(b) maize
(c) meristematic tissue
(d) liquid endosperm of coconut

96. Through which part of the embryo sac, does the pollen tube enter the embryo sac?
(a) Egg cell (b) Persistent synergid
(c) Degenerated synergid (d) Central cell

97. What is the main function of filiform apparatus present at the micropylar part of the ovule?
(a) It prevents the entry of more than one pollen tube into the embryo sac.
(b) It helps in the entry of pollen tube into an antipodal cell.
(c) It helps the pollen tube to enter the ovule through chalazal end.
(d) It guides the entry of pollen tube into a synergid and discharge the male gametes.

Hints & Solutions

Chapter 24 : Sexual Reproduction in Flowering Plants

1. (b) Flowers are highly modified shoot bearing nodes and modified floral leaves, which are meant essentially for sexual reproduction in plants.

2. (c) A typical flower has four different kind of whorl. These are calyx (green leafly sepals) corolla (bright colored petals), and androecium (male reproduction organ) and gynoecium (female reproduction organ).

3. (a) Typically, angiospermic anther is bilobed which is connected by connective and dithecous *i.e.*, each lobe has two theca. The bilobed structure of the anther is tetrasporangiate (four sporangia). In transverse section, it appears as four sided tetragonal structure consisting of two microsporangia in each lobe.

4. (c) The tapetum is a layer of nutritive cells found within the sporangium, particularly within the anther, of flowering plants. Its main function is to provide nutrition to the developing microspore mother cells and pollen grains.

5. (c) Microsporogenesis is the process of formation of microspores or pollen grains, from a pollen mother cell through meiosis is micro sporogenesis Each cell of sporogenous tissue serve as microspore mother cell (MMC). These MMCs undergo meiosis and form microspore tetrad and become haploid, microspores or pollen grains. As anthers mature microspores of the tetrad separate from each other and develops into pollen grains. Each microsporangium contains numerous pollen grains which are released after dehiscence of anther wall.

6. (d) Exine is tough, cutinized layer often with spinous outgrowth but sometimes smooth. Exine is composed of sporopollenin which is resistant to physical and biological decomposition. It protect the pollens from environmental extremes.

7. (c) Sporopollenin is the tough resistant biopolymer that coats the outer walls of pollen grains spores and related micro-organisms. It is considered "the most resistant organic material known" and accounts for the morphology and microstructure and for geological preservation of polymorphs (an organic microfossils).

8. (d) Pollen grain is liberated at 2 or 3 celled stage. If pollen grain is released at the 2-celled stage (*i.e.*, vegetative and generative cells) then generative cell divides meiotically to produce two male gametes, but when pollen grains are released at 3-celled stage then two male gametes are already present.

9. (c) Pollen grains can be stored in liquid nitrogen (–196°C) to retain their viability for longer duration of time. Such stored pollen can be used as pollen banks similar to seed banks, in crop breeding programmes.

10. (a) Ovule is the part of the ovary of seed plants that contains the female germ cell and after fertilization becomes the seed. An ovule consists of a megasporangium surrounded by one or two layers of tissue called integuments. The megasporangium produces spores that develop into megagametophytes. These megagametophytes remain within the tissues of the ovule and produce one or more egg cells.

11. (d) Placenta is the surface of the carpel to which the ovules (potential seeds) are attached. The placenta is usually located in a region corresponding somewhat to the margins of a leaf but is actually submarginal in position.

12. (b) The point at which funiculus touches the ovule is called hilum. Thus, hilum represents the junction between the ovule and funiculus.

13. (c) Egg apparatus consists of two synergids and one egg cell lying at the micropylar end. Synergids bear prominent structure called ' filiform' apparatus which are finger like projections. Synergids guide the path of pollen tube towards the egg, help in obtaining nourishment from the outer nucellar cells and also function as shock absorbers during the penetration of pollen tube into the embryo sac. Cytoplasm of egg is inactive, rich in ribosomes, and contains plastids.

14. (c) In Anatropous ovule, the body of the ovule is completely turned at 180° angle, due to unilateral growth of funiculus, so it is also called inverted ovule. The chalaza and micropyle lie in straight line. The hilum and micropyle lie side by side very close to each other. This type of ovule is found in 80% families of angiosperms but not in *Capsella*. In this ovule, micropyle is facing downward condition. This is the most common type of ovule so that it is considered as a **"typical ovule"** of angiosperms.

15. (a) Synergids bear prominent structure called 'filiform' apparatus which are finger like projections. This apparatus is present in upper part of each synergid. This apparatus is useful for the absorption and transportation of materials from the nucellus to the embryo sac.

16. (b) A typical mature embryo sac of angiosperm is 7-celled, 8 nucleate structure *i.e.*, 3 antipodal cells, 3-egg apparatus cells and one central cell (2 polar nuclei).

17. (a) Autogamy and geitonogamy are types of self - pollination. Geitonogamy is the fertilization of a flower by pollen from another flower on the same (or a genetically identical) plant. It occurs between bisexual flowers or unisexual flowers of the same plant. While autogamy is a kind of pollination in which the pollen from the anthers of a flower are transferred to the stigma of the same flower.

18. (b) In some plants, bisexual flowers are formed which never open throughout the life. Such flowers are called cleistogamous flowers such as *Commelina viola*. So only self-pollination takes place in these plants. Self pollination is a rule in cleistogamous flowers.

19. (b)

20. (a) Pollination by water (called hydrophily) occurs in *Vallisneria*. In vallisneria (ribbon weed), female flower reaches on the surface of water and assumes horizontal position due to elongation of its stalk, male flowers or pollen grains are released on to the surace of water. They are carried passively by water currents & some of which eventually reach to the stigma.

21. (b) Bees are important to agriculture as they perform pollination. Bees are responsible for over 80% of all pollination done by insects. Plants pollinated by insects are colorful with fragrance and abundant nectar which attracts insects.

22. (d) The fusion of male and female gametes is called fertilization. Fertilization in angiosperms involves two nuclear fusions, one between one of the male gametes and the egg and the other between the second male gamete and the secondary nucleus of the polar nuclei. The first of these fusions called generative fertilization or syngamy which leads to the formation of a zygote and the second known as vegetative fertilization which leads to the formation of a triploid primary endosperm nucleus.

23. (b) During double fertilization in plants one sperm fises with the egg cell and the other sperm fuses with two polar nucles of the central cell to produce triploid primary endospersm cell (3n). Since the latter involves fusion of three haploid nudeus therefore it is called triple fuxion.

24. (b) Endosperms is produced inside the seeds of most flowering plants around the time of fertilization. It is formed when the two sperm nuclei inside a pollen grain reach the interior of an embryo sac or female gametophyte. One sperm nucleus fertilizes the egg, forming a zygote, while the other sperm nucleus usually fuses with the two polar nuclei at the centre of the embryo sac, forming a primary endosperm cell (its nucleus is often called the triple fusion nucleus). About 70% of angiosperm species have endosperm cells that are polyploid. These are typically triploid (containing three sets of chromosomes) but can vary widely from diploid (2n) to 15n.

25. (c) Coconut water is the clear liquid inside young green coconuts. Milky water of green coconut is called liquid endosperm.

26. (c) A nature embryo in monocotyledons has a single cotyledon called 'scutellum', e.g. *Triticum*.

27. (d) In most of the angiosperm, entire part of the nucellus is utilized by developing embryo sac but in some of the angiosperm some part of the nucellus remain inside the ovules. That part of the nucellus present inside the seed in the form of a thin layer is known as perisperm.

28. (d) False fruits are those in which addition to ovary other floral parts also contribute for its development is called false fruits, examples - apple, pear, strawberry and cashewnut.

29. (d) Seeds can remain dormant for many years and germinate on return of favourable conditions. Reproductive process is not dependent on water. Seeds have sufficient food reserves to initiate embryo development and seedling development till the photosynthesis process is initiated. Hard seed coat also protects the embryo from environment extremes. Since seeds are the product of sexual reproduction it promotes diversity. Seeds have better adaptive strategies for dispersal to new habitats & help the species to colonise in other areas.

30. (d) Seeds which do not have an endosperm at maturity, are called non-endospermic or Ex–albuminous seeds. The endospermic tissues are absorbed during the development of embryo. The absorbed food materials from the endosperm is stored in cotyledons that is why they become so large and fleshy, *e.g.*, *Capsella* and all dicotyledons. But *Castor* seed is endospermic.

31. (b) Apomixis is the production of seeds without fertilization. The term apomixis was given by winker (1908). There are several ways of development of apomictic seeds. In some species the diploid egg cell is formed without reduction division & develops into the embryo without fertilization. In some species the nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac & develop into embryos. Some apomictic plants are citrus,

cactaceae, grasses, parthenium, etc.

32. (d) Polyembryony is the state of occurrence of more than one embryo in a seed. It was observed by Leeuwenhoek in citrus (orange) seeds. Polyembryony is commonly found in gymnosperms but it is also found in some of angiospermic plants such as orange, lemon and *Nicotiana*, etc.

33. (a) The movement of pollen tube towards embryosac though style is chemotactic as it secretes pectinase and other hydrolytic enzymes to create a passage for its entry into style.

34. (a) Emasculation is removal of anthers from the flower bud before the anther dehisces in bisexual flowers.

35. (a) In over 60 per cent of angiosperms, pollen grains are shed at cell 2-celled stage. In the remaining species the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed (3-celled stage.)

36. (c) Exine has apertures which are called germ pores (if rounded) or germinal furrows (if elongated). These are the areas where sporopollenin is absent.

37. (d) Double fertilization forms a diploid zygote nucleus and a triploid primary endosperm nucleus (PEN). After that, the two products of double fertilization *i.e.,* zygote and PEN, develop into embryo and endosperm respectively.

38. (c) Sporogenous tissue is always diploid, endothecium is second layer of anther wall and perform the function of protection and help in dehiscence of anther to release the pollen. Hard outer layer of pollen is called exine but tapetum always nourishes the developing pollen.

Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus (polypoid).

39. (b) Cleistogamous flowers do not expose their reproductive parts. Anthers and stigma lie close to each other. Pure autogamy occurs since there is no chance of cross-pollination. Cleistogamy is the most efficient floral adaptation for promoting self-pollination. *E.g.*, *Viola mirabilis* and *Oxalis autosella*.

40. (c) All the statements are correct about self - incompatibility. Self-incompatibility is a general name for several genetic mechanisms in angiosperms, which prevent self-fertilization and thus encourage outcrossing and allogamy. In plants with self - incompatibility, when a pollen grain produced in a plant reaches a stigma of the same plant or another plant with a similar genotype, the process of pollen germination, pollen tube growth, ovule fertilization, and embryo development is halted at one of its stages, and consequently no seeds are produced.

41. (c) The coconut water from tender coconut is nothing but free nuclear endosperm (made up of thousands of nuclei) and the surrounding white kernel is the cellular endosperm. Female gametophyte is embryo sac.

42. (c) Statement (i) and (ii) are correct about typical female gametophyte. Female gametophyte contains the egg cell and central cell that become fertilized and give rise to the embryo and endosperm of the seed, respectively. Female gametophyte development begins early in ovule development with the formation of a diploid megaspore mother cell that undergoes meiosis.

43. (b) In a majority of water plants like water hyacinth and water lily, flowers emerge above the water level and are pollinated by insects.

44. (d)

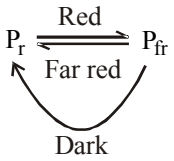
45. (b) During the development of a dicot embryo, the zygote gives rise to the proembryo and subsequently to the globular heart-shaped and mature-embryo.

46. (a) Pollen mother cells undergo meiosis and produce pollen grains. The pollen grains have haploid number of chromosomes.

47. (a) Male gamete (n) + secondary nucleus (2n) = primary endosperm nucleus which develops into endosperm (3n)

Endosperem is the reserve food used by developing embryo.

48. (a) Active form of PFR is responsible for inducing flowering. Phytochrome, protein pigment, exists in two inter convertible forms.



49. (d) Honey bee visit flowers to gather nectar and turn it into honey. Visiting of insects for nectar helps in pollination.

50. (b) The majority of angiosperms bear chasmogamous flowers, which means the flowers expose their mature anthers and stigma to the pollinating agents. There is another group of plants which set seeds without exposing their sex organs. Such flowers are called cleistogamous and the phenomenon is cleistogamy.

51. (c) A : Zoophily is a form of pollination whereby pollen is transferred by vertebrates, particularly by humming-birds and other birds, and bats, but also by monkeys, marsupials, lemurs, bears, rabbits, deer, rodents, lizards and other animals.

B : Ornithophily is the pollination of flowering plants by birds.

C : Entomophily is the pollination whereby pollen or spores are distributed by insects. Several insects are reported to be responsible for the pollination (potential or effective) of many plant species, particularly bees, Lepidoptera (butterflies and moths), wasps, flies, ants and beetles.

D : Chiropterophily is pollination of plants by bats. Bat pollination is most common in tropical and desert areas that have many night-blooming plants.

52. (b) Funicle is a filamentous stalk attaching a seed or ovule to the placenta. Hilum is the point at which funiculus touches the ovule. Thus, hilum represents the junction between the ovule and funiculus. Integuments are the protective covering or layers present in the ovule. It encircles the ovule except at the tip where a small opening called micropyle is organised. Chalaza is the basal swollen part of the nucellus (opposite the micropylar end) from where the mteguments originate. Nucellus is the central part of an ovule, containing the embryo sac.

53. (a) Fruit is mature or ripened ovary, developed after fertilization. The ovules after fertilization, develop into seeds. The wall of the ovary develops into the wall of fruit called pericarp. In fleshy fruits pericarp is generally distinguished into three layers epicarp, mesocarp and endocarp. Mesocarp is fleshy or fibrous. These fruits are indehiscent. *e.g.*, guava, orange, mango etc. In dry fruits pericarp is not distinguished into three layers. They may be dehiscent, indehiscent and splitting *e.g.*, groundnut, mustard, etc.

54. (b) Parthenocarpy is the development of fruit without the formation of seeds due to lack of pollination, fertilization and embryo development. Polyembryony is the formation of more than one embryo from a single fertilized ovum or in a single seed. Apomixis is the development of an embryo without the occurrence of fertilization. Parthenogenesis is one form of apomixis. Dormancy is a state of temporary metabolic inactivity or minimal activity therefore helps an organism to conserve energy.

55. (a) Tapetum is a layer of nutritive cells found within the sporangium, particularly within the anther, of flowering plants. Exine is the decay-resistant outer coating of a pollen grain or spore. It is made up of sporopollenin (most resistant organic material known). Pollenkit is a sticky covering found on the surface of pollen grains. It is especially common in plants that are pollinated by insects. Vegetative cells are involved in the formation of microspores. The vegetative cells are bigger, has abundant food reserves and a large irregular shaped nucleus. Sporogenous tissue is a group of compactly arranged homogenous cells. It is irregular in shape with abundant food reserves.

56. (d) Coleorhiza is the sheath that envelops the radicle in certain plants (grass or cereal grain) and that is penetrated by the root in germination. Food storing tissue is endosperm. Endosperm is the part of a seed which acts as a food store for the developing plant embryo. Parthenocarpic fruit produced without the formation of seeds due to lack of pollination, fertilization and embryo development. Example- banana, pineapple, orange and grapefruit. Single seeded fruit developing from monocarpellary is mango. Membranous seed coat is present in maize.

57. (d) Male reproductive organ is called androecium and their unit is called stamen. Stamen is also known as microsporophyll. A typical stamen differentiates into three parts- filament, anther and connective tissue. The anther is bilobed and the lobe encloses 4 pollen sacs or microsporangia. The integumented nucellus or megasporangium is called ovule.

58. (d) When the pollination takes place in between the two different flowers of two different plants of the same species then it is called xenogamy. This is real or true cross-pollination. Genetically, as well as ecologically, it is cross-pollination.

59. (d) In the given figure of typical stamen (a) and three dimensional cut section of anther (b), the structure marked as a, b, c and d are respectively anther, petiole, pollen sac and megaspore. Anther is the part of a stamen that contains the pollen. Petiole is the slender stalk by which a leaf is attached to the stem. Pollen sac is one of the chambers of an anther or a male cone in which pollen is produced; the microsporangium of a seed plant. Whereas megaspore is a spore that gives rise to a female gametophyte and is larger than a microspore.

60. (a) In the given figure of TS of anther, the structure marked as A, B, C, D and E are respectively sporogenous tissue, tapetum, epidermis, middle layer and endothecium. Sporogenous tissue is a group of compactly arranged homogenous cells. It is irregular in shape with abundant food reserves. Tapetum is a layer of nutritive cells found within the sporangium, particularly within the anther, of flowering plants. It is important for the development of pollen grains. Epidermis is the common anther covering. Cells of

middle layers degenerate to provide nourishment to the growing microspore mother cells. Endothecium is the inner lining of a mature anther of a flower.

61. (b) In the given figure of mature embryo sac, the structure marked as A, B, C, D, and E are respectively antipodal cells, central cells, polar nuclei, synergids and filiform apparatus.

Embryo sac is the female gametophyte of a seed plant, containing the egg, synergids, and polar and antipodal nuclei. In this, fusion of the antipodal and a pollen generative nucleus forms the endosperm. The embryo sac develops in the central portion of the ovule (nucellus), where the maternal macrosporocyte, as a result of meiotic division, forms four haploid cells (a tetrad of macrospores), of which one develops (the rest atrophy). During the development of the embryo sac there are three successive synchronous mitotic divisions of its nuclei, so that their number increases in the progression 1: 2: 4: 8 and they are distributed evenly along the ends of the growing embryo sac.

62. (b) Fig (b) is a wind pollinated plant showing compact inflorescence and well expored stamens. Pollination by wind is more common amongst abiotic pollinations. Wind pollination also requires that the pollen grains are light, small, dry and non-sticky so that they can be transported in wind currents. Both the stigmas and anthers are exserted. Anthers are versatile, stigma is hairy, feathery or branched to catch the wind borne pollen grains.

63. (a) The given figure shows the stages in embryogenesis in a typical dicot (*Capsella*). The structure marked as A, B, C and D is respectively suspensor, radicle, plumule and cotyledon. Suspensor is a suspending part or structure as a group or chain of cells that is produced from the zygote of a seed plant and serves to push the developing embryo into the endosperm. Radicle is the part of a plant embryo that develops into the primary root. Plumule is the young shoot of a plant embryo above the cotyledons, consisting of the epicotyl and often of immature leaves. Cotyledon is an embryonic leaf in seed-bearing plants, one or more of which are the first leaves to appear from a germinating seed.

64. (a) In the given figure of LS of flower, the structure marked as A, B, C, D and E are respectively antipodal cells, polar nuclei, stigma, style and chalaza.

Antipodal cells are the three haploid cells in the mature embryo sac of flowering plants that are situated at the opposite end to the micropyle. Polar nuclei are either of the two nuclei of a seed plant embryo sac that are destined to form endosperm. The stigma is the receptive tip of a carpel, or of several fused carpels, in the gynoecium of a flower. Style is a long, slender stalk that connects the stigma and the ovary. Chalaza is two spiral bands of tissue that suspend the yolk in the centre of the white (the albumen).

65. (d) Pollen grains represent the male gametophyte. The outer part of the pollen is exine, which is composed of a complex polysaccharide, sporopollenin. Inner part is intine. The cell contains vegetative cell which develop into the pollen tube and germ pore and generative cell (degenerative) are also present.

66. (c) False fruit are those fruits in which addition to ovary other floral parts (like thalamus) also contribute for its development is called false fruits. Examples– apple, pear, strawberry and cashewnut. In the given figure of false fruit (apple), the structure marked as A, B, C and D are respectively thalamus, seed, endocarp and mesocarp.

Thalamus is a receptacle of a flower in which the embryo fruits and later the seeds are held. Seed is a fertilized and ripened ovule and the characteristics of gymnosperms and angiosperms. Endocarp is the innermost layer of the pericarp which surrounds a seed in a fruit. It may be membranous (as in apples) or woody (as in the stone of a peach or cherry). Mesocarp is the middle layer of the pericarp of a fruit, between the endocarp and the exocarp.

67. (b)

68. (c) P_1-Autogamy; P_2-Geitnogamy; P_3-Xenogamy. If the pollen grains are transferred from an anther to the stigma of the same flower, or different flowers of the same plant is called self-pollination or autogamy.

When the pollen grains are transferred to the stigma of other flower of the same species is called cross-pollination or allogamy. It takes place in between two different flowers.

Cross-pollination is of two types – Geitonogamy and Xenogamy.

Geitonogamy : When pollination takes place in between the two flowers of the same plant then it is called geitonogamy.

When the pollination takes place in between the two different flowers of two different plants of the same species then it is called xenogamy.

69. (d) Anatropous ovule is a completely inverted ovule turned back 180 degrees on its stalk. It is inverted at an early stage of growth, so that the micropyle is turned toward the funicle and the embryonic root is at the opposite end. In the given figure of anatropous

ovule, the structure marked as A, B, C and D are respectively micropyle, nucellus, embryo sac and chalazal pole.

Micropyle is the opening through which pollen nuclei enter the ovule. Nucellus is the central part of an ovule, containing the embryo sac. Embryo sac is the female gametophyte of a seed plant, containing the egg, synergids, and polar and antipodal nuclei. Chalazal end is the basal part of a plant ovule opposite the micropyle; where integument and nucellus are joined.

70. (d) In the given figure of monocot embryo, the structure marked as A, B, C and D are respectively scutellum, coleoptile, epiblast and coleorhiza.

Scutellum is the large shield like cotyledon of the embryo of certain monocots. It is specialized for the absorption of food from the endosperm. Coleoptile is the first leaf above the ground, forming a protective sheath around the stem tip. It surrounds the plumule. Epiblast is the outermost layer of an embryo before it differentiates into ectoderm and mesoderm. Coleorhiza is the sheath that envelops the radicle in certain plants (grass or cereal grain) and that is penetrated by the root in germination.

71. (b) Central cell is the cell in the venter of the archegonium whose division produces the egg and usually also the ventral canal cell (as in cycads). It is the largest cell the in an embryo sac.

72. (d) Antheridium is a male structure and the other three archegonium, oogonium & ovule are female parts. An antheridium is a haploid male reproductive structure producing gametes, occurring in ferns, mosses, fungi and algae. Archegonium is the female, egg-producing reproductive structure on the gametophytes of non-flowering land plants. The archegonium is comprised of an oogonium surrounded by protective layers of thick-walled pigmented cells. In seed plants, ovule is the structure that gives rise to female reproductive cells.

73. (b) In a fertilized ovule n, 2n and 3n conditions occur respectively in egg, nucellus and endosperm.

74. (a) The seed coat develops from integuments originally surrounding the ovule. It is thick and hard in coconut which protects the embryo from mechanical injury and from drying out.

75. (c) Ovary wall forms pericarp after fertilization. Pericarp is the tissue that develops from the ovary wall of the flower and surrounds the seeds. The pericarp is typically made up of three distinct layers: the epicarp (outermost layer); the mesocarp (middle layer); and the endocarp (inner layer surrounding the ovary or the seeds). In a citrus fruit, the epicarp and mesocarp make up the peel.

76. (b) Sexual reproduction leads to formation of new combination and appearance of variations. Genetic recombination, interaction etc. during sexual reproduction provides vigour and vitality to the offsprings. They better adapt themselves to changing environmental conditions and also plays an important role in evolution.

77. (d) Sequence of development during the formation of embryo sac is:

Archesporium $\rightarrow$ Megaspore mother cell $\rightarrow$ Megaspore $\rightarrow$ Embryo sac

78. (a) Development of male gametophyte is called micro - gametogenesis. One meiotic division and two mitotic divisions are necessary for the complete development of male gametophyte. Male gametophyte when fully developed is a 3 nucleate structure.

79. (a) Single megaspore mother cell (MMC) with dense cytoplasm and a prominent nucleus gets differentiated from nucellus near the micropylar region. This megaspore mother cell (MMC) undergoes meiosis to form '4' haploid cells (called megaspores) and the process of formation is known as megasporogenesis.

80. (a) Megaspore mother cell (MMC) undergoes meiosis to form four haploid cells (called megaspores) and the process of formation is known as megasporogenesis. The MMC undergoes meiotic division results in the production of four megaspores 100 functional megaspores are produced by 100 MMC, since three out of four megaspores degenerate in each case.

81. (d) In the cytoplasm of the synergid pollen tube releases the two male gametes. After reaching ovary the poller tube enters the ovule. One of these male gametes fuses with egg to form diploid zygote (2n) while the other uses with two polar nucles of the central cell to produce triploid primary endosperm cell (PEC) (3n). So, in some angiosperms these two types of fusion occur in the same embryo sac. This phenomenon is called double fertilization.

82. (c) Unisexuallity of flowers prevents autogamy but not geitonogamy because autogamy is the transfer of pollen grains from anther to stigma of same flower and geitonogamy is the fertilization of a flower by pollen from another flower on the same (or a

genetically identical) plant. Therefore, geitonogamy occurs between bisexual flowers or unisexual flowers of the same plant.

83. (b) Endosperm is the nutritive tissue which provides nourishment to the embryo in seed plant. Albuminous seeds retain a part of endosperm as it is not completely used up during embryo development (*e.g.*, wheat, maize, barley, castor, sunflower).

84. (c) The transfer of pollen grains from anther to the stigma is called pollination. This process of pollination occurs only in gymnosperms and angiosperms.

85. (d) Cleistogamy is a self-fertilization that occurs within a permanently closed flower. In cleistogamous flower, the anther and stigma lies close to each other. When anther dehisces in the flower buds, pollen grains come in contact with the stigma to effect pollination. Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross - pollen landing on the stigma. Cleistogamous flowers produce assured seed set even in the absence of pollinators.

86. (d) Nucellus, embryo sac & micropyle are all found in ovule while pollen grain is a male gametophyte.

87. (c) Artificial hybridization is one of the major approaches of crop improvement programme. While planning for artificial hybridization programmes, if the female parent has unisexual flowers, then process of emasculation (removal of the anthers of a flower in order to prevent self-pollination or the undesirable pollination of neighbouring plants) does not relevant. The female flower buds are bagged before the flowers open. When the stigma becomes receptive, pollination is carried out using the desired pollen and the flower rebagged.

88. (c) Cotyledons and scutellum are two homologous structures in the embryo of a typical dicot and a grass. Cotyledon is an embryonic leaf in seed-bearing plants, one or more of which are the first leaves to appear from a germinating seed. Scutellum is the large shield like cotyledon of the embryo of certain monocots. It is specialized for the absorption of food from the endosperm.

89. (c) 100 zygotes require 100 pollen grains and 100 embryo sacs. 100 pollen grains are formed from 25 microspore mother cells while 100 embryo sacs are formed from 100 functional megaspores which in turn are produced by 100 megaspore mother cells since three out of four megaspores degenerate in each case.

90. (b) In angiospermic seed, the endosperm is formed after fertilization. Angiosperms undergo two fertilization events where a zygote and endosperm are both formed. Endosperm is a tissue in which the nutrient substances necessary for the development of the embryo are deposited. In angiosperms the endosperm is formed after fertilization as a result of the merging of the spermatozoid with the secondary (diploid) nucleus of the embryo sac. In this case the cells of the endosperm are triploid. By uniting sets of chromosomes from both parent plants the endosperm becomes a physiologically active, viable nutrient tissue. It is not only feeds the embryo but fosters embryonic growth and differentiation.

In gymnosperms the endosperm is formed in the ovule during germination of the megaspore; it consequently becomes the female prothallus (gametophyte), with a haploid set of chromosomes.

91. (b) Artificial hybridization is one of the major approaches of crop improvement programme. The correct sequence in artificial hybridization experiment in bisexual flower is:

Emasculation → Bagging → Cross-pollination → Rebagging

Emasculation is the removal of the anthers of a flower in order to prevent self-pollination or the undesirable pollination

of neighbouring plants. After that emasculated male and female plants are kept in isolation by enclosing them in a bag in a process called bagging. When the stigma of bagged flowers attains receptivity, mature pollen grains collected from anthers of the male parent are dusted on the stigma, and the flowers are rebagged and the fruits allowed develop.

92. (a) Diploid female plant will have 2 polar nuclei (each haploid) with which one male gamete form tetraploid male plant (male gamete of tetraploid plant will be diploid) fuses, making endosperm. So endosperm will be tetraploid.

$$\underset{(2n)}{\text{Male gamete}} + \underset{(n)\ \ (n)}{\text{2 polar nuclei}} \longrightarrow \underset{(4n)}{\text{Endosperm}}$$

93. (c) In a seed of maize, the scutellum is considered as cotyledon because it absorbs food materials and supplies them to the embryo.

94. (c) Each microspore mother cell gives rise to 4 microspores which develop into pollen grains.

95. (d) Depending upon the mode of its formation, angiospermic endosperm is of three types nuclear, cellular and helobial. Multinucleate condition is present in liquid endosperm of coconut. Multinucleate condition is also known as nuclear type of endosperm. Coconut has multicellular

endosperm (called coconut meal) in the outer part and free nuclear as well as vacuolated endosperm (called coconut milk) in the centre. Nuclear endosperm is the most common type of endosperm. It is named so because it contains free nuclei in the beginning.

96. (c) After entering the ovule, the pollen tube is attracted towards the micropylar end of the embryo sac. The attractants are secreted by synergids or help cells. The pollen tube pierces one of the two synergids and bursts open into it. The synergid is simultaneously destroyed.

97. (d) Filiform apparatus in the form of finger-like projection from cell wall is present in the upper part of each synergids. This apparatus is useful for the absorption and transportation of materials from the nucellus to the embryo sac.