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CBSE – XIIth

Biology

Central Board of Secondary Education (CBSE)

Previous Year Questions + PYQ Solution

SIERRA INNOVATIONS

INDEX

Previous Year Questions CBSE

1.1 Flower -A Fascinating Organ of Angiosperms

MCQ

1. In a fertilized ovule of an angiosperm, the cells in which n, 2n and 3n conditions respectively occur are : **(2024)**

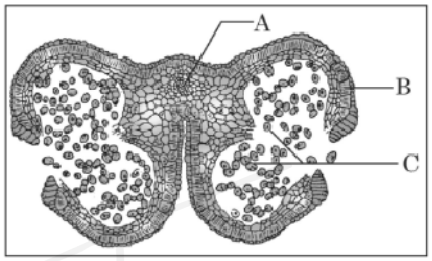
(A) antipodal, zygote and endosperm

(B) zygote, nucellus and endosperm

(C) endosperm, nucellus and zygote

(D) antipodals, synergids and integuments

2. Study the following diagram of Transverse Section of a young anther of an angiosperm : **(2024)**



Select the option where parts 'A', 'B' and 'C' are correctly identified.

(A) A–Connective, B–Endothecium, C–Pollen grain.

(B) A–Endothecium, B–Connective, C–Pollen grain.

(C) A–Pollen grain, B–Connective, C– Endothecium.

(D) A–Endothecium, B–Pollen grain, C–Connective.

LA (5 marks)

3. Distinguish between the two cells enclosed in a mature male gametophyte of an angiosperm. **(2025)**

1.2 Pre-fertilisation : Structures and Events

Stamen, Microsporangium and Pollen Grain

MCQ

4. In which of the following plants are both male and female flowers born on the same plant and the mode of pollination can be geitonogamy or xenogamy ? **(2024)**

(A) Papaya (B) Date Palm

(C) Maize (D) Spinach

5. A phenomenon where a male insect mistakenly identified the patterns of a orchid flower as the female insect partner, and tries to copulate and there by pollinates the flower is said to be : **(2024)**

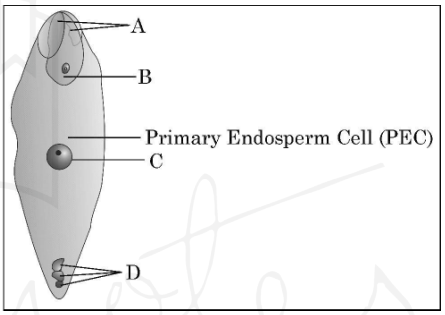
(A) Pseudocopulation

(B) Pseudopollination

(C) Pseudoparthenocarpy

(D) Pseudofertilisation

6. Identify the correct labellings in the figure of a fertilised embryo sac of an angiosperm given below : **(2024)**



(A) A – zygote, B – degenerating synergids, C – degenerating antipodals, D – PEN.

(B) A – degenerating synergids, B – zygote, C – PEN, D – degenerating antipodals

(C) A – degenerating antipodals, B – PEN, C – degenerating synergids, D – zygote

(D) A – degenerating synergids, B – zygote, C – degenerating antipodals, D – PEN

7. An angiosperm embryo sac is located within the : **(2024)**

(A) Placenta (B) Megasporangium

(C) Nucellus (D) Ovary

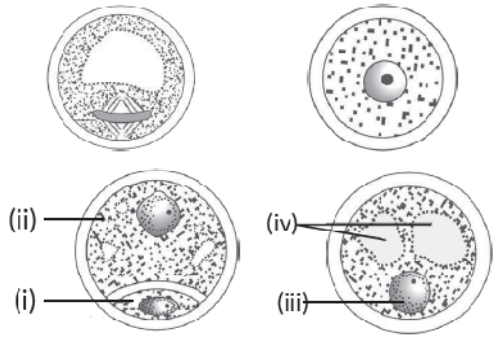
8. A group of compactly arranged homogenous mass of cells occupying the centre of a typical microsporangium in an anther is

(a) sporogenous tissue (b) pollen sacs

(c) microspore tetrads (d) spores.

(Term-I, 2021-22) R

9. The figures of the developmental stage of a microspore into a mature pollen grain are given below. Choose the option showing the correct labellings for (i), (ii), (iii) and (iv).



	(i)	(ii)	(iii)	(iv)
(a)	Generative cell	Vegetative cell	Male Gametes	Vacuoles
(b)	Vegetative cell	Generative cell	Vacuoles	Male Gametes
(c)	Generative cell	Vegetative cell	Nucleus	Vacuoles
(d)	Vegetative cell	Generative cell	Vacuoles	Nucleus

(Term-I, 2021-22) R

VSA (1 mark)

10. Name any two outbreeding devices that flowering plants have developed and explain how they help in encouraging cross-pollination. **(2024)**

11. Give an example of a plant which came into India as a contaminant and is a cause of pollen allergy. **(AI 2014)**

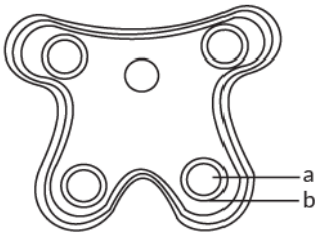
SA I (2 marks)

12. A bilobed dithecous anther has 200 m1crospore mother cells per microsporangium. How many male gametophytes can be produced by this anther? **(2025)**

13. Write the composition of intine and exine layers of a pollen grain. **(2025)**

14. (a) Explain the process of the development of a male gametophyte in an angiosperm.
(b) Why is it called a male gametophyte? **(2023) U**

15. In the T.S. of a mature anther given below, identify "a" and "b" and mention their functions.



(AI 2019) U

16. A pollen grain in angiosperm at the time of dehiscence from an anther could be 2-celled or 3-celled. Explain. How are the cells placed within the pollen grain when shed at a 2-celled stage? **(AI 2017)**

17. Name the organic materials exine and intine of an angiosperm pollen grain are made up of. Explain the role of exine. **(Delhi 2014)**

18. Draw a diagram of a matured microspore of an angiosperm. Label its cellular components only. **(Foreign 2014) A**

19. Draw a longitudinal section of pistil of a flower showing growth of the pollen tube. Label the part :
(a) through which the pollen tube moves down. **(2024)**
(b) the cell wherein the pollen tube releases its contents.

20. Draw a well labelled diagram of sectional view of male gametophyte/microspore of an angiosperm and write the functions of any two parts labelled. (Any four labels). **(2024)**

21. (a) Explain how it is ensured that the orchid Ophrys is pollinated by a specific species of bee. **(2024)**
(b) Describe co-evolution with the help of this example.

SA II (3 marks)

22. Draw a schematic transverse section of a mature anther of an angiosperm. Label its epidermis, middle layers, tapetum, endothecium, sporogenous tissue and the connective. **(2020) Cr**

23. Where are the following structures present in a male gametophyte of an angiosperm? Mention the function of each one of them.
(a) Germ pore
(b) Sporopollenin
(c) Generative cell **(2019)**

24. (a) Name the organic material exine of the pollen grain is made up of. How is this material advantageous to pollen grain?
(b) Still it is observed that it does not form a continuous layer around the pollen grain. Give reason.
(c) How are 'pollen banks' useful? **(AI 2016)**

25. Why are angiosperm anthers called dithecous? Describe the structure of its microsporangium. **(AI 2014)**

LA (5 marks)

26. (a) Where does microsporogenesis occur in an angiosperm? Describe the process of microsporogenesis.

(b) Draw a labelled diagram of the two celled male gametophyte of an angiosperm. How is a three celled male gametophyte different from it?

(2020) Ap

27. (i) Explain the development of male gametophyte in an angiosperm. **(2024)**

(ii) Draw a labelled diagram of a three-celled male gametophyte.

28. (i) Explain any four devices that flowering plants have developed to encourage cross-pollination. **(2024)**

(ii) Why do plants discourage self-pollination? State any one reason.

29. **(2024)**

Observe the picture of Commelina plant bearing two types of flowers given above.

(i) Identify the two types of flowers labelled 'A' and 'B' in the picture.

(ii) Compare the two types of flowers with reference to:
(1) Characteristic feature
(2) modes of pollination

(iii) List any two 'out breeding devices' in flowering plants. Explain why do plants develop such devices.

30. Trace the development of a 2-celled pollen grain of an angiosperm within an anther.
Draw a labelled diagram to substantiate your answer. **(2020)**

31. (a) Name the specific part in the anther and the process responsible for the development of a male gametophyte in an angiosperm.

(b) Draw a labelled diagram of a mature male gametophyte (3-celled) of an angiosperm. Write the functions of each labelled part. **(2020C)**

32. (a) Draw a labelled diagram of the sectional view of microsporangium of an angiosperm.

(b) Explain the development of male gametophyte in the microsporangium. **(Delhi 2015C) R**

33. (a) Describe the sequence of the process of microsporogenesis in angiosperms.

(b) Draw a labelled diagram of a two celled final structure formed. **(Delhi 2015C)**

Pistil, Megasporangium and Embryo sac

MCQ

34. Figure (i) and figure (ii) given below are showing two stages of megasporogenesis in a typical angiosperm plant.

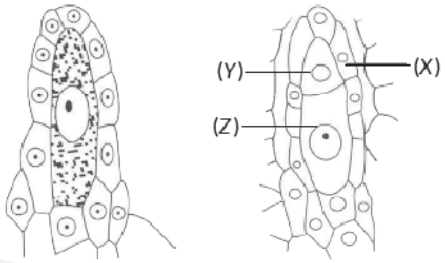


Fig. (i) Fig. (ii)

Choose the option showing the correct ploidy of X, Y and Z in the table given below.

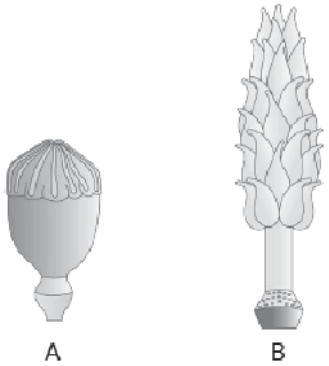
	X	Y	Z
(a)	2n	n	2n
(b)	2n	n	n
(c)	2n	3n	n
(d)	3n	2n	n

(Term-I, 2021-22) An

35. Which one of the following is not found in a female gametophyte of an angiosperm?
(a) Germ pore
(b) Synergids
(c) Filiform apparatus
(d) Central cell **(2020)**

VSA (1 mark)

36.



These pictures show the gynoecium of (A) Papaver and (B) Michelia flowers. Write the difference in the structure of their ovaries.

(NCERT Exemplar, Delhi 2015C) An

37. State the function of filiform apparatus found in mature embryo sac of an angiosperm. **(Foreign 2014)**

SA I (2 marks)

38. A mature embryo sac in flowering plant may possess 7-cells, but 8-nuclei. Explain with the help of diagram only. ***(NCERT Exemplar, Delhi 2017)***

39. Gynoecium of a flower may be apocarpous or syncarpous. Explain with the help of an example each. **(AI 2016) An**

SA II (3 marks)

40. (a) Draw a L.S. of pistil showing pollen tube entering into the embryo sac. Label the following:
(i) Nucellus (ii) Antipodals
(iii) Synergids (iv) Micropyle
(b) Write the functions of the following :
(i) Synergids
(ii) Micropyle **(AI 2019)**

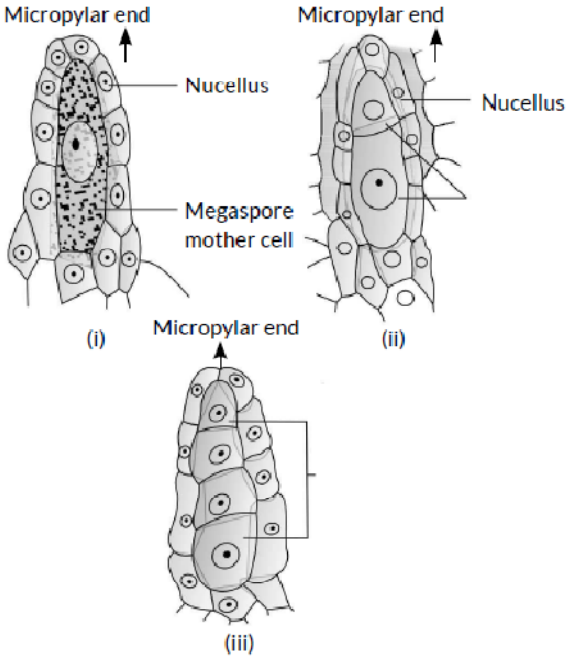
41. Draw a labelled diagram of a typical anatropous ovule. **(NCERT, Delhi 2014)**

LA (5 marks)

42. Draw a labelled diagram of a fertilised embryo sac of an angiosperm. (label any four parts) **(2025)**

43. (i) Explain the monosporic development of embryo sac in the ovule of an angiosperm.
(ii) Draw a diagram of the mature embryo sac of an angiospermic ovule and label any four parts in it. **(2023) R**

44. Study the figures given below of the development of megaspore in an angiosperm and answer the questions that follow:



(i) Describe the developmental events in the nucellus of the ovule. What is this type of development of megaspore referred to as ?
(ii) How many free nuclear mitotic divisions will the functional megaspore undergo to form a mature embryo sac ?
(iii) Describe the structure of a typical female gametophyte of a flowering plant. **(2021C)**

45. Where does the process of megasporogenesis start in an angiosperm? Describe the process upto the formation of embryo sac. **(Delhi 2019)**

OR

Describe the process of megasporogenesis upto fully developed embryo sac formation in an angiosperm. **(AI 2019)**

Pollination

MCQ

46. Long ribbon-like pollen grains are seen in some :
(A) Aquatic plants **(2025)**
(B) Wind-pollinated grasses
(C) Gymnosperms
(D) Bird-pollinated flowers

47. Select the plant species, where emasculation is not required for artificial hybridisation experiment.
(a) Castor (b) Maize
(c) Papaya (d) Wheat
(Term-I, 2021-22) An

48. Which of the given statements are correct with respect to pollination in Vallisneria?
(i) Pollen grains are light and non-sticky.
(ii) Female flowers reach the surface of water by long stalks.
(iii) Pollen grains are carried passively by water currents.
(iv) Female flowers remain submerged in water.
Choose the correct option.
(a) (i) and (iv) (b) (ii) and (iv)
(c) (i) and (ii) (d) (ii) and (iii)
(Term-I, 2021-22)

49. Self-pollination is fully ensured if
(a) the flower is bisexual
(b) the style is longer than the filament
(c) the flower is cleistogamous
(d) the time of pistil and anther maturity is different. **(2020)**

50. Cleistogamous flowers are self pollinated because
(a) they are bisexual flowers which do not open at all
(b) they are bisexual and open flowers
(c) they are unisexual
(d) their stigma mature before anthers dehisce. **(2020) R**

VSA (1 mark)

51. Comment on the interaction between a fig tree and wasp. Mention the phenomenon that operates in their relationship. **(2025)**

52. Name the part of the flower which the tassels of the corn-cob represent. **(AI 2014) R**

53. What is pollen-pistil interaction and how is it mediated? **(Foreign 2014)**

54. Differentiate between xenogamy and geitonogamy. **(1/3, AI 2014C)**

SA I (2 marks)

55. Explain the mechanism of pollination in marine seagrasses like Zostera. **(2021C)**

56. Mention the advantages of emasculation and bagging in artificial hybridisation in plants bearing unisexual and bisexual flowers. **(2020)**

57. What is 'bagging' ? State its importance in artificial hybridisation of flowering plants. **(2020C)**

58. Express the process of pollination in Vallisneria. **(Delhi 2019) U**

59. What is cleistogamy? Write one advantage and one disadvantage of it, to the plant. **(AI 2019)**

60. List the different types of pollination depending upon the source of pollen grain. **(2/5, Delhi 2016) R**

61. Angiosperms bearing unisexual flowers are said to be either monoecious or dioecious. Explain with the help of one example of each. **(Delhi 2016)**

62. A single pea plant in your kitchen garden produces pods with viable seeds, but the individual papaya plant does not. Explain. **(AI 2016) Ap**

63. Why do hermaphrodite angiosperms develop outbreeding devices? Explain any two such devices with the help of examples. **(AI 2015C)**

SA II (3 marks)

64. One of the major approaches of crop improvement programme is artificial hybridisation. Explain the steps involved in making sure that only the desired pollen grain pollinate the stigma of a bisexual flower by a plant breeder. **(2023) U**

65. Draw a longitudinal section of the pistil from a flowering plant where pollination has occurred. Label the following:
(a) Stigma showing germinating pollen grains.
(b) Style
(c) Pollen tube reaching the micropyle of the ovule.
(d) Embryo sac
(e) Components of the egg apparatus. **(2020) U**

66. Explain three different modes of pollination that can occur in a chasmogamous flower. **(2020) R**

67. Differentiate between wind pollinated and insect pollinated flowers. **(2020)**

OR

Write the differences between wind-pollinated and insect-pollinated flowers. Give an example of each type. **(Foreign 2014)**

68. (a) Differentiate between geitonogamy and xenogamy.
(b) Write the difference in the characteristics of the progeny produced as a result of the two processes. **(Delhi 2019)**

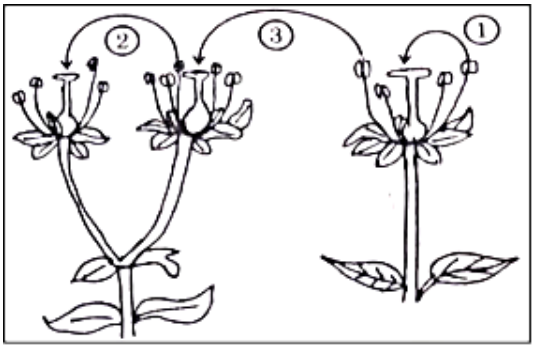
69. Emasculation and bagging are the two important steps carried during artificial hybridisation to obtain superior varieties of desired plants. Explain giving reasons, in which types of flowers and at what stages are the two processes carried out. **(AI 2019)**

70. (a) Can a plant flowering in Mumbai be pollinated by pollen grains of the same species growing in New Delhi? Provide explanations to your answer.
(b) Draw the diagram of a pistil where pollination has successfully occurred. Label the parts involved in reaching the male gametes to its desired destination. **(AI 2017) Ap**

71. Make a list of any three outbreeding devices that flowering plants have developed and explain how they help to encourage cross-pollination. **(AI 2014)**

LA (5 marks)

72. (a) Study the diagram given below showing the modes of pollination. Answer the uestions that follow. **(2025)**



(i) The given diagram shows three methods of pollen transfer in plants. Examine them carefully and write the technical terms used for pollen transfer in methods '1', '2' and '3'.

(ii) How do the following plants achieve pollination successfully?

(a) Water lily (b) Vallisneria

(iii) Write advantages of pollen transfer method '3'.

73. Angiosperm flowers may be monoecious, cleistogamous or show self-incompatibility. Describe the characteristic features of each one of them and state which one of these flowers promotes inbreeding and outbreeding respectively. **(Delhi 2014C) An**

74. (a) Describe the formation of mature female gametophyte within an ovule in angiosperms.

(b) Describe the structure of the cell(s) that guide(s) the pollen tube to enter the embryo sac. **(AI 2014C)**

75. (a) Draw a longitudinal section of a pistil of an angiosperm showing the growth of the pollen tube up to the micropyle of the ovule. Label

(i) stigma, (ii) embryo sac,

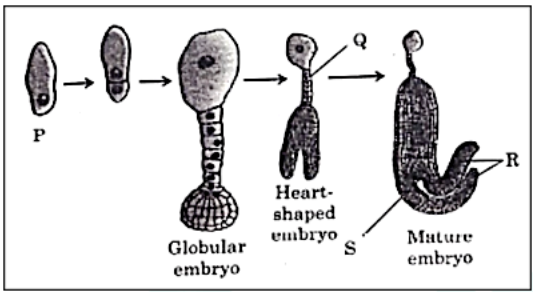
(iii) pollen tube (iv) micropyle.

(b) Explain the events that occur, upto fertilisation, when the compatible pollen grain lands on the stigma. **(AI 2014C) Ap**

1.3 Double Fertilisation

MCQ

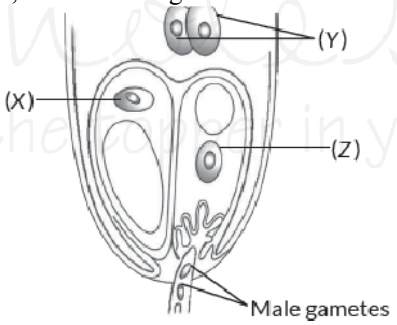
76. The diagram given below shows labelling of four parts of a dicot embryo during its development as P, Q, R and S.



Choose the option that indicates correct labelling of 'P', 'Q', 'R' and 'S' of embryo in different stages of its development:

	P	Q	R	S
(A)	Egg	Suspensor	Radicle	Cotyledon
(B)	Zygote	Suspensor	Cotyledon	Plumule
(C)	Egg	Radicle	Suspensor	Cotyledon
(D)	Zygote	Suspensor	Cotyledon	Radicle

77. The given figure of an egg apparatus of an angiosperm shows the entry of pollen tube for releasing the two male gametes. Which of the two from 'X', 'Y' and 'Z', the two male gametes fuse with?



(a) X and Z (b) X and Y

(c) Y and Z (d) Z and Z

(Term-I, 2021-22) Ev

SA I (2 marks)

78. If the cells in the leaves of a maize plant contain 10 chromosomes each, write the number of chromosomes in its endosperm and zygote. Name and explain the process by which an endosperm and a zygote are formed in maize. **(2024)**

79. Draw a diagram of a fertilised embryo sac of a dicot flower.Label all its cellular components.

(Delhi 2015C) Ap

SA II (3 marks)

80. Explain double fertilisation in an angiosperm. **(2020)**

OR

Explain the phenomenon of double fertilisation. **(3/5, AI 2014)**

LA (5 marks)

81. Explain double fertilisation in angiospermic plant. **(2025)**

82. (i) Explain the process of double fertilization in an angiosperm starting from the germination of pollen grains on the stigma, mentioning the ploidy of the end products formed at the end. State the role of synergids during the course of the process. **(2024)**

(ii) Why does the development of endosperm precede that of the embryo?

83. (a) Describe any two devices in a flowering plant which prevent both autogamy and geitonogamy.

(b) Explain the events upto double fertilization after the pollen tube enters one of the synergidsin an ovule of an angiosperm. **(2018) An**

1.4 Post-fertilisation : Structures and Events

Endosperm

MCQ

84. The part of the ovule that develops into protective coats of a seed after fertilization in a typical flowering plant is : **(2024)**

(A) embryo sac

(B) nucellus

(C) integuments

(D) megaspore

85. In which one of the following floral plants are many embryos formed in the seeds without fertilisation of the egg cell ? **(2024)**

(A) Black pepper

(B) Mustard

(C) Groundnut

(D) Citrus

86. **Assertion (A) :** A given fig species can be pollinated only by its partner' wasp. **(2024)**

Reason (R) : The wasp pollinates the fig inflorescence while searching for suitable egg laying sites.

(A) Both (A) and (R) are true and (R) is the correct explanation of (A).

(B) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

87. Select the correct statements with respect to the development of an endosperm in a typical angiosperm plant.

(i) Embryo development precedes endosperm development.

(ii) Endosperm cells divide repeatedly to form a triploid endosperm.

(iii) Endosperm tissue has scanty reserves of food materials.

(iv) PEN undergoes successive division to form free-nuclear endosperm.

Choose the correct option.

(a) (i) and (iii) (b) (ii) and (iii)

(c) (i) and (iv) (d) (ii) and (iv)

(Term-I, 2021-22) U

SA I (2 marks)

88. Write the difference between the tender coconut water and the thick white kernel of a mature coconut and their ploidy. **(AI 2015C)**

SA II (3 marks)

89. Describe the development of endosperm after double fertilisation in an angiosperm. Why does endosperm development precedes that of zygote? **(Delhi 2015)**

90. List the post-fertilisation events in angiosperms. **(Delhi 2014)**

LA (5 marks)

91. **(a)** Draw a diagram of a fully developed embryo sac of an angiosperm. Label its chalazal end and any other five parts within the embryo sac.

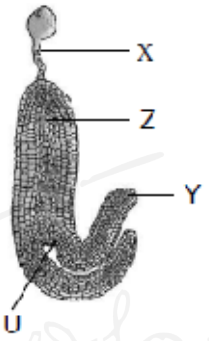
(b) Why does the development of an endosperm precede that of the embryo in angiosperm ?

(c) Number of chromosomes in an onion plant cell is 16. Name the cells of the embryo sac having 16 and 24 chromosomes formed after fertilisation. **(2020)**

Embryo

MCQ

92. Select the option that shows the correctly identified 'U', 'X', 'Y' and 'Z' in a developing dicot embryo.



(a) X – Plumule (2n), Y – Suspensor (n), Z – Cotyledon (2n), U – Radicle (2n).

(b) X – Plumule (2n), Y – Suspensor (2n), Z – Radicle (2n), U – Cotyledon (2n).

(c) X – Suspensor (2n), Y – Cotyledon (2n), Z – Radicle (2n), U – Plumule (2n).

(d) X – Cotyledon (2n), Y – Radicle (n), Z – Plumule (n), U – Suspensor (n). (2023) R

VSA (1 mark)

93. Mention the function of coleorhiza.

(Delhi 2015C) R

SA I (2 marks)

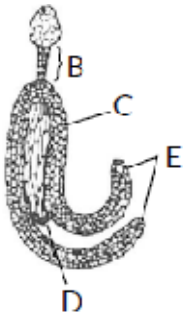
94. Draw a labelled mature stage of a dicotyledonous embryo. **(2/5, AI 2014) Ev**

OR

Draw a labelled diagram of a matured embryo of a dicotyledonous plant. **(AI 2014C)**

SA II (3 marks)

95. (a) Identify the figure given below and also identify the parts B, C, D and E.



(b) State the function of E. **(2020) Ap**

96. Draw a diagram of L.S. of an embryo of grass and label any six parts. **(2019C)**

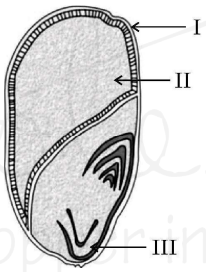
97. Explain the development of a mature embryo from the embryo sac of dicot flower.

(NCERT Exemplar, Delhi 2015C)

Seed

MCQ

98. Given below is a diagram of T.S. of a monocot seed with parts I, II & III labelled: **(2025)**



Choose the option where parts I, II and III are identified correctly.

	I	II	III
(A)	Pericarp,	Endosperm,	Scutellum
(B)	Pericarp,	Endosperm,	Coleorhiza
(C)	Scutellum,	Pericarp,	Coleorhiza
(D)	Coleor hiza,	Scutellum,	Pericarp

99. Match the correct structures given in column I with the fruit in column II in the given chart :

Column I (Structure)		Column II (Fruit)	
P.	Perisperm	i.	Maize
Q.	Thalamus	ii.	Black pepper
R.	Pericarp	iii.	Strawberry
S.	Endosperm	iv.	Mango

(a) P-i, Q-ii, R-iii, S-ii (b) P-ii, Q-iii, R-iv, S-i

(c) P-iii, Q-i, R-i, S-iii (d) P-iv, Q-i, R-ii, S-iv

(2023) U

100. Endosperm is completely consumed by the developing embryo in
(a) Castor and coconut
(b) Coconut and groundnut
(c) Groundnut and pea
(d) Castor and pea.
(Term-I, 2021-22) R

101. The floral part that develops into a fruit in strawberry is
(a) pedicel (b) calyx
(c) thalamus (d) bracts.
(Term-I, 2021-22) R

102. In which of the following combinations of seeds/grains of different plants, residual endosperm will be present at maturity?
(a) Groundnut, Barley, Beans
(b) Castor, Groundnut, Maize
(c) Wheat, Maize, Barley
(d) Pea, Groundnut, Beans
(Term-I, 2021-22) U

VSA (1 mark)

103. Differentiate between parthenogenesis and parthenocarpy. **(1/3, AI 2014C)**

SA I (2 marks)

104. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?
(b) The development of endosperm precedes that of embryo in plants. Justify. **(2019)**

105. A non biology person is quite shocked to know that apple is a false fruit, mango is a true fruit and banana is a seedless fruit. As a biology student how would you satisfy this person?
(Delhi 2015)

106. Banana fruit is said to be parthenocarpic whereas turkey is said to be parthenogenetic. Why?
(Delhi 2015C)

107. Some angiosperm seeds are said to be 'albuminous', whereas few others are said to have a perisperm. Explain each with the help of an example.
(Foreign 2014) U

108. Banana crop is cultivated by farmers without sowing of seeds. Explain how the plant is propagated.
(Delhi 2014C)

SA II (3 marks)

109. Draw a diagram of LS of Maize grain and label its any six parts. **(2019)**

110. Differentiate between parthenocarpy and parthenogenesis. Give one example of each.
(2018)

111. Explain the post-pollination events leading to seed production in angiosperms. **(Delhi 2016) U**

112. Double fertilisation is reported in plants of both castor and groundnut. However, the mature seeds of groundnut are non-albuminous and castor are albuminous. Explain the post fertilisation events that are responsible for it. **(Delhi 2015)**
OR
Name the two end products of double fertilisation in angiosperms. How are they formed? Write their fate during the development of seed.
(Delhi 2014C) Ap

113. Explain any three advantages the seeds offer to angiosperms. **(Delhi 2014)**

LA (5 marks)

114. (i) Double fertilisation is an event unique to all flowering plants. Explain the process.
(ii) Give a reason for the following :
(1) A seed of an orange has many embryos.
(2) Cashew is a false fruit but guava is a true fruit.
(2023) U

115. (a) Describe the process of double fertilisation in angiosperms.
(b) Trace the development of polyploidal cell that is formed after double fertilisation in a nonalbuminous seed and albuminous seed.
(2020) U

116. Read the following statement and answer the questions that follow : "A guava fruit has 200 viable seeds."
(a) What are viable seeds?
(b) Write the total number of :
(i) Pollen grains
(ii) Gametes
in producing 200 viable guava seeds.
(c) Prepare a flow chart to depict the postpollination events leading to viable-seed production in a flowering plant. **(Delhi 2017)**

117. A flower of tomato plant following the process of sexual reproduction produces 200 viable seeds.
Answer the following questions giving reasons.
(a) What would have been the minimum number of ovules present in per pollinated pistil?
(b) How many microspore mother cells would minimally be required to produce requisite number of pollen grains?
(c) How many pollen grains must have minimally pollinated the carpel?
(d) How many male gametes would have used to produce these 200 viable seeds?
(e) How many megaspore mother cells were required in this process? **(Delhi 2015) Ev**

118. A flower of brinjal plant following the process of sexual reproduction produces 360 viable seeds.
Answer the following questions giving reasons:
(a) How many ovules are minimally involved?
(b) How many megaspore mother cells are involved?
(c) What is the minimum number of pollen grains that must land on stigma for pollination?
(d) How many male gametes are involved in the above case?
(e) How many microspore mother cells must have undergone reduction division prior to dehiscence of anther in the above case?
(Delhi 2015) Ev

119. (a) Explain the events after pollination leading to the formation of a seed in angiosperms.
(b) Mention the ploidy levels of the cells of different parts of an albuminous seed.
(Foreign 2015) Ap

1.5 Apomixis and Polyembryony

MCQ

120. Seeds of an orange when taken out and squeezed, show many embryos of different sizes and shapes. The reason for this is as many embryos have developed from
(a) egg cells fusing with different male gametes forming embryos
(b) PEN fusing with different male gametes forming embryos
(c) nucellar cells dividing and developing into embryos
(d) synergids dividing and developing into embryos.
(Term-I, 2021-22) R

VSA (1 mark)

121. Mention advantage of apomictic seeds to farmers. **(AI 2014) U**

SA I (2 marks)

122. State two advantages of an apomictic seed to a farmer. **(2020)**

OR

Suggest the advantage to a farmer for using apomictic seeds of hybrid varieties. **(Foreign 2015)**

123. It is said apomixis is a type of asexual reproduction. Justify. **(2019)**

124. What is apomixis? How is the phenomenon useful to the farmer? **(NCERT, Foreign 2015)**

125. Explain the different ways apomictic seed can develop. Give an example of each.
(2/5, AI 2014)

126. **(a)** Why are seeds of some grasses called apomictic? Explain.
(b) State two reasons to convince a farmer to use an apomictic crop. **(AI 2014C)**

SA II (3 marks)

127. State what is apomixis. Write its significance. How can it be commercially used?
(AI 2019, 2015)

128. **(a)** How is apomixis different from parthenocarpy?
(b) Describe any two modes by which apomictic seeds can be produced. **(AI 2014C)**

LA (5 marks)

129. **(a)** When a seed of an orange is squeezed, many embryos, instead of one are observed. Explain how it is possible.
(b) Are these embryos genetically similar or different? Comment. **(AI 2017) An**

Detailed SOLUTIONS

Previous Years' CBSE Board Questions

1. (A)**:** It is true that most antipodal cells are haploid (n). The union of haploid egg and sperm cells produces a diploid (2n) zygote. A haploid sperm cell fuses with two haploid polar nuclei in the centre cell to generate the triploid (3n) endosperm.

2. (A): It is called connective tissue. It is the main parenchymatous tissue that holds the two anther lobes together. This means that part (A) is the connective.
The top layer is called the epidermis, and the layer below it is called the endothecium. This means that part B is the endothecium.
The microspore mother cells are inside the tapetum. They divide meiotically to make pollen grains. In this case, the part marked (C) is the pollen grain.

3.

Vegetative cell	Generative cell
It is big with abundant food reserve and an irregular shaped nucleus	Generative cell is small, floats in the cytoplasm of the vegetative cell
Helps in the formation of pollen tube	Forms two male gamete

4. (C): Plants that bear both male and female flowers on the same plant are called monoecious plants. Maize is an example of a monoecious plant.
Geitonogamy refers to the transfer of pollen between flowers on the same plant.
Xenogamy refers to the transfer of pollen between flowers of different plants. Maize exhibits both types of pollination.

5. (A): If a male insect misidentifies the patterns or traits of a flower, usually an orchid, as belonging to a female insect mate, this is known as Pseudocopulation. This mechanism involves the flower mimicking sexual pheromones.

6. (B):
In the fertilized embryo sac:
(A) represents degenerating synergids as they are no longer needed post-fertilization.
(B) is the zygote, formed after the fusion of male and female gametes.
(C) is the Primary Endosperm Nucleus (PEN), which divides to form the endosperm, a nutritive tissue.
(D) shows degenerating antipodal cells that play no role after fertilization.

7. (C)
In angiosperms, the embryo sac is located within the nucellus, which is a part of the ovule. The nucellus contains the female gametophyte, the embryo sac, where fertilization takes place.

8. (a) : When the anther is young, a group of compactly arranged homogenous cells called the sporogenous tissue occupies the centre of each microsporangium.

9. (c) : (i)-Generative cell, (ii)-Vegetative cell, (iii)-Nucleus, (iv)-Vacuoles

10. **1. Dichogamy:** Flowers are unisexual, so self-pollination is not possible. The plants may be monoecious, bearing both male and female flowers (e.g. maize), or dioecious, bearing male and female flowers on separate plants (e.g. mulberry, papaya).
2. Prepotency: Pollen grains of another flower germinate more rapidly on the stigma than pollen grains of the same flower. Examples of this include apples and grapes.
3. Self-sterility (Self-incompatibility): Pollen grains of a flower do not germinate on the stigma of the same flower because of the presence of similar self-sterile genes. Examples of this include tobacco, potatoes, and crucifers.

11. Parthenium or carrot grass is an example of a plant which came to India as a contaminant with imported wheat and is a major contributor to pollen allergy.

12. 3200 male game

13. Intine made up of cellulose, and pectin.
Exine made up of sporopollenin.

14. (a) The cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads as the anther develops. As the anther mature and dehydrate, the microspores dissociate from each other and develop into pollen grains which represents the male gametophyte. Pollen grains are released with the dehiscence of anther.

(b) Male gametophyte is called so because it produces male gametes for fertilisation.

15. In the given figure, 'a' represents sporogenous tissue and 'b' represents tapetum.

Functions : Sporogenous tissue (a) fills the whole interior of the microsporangium. Its cells divide with the growth of anther and increase their number. Ultimately, they are transformed into microspore or pollen mother cells (PMC). Microspore mother cells undergo meiosis to produce haploid microspores or pollen grains.

Tapetum (b) helps in nourishment of the developing microspore mother cells and pollen grains. It also produces lipid rich Ubisch granules containing sporopollenin for exine formation.

16. At the time of dehiscence, a pollen grain in angiosperm could be 2-celled when it contains one tube cell and one generative cell or it could be 3-celled when the generative cell divides mitotically to give rise to the two male gametes, and hence, one tube cell and two male gametes make pollen grain a 3-celled structure. At 2-celled stage, one small generative cell and one large tube cell are placed within the pollen grains.

Commonly Made Mistake

- Students generally got confused that vegetative cell give rise to male gametes but generative cell give rise to male gametes.

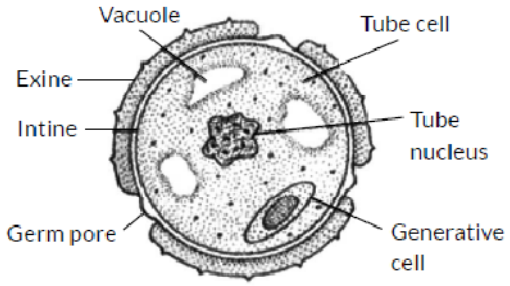
17. Exine is the outer tough and resistant layer of pollen grains made up of sporopollenin. Intine is thin continuous and inner wall of the pollen grain which is made up of cellulose and pectin.

Exine provides protection to pollen grain during its hazardous journey from anther of one flower to the stigma of another flower. Due to presence of sporopollenin in exine, pollens of past are well preserved as fossil in soil and sediments enabling the scientists to study pollen structure and pollination pattern of angiosperms of past.

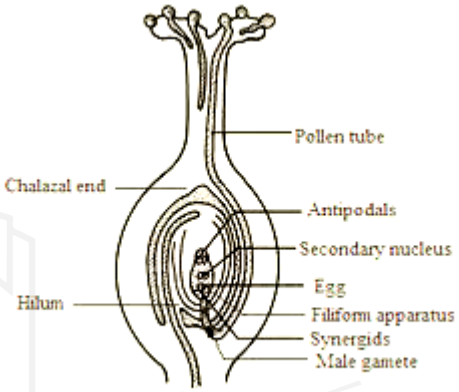
NCERT Core

- Exine → Sporopollenin
- Intine → Pectocellulosic

18. Labelled diagram of mature microspore (or pollen grain) is as follows:

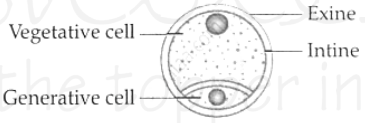


19.



L.S of Post Pollinated Pistil

20. Sectional view of male gametophyte



Functions:

1. Exine: A tough outer covering of pollen grains that can withstand harsh circumstances such as high temperatures, strong acids, and alkalines. It shelters the pollen and protects it during pollination.

2. Intine: A fragile inner layer of cellulose and pectin that forms a thin, continuous covering. The intine promotes the formation of a pollen tube necessary for fertilisation.

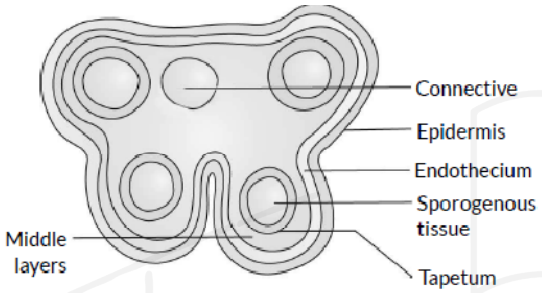
3. Vegetative cell: A vegetative cell is a more giant pollen grain component that contains enough food reserves for pollen germination and tube production during fertilisation.

4. Generative cell: The pollen grain component that divides mitotically to produce two male gametes required for fertilisation.

21. **a.** Ophrys is an orchid that uses mimicry to guarantee pollination by a particular kind of bee. By imitating the female bee's appearance and aroma, the flower draws the male bee, which tries to mate with it (a process known as pseudocopulation) and gathers and spreads pollen.

b. Co-evolution is the process through which two or more species affect one another's evolutionary paths. In the case of the orchid Ophrys and the bee, there is a continuous evolutionary interaction as the flower develops to more closely resemble the female bee, while the bee may develop to become more picky about recognising real female bees.

22. Labelled diagram of a mature anther of an angiosperm is as follows :



23. **(a)** Germ pore is present on exine of pollen grains. It is the place where exine and sporopollenin is absent. The contents of the pollen grain move into the pollen tube through the germ pore.

(b) Sporopollenin is present on the outer surface of pollen grains. Sporopollenin is one of the most resistant organic material known. It can withstand high temperatures and strong acids and alkali. No enzyme that degrades sporopollenin is so far known.

(c) Generative cell is one of the two cells present inside the pollen grain which mitotically produce two male gametes before pollen grains are shed at 3-celled stage.

24. **(a)** Exine is made up of a highly resistant fatty substance called sporopollenin. Sporopollenin is highly protective layer not degraded by any enzyme. It is not affected by high temperature, strong acid or strong alkali. Because of sporopollenin, exine provides protection during the hazardous journey of pollen from anther to stigma. Also, pollen grains are well preserved as microfossils and protected from external adversities due to the presence of sporopollenin.

(b) Exine of pollen grain is not a continuous layer. It bears prominent apertures called germ pores. These are the places from where intine comes out as pollen tube, which carries male gametes required for fertilisation in angiosperms. If the exine is present as a continuous layer, it would render the formation of pollen tube.

(c) Pollen banks are used to store pollen grains for long time, which can be used in plant breeding programmes. In pollen banks, pollens are stored in liquid nitrogen at a temperature of –196°C.

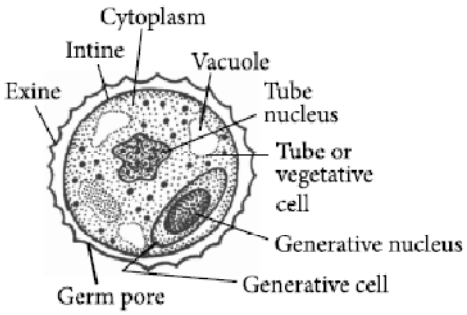
25. Angiosperm anthers consist of two anther lobes therefore are called dithecous.

A microsporangium or pollen sac is a cylindrical sac which appears circular in transverse section. It consists of two parts, outer wall and central homogenous sporogenous tissue. Microsporangial wall has four types of layers - epidermis (common anther covering), endothecium, 1-3 middle layers and tapetum. The outer three perform the function of protection in the young anther and help in dehiscence of the mature anther to release pollen.

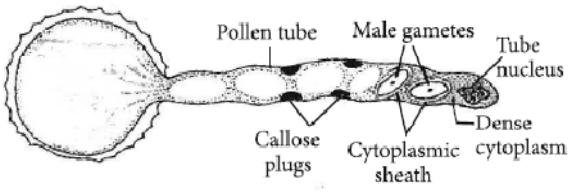
The innermost wall layer is tapetum that nourishes the developing pollen grains. Sporogenous tissue occupies the centre of each microsporangium which undergo meiotic division to form microspore tetrads.

26. **(a)** Microsporogenesis occurs inside the anther of a flower. In an anther, each cell of the sporogenous tissue is a potential pollen or microspore mother cell (PMC). Each PMC divides by meiosis to form a microspore tetrad. This process is called microsporogenesis. As the anthers mature and dehydrate, the microspores dissociate from each other and develop into pollen grains.

(b) Given below is the labelled diagram of a 2 celled male gametophyte or pollen grain.



At the time of germination, a pollen tube is formed and generative nucleus divides to form two male gametes which migrate into the pollen tube. This is known as 3-celled pollen grain or male gametophyte.



27. Before pollination in the pollen sac:

a. Pollen grain/microspore marks the beginning of the male gametophyte, thus it is the first cell of the male gametophyte.

b. It undergoes the first mitotic division to produce a bigger, naked vegetative cell and a small, thin-walled generative cell.

c. The vegetative cell is rich in food and having an irregularly shaped nucleus.

d. The generative cell floats in the cytoplasm of the vegetative cell.

e. The second mitotic division is concerned with generative cells only and gives rise to two non-motile male gametes.

f. The mitotic division of generative cells takes place either in the pollen grain or in the pollen tube.

g. The pollen grains are shed from the anther, at this two-celled stage in most of the angiosperms.

After pollination on the stigma:

a. After pollination, the two-celled pollen grain gets deposited on the stigma and absorbs the sugary stigmatic secretion.

b. Due to this, the volume of the cytoplasm increases, thus creating pressure on the intine.

c. The intine comes out in the form of a tube-like structure called a pollen tube through the germ pore.

d. The tube nucleus, cytoplasm, and generative cell, all migrate into the pollen tube.

e. The pollen tube grows through the style towards the ovule due to some chemical stimulus inside the ovary.

f. The generative cell of the pollen grain divides by mitosis and forms two haploid non-motile gametes.

g. The pollen tube consisting of two male gametes and a degenerating sterile vegetative nucleus represents the male gametophyte.

28. (i)

1. Unisexuality:

In this, the plant bears either male or female flowers. It is also called as dioecism.

Plants may be monoecious, e.g. Maize or dioecious, e.g. Mulberry, Papaya.

2. Dichogamy: In this, anthers and stigmas mature at different times in a bisexual flower due to which self-pollination is prevented. It can be further divided into two types:

a. Protandry:

b. Protogyny:

3. Prepotency:

In this, pollen grains of other flowers germinate rapidly over the stigma than the pollen grains from the same flower, e.g. Apple.

4. Herkogamy: It is a mechanical device to prevent self-pollination in a bisexual flower.

(ii) Self-pollination is discouraged as it leads to inbreeding depression, reducing genetic variability and adaptability in plants.

29. (i). A. Chasmogamous

B. Cleistogamous

(ii). Comparing the two varieties of flowers with respect to:

1. Characteristic Features: Chasmogamous flowers (type A) are often large and beautiful, with open petals that provide pollinators easy access to the reproductive organs. Cleistogamous flowers (type B) are often tiny, inconspicuous, and closed, with petals closely concealing the reproductive organs.

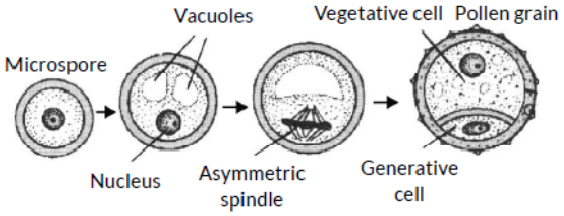
2. Pollination modes: chasmogamous flowers (type A) rely on crosspollination, which is helped by pollinators such as insects, birds, and wind. These blooms attract pollinators by producing an abundance of nectar and pollen. Cleistogamous flowers (type B) pollinate themselves or reproduce autonomously. Because they remain closed, pollinators are less likely to visit them. Instead, they self-pollinate inside the closed bloom, ensuring reproductive success even in the absence of pollinators.

(iii). Two outbreeding devices in flowering plants:

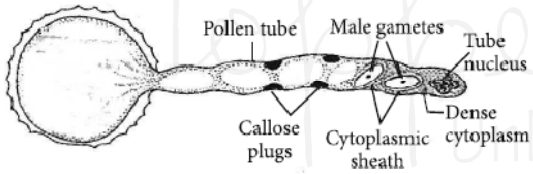
1. Dichogamy: The temporary separation of male and female reproductive organs within a flower or between flowers of the same plant.

2. Herkogamy: structural adaptations that physically prohibit self-pollination, such as the spatial separation of stigma and anthers or specialised floral structures that direct pollinators to reproductive organs. Plants create outbreeding devices to increase genetic variety and reproductive success. Plants promote crosspollination or restrict self-pollination, increasing the chances of successful fertilisation and producing genetically diverse offspring, which helps species survival and adaptation.

30. In an anther, each cell of the sporogenous tissue is a potential pollen or microspore mother cell (PMC). Each PMC divides by meiosis to form a microspore tetrad. This process is called microsporogenesis. As the anthers mature and dehydrate, the microspores dissociate from each other and develop into pollen grains. The hard outer layer called the exine is made up of sporopollenin. The inner wall of the pollen grain is called the intine. When the pollen grain is mature it contains two cells, the vegetative cell and the generative cell.
Different stages of microsporogenesis after microspore formation are shown as:

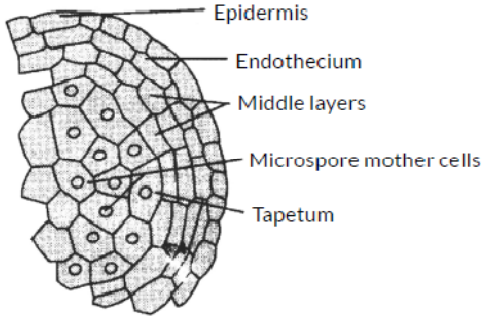


31. (a) The cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads,as the anther develops. Each cell of the sporogenous tissue is capable of giving rise to a microspore tetrad. Each one is a potential pollen or microspore mother cell. The process of formation of microspores from a pollen mother cell (PMC) through meiosis is called microsporogenesis.
(b)



The vegetative tube cell is bigger and has abundant food reserve. The pollen tube releases the two male gametes into the cytoplasm of the synergid after entering one of the synergids. One of the male gametes moves towards the egg cell and fuses with its nucleus leading to the formation of a diploid cell, the zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN).

32. (a) Sectional view of microsporangium of an angiosperm is as follows:



(b) Pollen grain or microspore is the first cell of male gametophyte and represents immature male gametophyte. Development of male gametophyte is precocious, i.e., it begins inside the microsporangium or pollen sac.
Young pollen grain has a centrally placed nucleus embedded in dense cytoplasm covered by plasma membrane. It grows in size with the inflow of nutrients. The protoplast of the pollen grain divides mitotically to form two unequal cells - smaller generative cell and larger tube or vegetative cell. A layer of callose develops around the generative cell which separates the cell from the pollen wall. Later on, callose dissolves and the naked generative cell comes to lie freely in the cytoplasm of the tube cell. The tube cell has vacuolated cytoplasm which is rich in the food reserve and cell organelles. Its nucleus becomes large and irregular. The generative cell is spindle shaped to spherical in outline with thin dense cytoplasm surrounding a prominent nucleus. In some species, the generative cell divides into two non-motile male gametes prior to the dehiscence of anther and release of the pollen grains. Therefore, at the time of pollination, the pollen grain is either 2-celled or 3-celled.

Quick Tip

- **Pollen grain :** 2-celled (tube cell + generative cell)
  3-celled (tube cell + two male gametes)

33. (a) Refer to answer 14.
(b) Refer to answer 8.

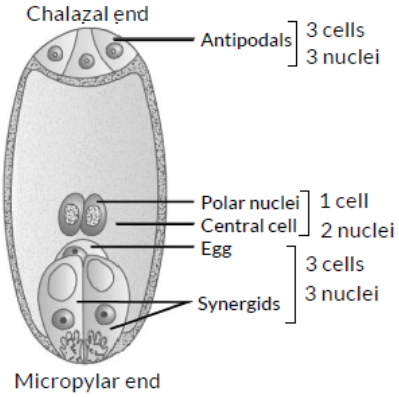
34. (b) : In the given figure, X is nucellus and Y and Z are megaspore dyad. Ploidy of nucellus is 2n. When megaspore mother cell (MMC) undergoes meiosis-I, i.e., reductional division, it results in production of two haploid (n) megaspores.

35. (a)

36. The gynoecium of Papaver is multicarpellary and syncarpous (carpels fused) whereas the gynoecium of Michelia is multicarpellary and apocarpous (carpels free). In Papaver, ovary is unilocular to multilocular whereas in Michelia, ovary is always unilocular.

37. Filiform apparatus refers finger-like projections which arise from cell wall of the synergid and penetrate into the cytoplasm of the central cell. These are present at the micropylar tip of synergids. They play an important role in distribution of nutrients in the embryo sac, secretion of substances that attract pollen tube thereby guiding the pollen tube into synergid and also provide mechanical strength to synergids.

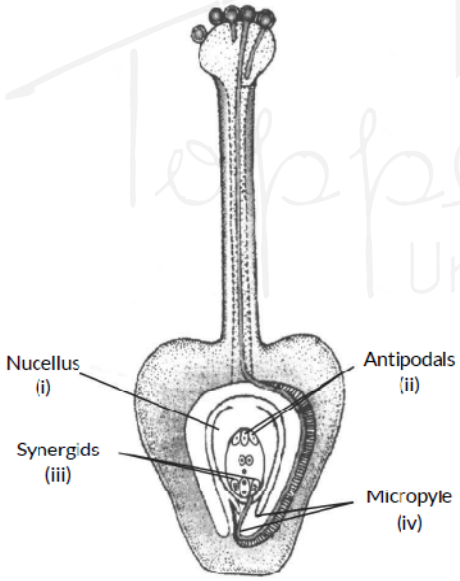
38. Diagrammatic representation of a mature embryo sac is as follows:



It is clear from the above diagram that a mature embryo sac contains 7-cells and 8-nuclei.

39. Gynoecium represents the female reproductive part of a flower. Gynoecium is called apocarpous if the carpels are free, e.g., Michelia and it is called as syncarpous if the carpels are fused, e.g., Papaver (poppy).

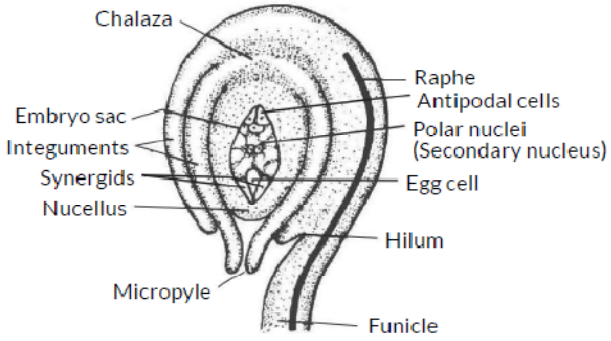
40. (a) Longitudinal section of pistil showing growth of pollen tube is given below:



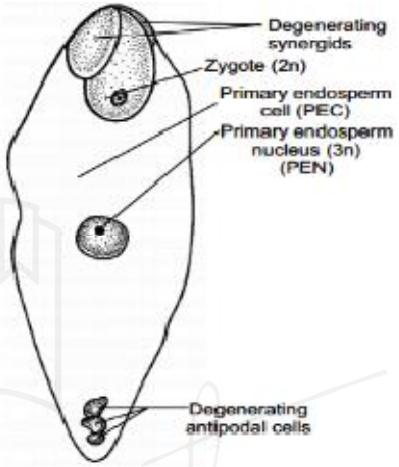
(b) (i) Synergids help in obtaining nourishment from the outer nucellar cells, guide the path of pollen tube by their secretion and function as shock absorbers during the penetration of pollen tube into the embryo sac.

(ii) Micropyle plays an important role in fertilization as the pollen tube enters the ovule through micropyle. It also helps in the germination of seed. The oxygen and water enters the seed at the time of germination through micropyle.

41. Sectional view of anatropous ovule is given as follows:



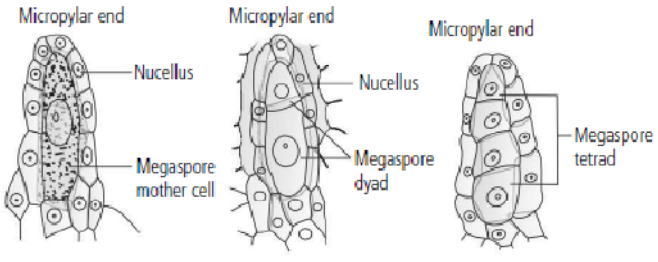
42.

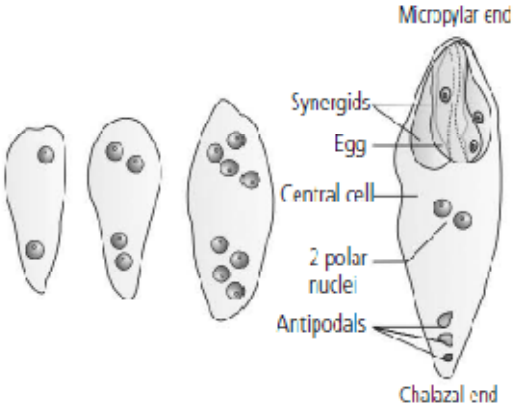


43. (i) In a majority of flowering plants, monosporic development of embryo sac occurs in which one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac).

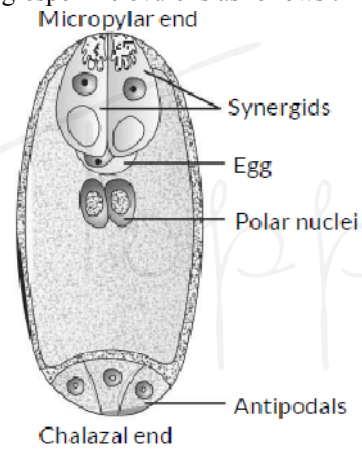
The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. These mitotic divisions are strictly free nuclear, that is, nuclear divisions are not followed immediately by cell wall formation. After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. Six of the eight nuclei are surrounded by cell walls and organised into cells; the remaining two nuclei, called polar nuclei are situated below the egg apparatus in the large central cell.

The diagrammatic representation of the monosporic development of embryo sac in the ovule of an angiosperm is as follows:





(ii) A diagram of the mature embryo sac of an angiospermic ovule is as follows :



44. (i) Megasporogenesis is the formation of megaspore (n) from megaspore mother cell (2n) inside the ovule by the process of meiosis. In the hypodermal region of nucellus towards the micropylar end develops a primary archesporial cell. The primary archesporial cell divides periclinally to form outer parietal cell and inner sporogenous cell. The sporogenous cell functions as megaspore mother cell (MMC). The MMC undergoes meiotic division and produce four haploid megaspores. One of the megaspore is functional while other three degenerate. The functional megaspore develops into female gametophyte (embryo sac). This method of embryo sac development from a single megaspore is termed monosporic development.

(ii) The nucleus of the functional megaspore divides mitotically to form two nuclei which moves to opposite poles, forming 2 nucleate embryo sac.

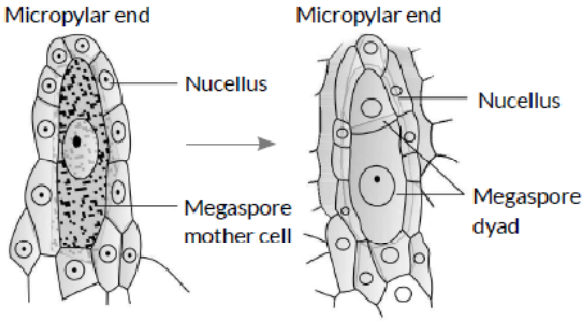
Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. Hence, a total of three mitotic divisions in megaspore results in mature embryo sac.

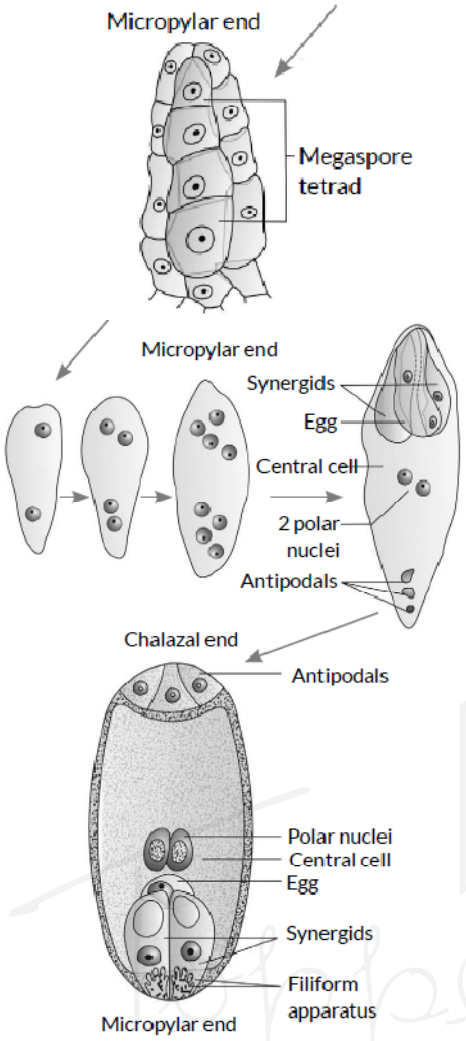
(iii) Female gametophyte of angiosperms is also called embryo sac. A typical female gametophyte is monosporic and Polygonum type. It has four nuclei at the micropylar end and four nuclei at the chalazal end. Three nuclei at the micropylar end organize into egg apparatus consisting of an egg cell and two synergids and one nucleus migrate towards the centre. It is called polar nucleus. Similarly, three nuclei at chalazal end organize into three antipodal cells and one polar nucleus migrates towards the centre.

Thus, a mature female gametophyte has egg apparatus, (2 synergids and 1 egg cell) three antipodal cells and two polar nuclei. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled.

45. The process of formation of megaspores from the megaspore mother cell is called megasporogenesis. It starts inside the nucellus of developing ovule of angiosperms.

Megasporogenesis is the formation of megaspore (n) from megaspore mother cell (2n) inside the ovule by the process of meiosis. In the hypodermal region of nucellus towards the micropylar end develops a primary archesporial cell. The primary archesporial cell divides periclinally to form outer parietal cell and inner sporogenous cell. The sporogenous cell functions as megaspore mother cell (MMC). The MMC undergoes meiotic division and produce four haploid megaspores. One of the megaspore is functional while other three degenerate. Different stages in the formation of embryo sac from functional megaspore are represented diagrammatically as follows :





The functional megaspore is the first cell of female gametophyte or embryo sac. The nucleus of megaspore divides by mitosis into eight daughter nuclei. Two polar nuclei are present in centre which further fuse to form a secondary nucleus. After fertilisation with a male gamete it produces triploid endosperm. Three nuclei at the base of embryo sac form antipodal cells. The remaining three nuclei at the micropylar end constitute egg apparatus, which consists of two cells known as synergids or help cells and an egg cell or oosphere. The egg cell on fusing with one male gamete (fertilisation) gives rise to zygote.

46. (a) Aquatic plants

47. (c) : Emasculation is not required when female parent produces unisexual flowers. Castor, maize and wheat produces bisexual flowers while papaya produces unisexual flowers.

Concept Referred

- Dioecious plant or unisexual flower possesses either male reproductive part or female reproductive part.

48. (d) : Pollen grains are light and non-sticky in windpollinated plants. In marine plants like seagrasses, female flowers remain submerged in water and pollen grains are released inside the water.

49. (c) : Self pollination is fully ensured if the flower is cleistogamous as the flowers do not open at all. Thus, anthers and stigma lie close to each other.

50. (a)

51.
- They show mutualism, where female wasp uses the fruit not only as an oviposition (egg laying) site but uses the developing seeds within the fruit for nourishing its larvae, in return the wasp pollinates the fig inflorescence.
- Co-evolution is the phenomenon that operates in their relationship.

52. Tassels of corn-cob represent female part of the flower which is style and stigma.

53. Pollen-pistil interaction is the group of events that occur from the time of pollen deposition over the stigma to the time of pollen tube entry into ovule. The dialogue between pollen grain and the pistil is mediated by chemical components of the pollen interacting with those of the pistil.
The pistil has the ability to recognise the pollen, whether it is of the right type (compatible) or of the wrong type (incompatible). This is followed by its acceptance or rejection.

54. Differences between geitonogamy and xenogamy are as follows:

S.No.	Geitonogamy	Xenogamy
(i)	It is pollination Between two flowers of the same plant.	It is pollination between two flowers of different plants.
(ii)	The flowers are genetically similar.	The flowers Are genetically different.