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SEXUAL REPRODUCTION IN FLOWERING PLANTS

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IIT-JEE, NEET AND CBSE EXAMS

SEXUAL REPRODUCTION IN FLOWERING PLANTS

IIT-JEE
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ASSERTIONS- REASONS

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ASSERTIONS REASONS

Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

1. **Assertion :** Autogamy is a transfer of pollen grains from an anther to the stigma of the same flower on the same plant.
Reason : Xenogamy is pollination between two flowers on different plants.

2. **Assertion :** Insects visit flower to gather honey.
Reason : Attraction of flowers prevents the insects from damaging other parts of the plant. **[AIIMS 2004]**

3. **Assertion :** Pollen mother cells (PMCs) are the first male gametophytic cells.
Reason : Each PMC gives rise to two pollens. **[AIIMS 2009]**

4. **Assertion :** Chasmogamous flowers require pollinating agents.
Reason : Cleistogamous flowers do not expose their sex organs. **[AIIMS 2012]**

5. **Assertion:** Gynoecium consists of pistil.
Reason: It represents the male reproductive part in flowering plants.

6. **Assertion:** Flowers are the structures related to sexual reproduction in flowering plants.
Reason: Various embryological processes of plants occur in a flower.

7. **Assertion:** Geitonogamy is genetically similar to autogamy.
Reason: The pollen grains come from same plant.

8. **Assertion:** Cleistogamous flowers produce assured seed set in the absence of pollinators.
Reason: These flowers do not open at all.

9. **Assertion:** A typical microsporangium of angiosperms is generally surrounded by four wall layers.
Reason: The outer three wall layers perform the function of protection and help in dehiscence of anther to release the pollen.

10. **Assertion:** Exine of a pollen grain is made up of sporopollenins which are resistant to high temperatures, strong acids or alkali as well as enzymatic degradation.
Reason: Sporopollenins are absent in the region of germ pores.

11. **Assertion:** An angiospermous flower represents the modified condensed shoot which performs the function of sexual reproduction.
Reason: The fertile leaves of the shoot become modified into microsporophylls and magasporophylls which bear ovules and anthers respectively.

12. **Assertion:** Although geitonogamy is functionally cross-pollination involving a pollinating agent, genetically it is similar to autogamy since the pollen grains come from the same parent.
Reason: In getionogamy, pollen grains from the anthers of one flower are transferred to the stigma of another flower borne on the same plant.

13. **Assertion:** The pre-pollination growth of male gametophyte occurs inside the microsporangium whereas the rest of the growth occurs over the female reproductive organs.
Reason: Growth of the entire female gametophyte occurs inside the megasporangium.

14. **Assertion:** Hydrophily is a major mode of pollination in most of the aquatic plants in angiosperms.
Reason: Almost all the aquatic dicot and monocot plants require water for the transport of male gametes and for fertilisation.

15. **Assertion:** Pollen grains from male parent are mostly transferred to the stigma in the female parent by some external agency.
Reason: This is because the male flowers or male organs have no internal device to reach the female organs in another flower.

16. **Assertion:** In angiosperms, the male gametophyte is the pollen grain.
Reason: Pollen grain contains stigma, style and ovary.

17. **Assertion:** Xenogamy is pollination between two flowers on different plants.
Reason: Pollination between two flowers on the same plant is autogamy.

18. **Assertion:** Anemophilous plants have to produce enormous quantities of pollen.
Reason: Because during the transit of pollen through a wind, a considerable amount of pollen is lost.

19. **Assertion:** Tapetum helps in the dehiscence of microspores from tetrad.
Reason: It shows callose activity.

20. **Assertion:** Megaspore mother cell undergoes meiosis to produce four haploid gametes.
Reason: Megaspore mother cell is $2n$, meiosis gives haploid structure.

21. **Assertion:** Megaspore mother cell undergoes meiosis to produce four megaspores.
Reason: Megaspore mother cell and megaspore both are haploid.

22. **Assertion:** Meiosis is the cell division which occurs in sexually reproducing organisms.
Reason: Meiotic cell division results into two cells having exactly same genetic make up.

23. **Assertion :** If pollen mother cells has 42 chromosomes, the pollen has only 21 chromosomes.
Reason : Pollens are formed after meiosis in pollen mother cell. **[AIIMS 1997]**

24. **Assertion:** In a microsporangium, the tapetal cells possesss little cytoplasm and generally have a single prominent nucleus.
Reason: During microsporogenesis, the microspore mother cells (MMCs) undergo mitotic divisions to produce haploid microspore tetrads.

25. **Assertion:** In most angiosperms, microspores of a tetrad grow and separate from one another shortly after meiosis.
Reason: In the members of familes Orchidaceae and Asclepiadaceae, all the pollen grains of a sporangium remain united to form a compact structure called pollinium.

26. **Assertion :** Double fertilization is characteristic feature of angiospersms.
Reason : Double fertilization involves two fusions. **[AIIMS 2016]**

27. **Assertion :** The ovary forms fruit after fertilization.
Reason : The ovary forms parthenocarpic fruits without fertilization.

28. **Assertion :** The two cotyledons in seed are embryonic leaves.
Reason : The embryo contains radicle and plumule.

29. **Assertion :** The largest cell of the embryo sac is central cell.
Reason : It consists of a fused nuclei.

30. **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.

31. **Assertion :** The megaspore mother cell divides meiotically to produce four spores.
Reason : Megaspore mother cells are haploid and megaspore is diploid.

32. **Assertion :** Nuclear endosperm is formed by subsequent nuclear division without wall formation.
Reason : Coconut is an example of such endosperm, where the endosperm remains nuclear throughout the development of the fruit.

33. **Assertion:** The method of development of embryo sac from a single functional megaspore is termed as monosporic development.
Reason: In monosporic type of embryo sac development, usually the megaspore which is situated towards micropylar end remains functional.

34. **Assertion:** The suspensor serves as the main nutritive tissues for the embryo during embryo development in dicots.
Reason: The last cell of the suspensor at the end adjacent to the embryo is known as haustorium.

35. **Assertion:** The embryo capable of germination should have well-developed radicle plumule and one or two cotyledons.
Reason: In Orobanchaceae and Orchidaceae the embryo never differentiates a true radicle, plumule and cotyledons, but can germinate.

36. **Assertion:** Proembryo is restricted to 2-celled stage.
Reason: It has one basal and one apical cell.
37. **Assertion:** Anatropous type of ovule is most common.
Reason: Anatropous ovule resembles a horse-shoe.
38. **Assertion:** Megaspore mother cell undergoes meiotic division.
Reason: All four megaspores form female gametophyte.
39. **Assertion:** The chalazal cells of the embryo sac are called central cell.
Reason: They play nutritive role for embryo sac.
40. **Assertion:** The largest cell of the embryo sac is central cell.
Reason: It consists of a fused nuclei.
41. **Assertion:** Synergids play an important role in directing pollen tube growth.
Reason: Because synergids secrete some chemotropically active substance.
42. **Assertion:** The two sperms in a pollen tube often change their shape.
Reason: The sperms are released in the synergid as intact cells but only their nuclei migrate.
43. **Assertion:** In apomixis, plants of new genetic variations are not produced.
Reason: In apomixis, reductional division takes place.
44. **Assertion:** Apomixis is a form of asexual reproduction that mimics sexual reproduction in plants.
Reason: Apomixis involves the production of seeds without the fusion of gametes.
45. **Assertion:** The pollen sterility has been attributed to the malfunctioning of tapetum.
Reason: Premature degeneration of the tapetum deprives the developing spores of its nutrition.
46. **Assertion:** Self-incompatibility is a genetic mechanism which prevents pollen from the same flower or other flowers of the same plant from fertilizing the ovules by inhibiting pollen germination or pollen tube growth in the pistil.
Reason: In gametophytic self-incompatibility, the incompatibility reaction is determined by the genotype of the sporophytic tissue of the plant frome which the pollen is derived.
47. **Assertion:** Endosperm development precedes embryo development in angiosperms.
Reason: Double fertilization ensures that the nutritive tissue is formed only when the formation of embryo has taken place so that the energy spent on the formation of endosperm does not get wasted.
48. **Assertion:** Coconut water represents the cellular endosperm and the surrounding white kernel represents the free-nuclear endosperm in Cocos nucifera.
Reason: PEN undergoes a number of free nuclear divisions all of which are subsequently followed by wall formation.
49. **Assertion:** Ex-albuminous seeds do not possess any residual endosperm, as it is compeltely consumed during embryo development.
Reason: Wheat, castor, pea and groundnut are all the examples of ex-albuminous seeds.
50. **Assertion:** Formation of nucellar endosperm occurs by subsequent nuclear division without wall formation.
Reason: Coconut is an example of such endosperm, where the endosperm remains nuclear throughout the development of the fruit.
51. **Assertion:** Cellular endosperm is formed by both nuclear division and wall formation.
Reason: It lacks haustoria.
52. **Assertion:** Non-albuminous seeds have no residual endosperm.
Reason: The endosperm is completely consumed during embryo development.
53. **Assertion:** Mango is a true fruit.
Reason: The thalamus also contributes to formation of fruit in false fruits.
54. **Assertion:** Some fruits are seedless or contain non-viable seeds.
Reason: They are produced without fertilisation.
55. **Assertion:** The first step in artificial hybridisation is removal of anthers.
Reason: It prevents contamination of anthers.
56. **Assertion:** Endosperm development proceeds embryo development.
Reason: It assures nutrition to developing embryo.

Solutions

1. **(c)** Based on the destination of pollen grains, two types of pollination are recognised. When pollen grains are transferred from an anther to the stigma of the same flower the process is called self-pollination or autogamy. Cross-pollination is further classified depending on whether the pollination has occurred between two flowers on the same plant (geitonogamy) or between two flowers on different plants (xenogamy).
2. **(d)** Honey bee visit flowers to gather nectar and turn it into honey. Visiting of insects for nectar helps in pollination.
3. **(d)** Primary sporogenous cell gives rise to microspore mother cells or pollen mother cells (PMCs). They are sporophytic in nature *i.e.*, diploid. These cells undergo meiosis (reduction division) which gives rise to 4 microspores or pollens and this formation of microspores or pollens is called microsporogenesis. Microspores represent the beginning of the gametophytic phase and they are haploid in nature.
4. **(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.
5. **(c)** The gynoecium represents the female reproductive part of the flower consisting of pistil.
6. **(a)** Embryological processes occur in ovary, which is a part of flower.
7. **(a)** Geitonogamy is functionally cross-pollination involving pollinating agent, genetically it is similar to autogamy since the pollen grains come from the same plant.
8. **(a)** Cleistogamous flowers do not open at all thus ensuring fertilisation and hence produce assured seed-set even in the absence of pollinators.
9. **(b)** A typical microsporangium consists of two parts, outer wall and central homogeneous sporogenous tissue. Microsporangial wall has four types of layers– epidermis, endothecium, 1–3 middle layers and tapetum. The outer three wall layers perform the function of protection in the young anther and mechanism of dehiscence in the ripe anther.
10. **(b)** Wall of a pollen grain consists of two layers– outer exine and inner intine. Exine is the hard outer layer which is made up of sporopollenin. Sporopollenin is one of the most resistant organic material known. It can withstand high temperature, strong acids or alkali and is not degraded by enzymes. Because of the presence of sporopollenin, pollen grains are well preserved as fossils. At certain places, the exine is thin or absent, these areas may have thickened intine or deposition of callose. They are called germ pores (if rounded) or germinal furrows (if elongated). Sporopollenin is absent in the region of germ pores or germinal furrows.
11. **(c)** A flower is a modified condensed shoot specialised to carry out the function of sexual reproduction in angiosperms. Like a branch, it arises in the axil of a small leaf like structure called bract. The receptalce (thalamus or torus) of a flower supports all the floral appendages (i.e., sepals, petals, stamens and carpels). The receptalce consists of several crowded nodes which are separated by condensed internodes. The fertile leaves of the shoot become microsporophylls (stamens) and megasporo phylls (carpels) which bear anthers and ovules respectively. The anthers produce pollen grains and the ovules possess eggs.
12. **(a)** Geitonogamy is a type of pollination in which pollen grains of one flower are transferred to the stigma of another flower belonging to either the same plant or genetically similar plant. It usually occurs

in plants which show monoecious condition (unisexual male and female flowers borne on the same plant. Thus, geitonogamy is functionally cross pollination as it involves pollinating agent to carry out pollination, but genetically it is similar to autogamy (self-pollination) since the pollen grains come from the genetically same plant.

13. **(b)** Pollen grain or microspore is the first cell of male gametophyte generation and represents immature male gametophyte generation and represents immature male gametophyte. Development of male gametophyte is precocious, that is, it begins inside the microsporangium or pollen sac. The pollen grain is shed at 2 or 3 celled stage. The liberated pollen grains are transferred to the receptive surface of the carpel (i.e., stigma) through pollination. Growth of the pollen grain further occurs over the female reproductive organs. Female gametophyte or embryo sac is an oval multicellular haploid structure which is embedded in the nucellus towards micropylar end of the ovule (or integumented megasporangium). Whole of the development of female gametophyte occurs inside the megasporangium.

14. **(d)** Hydrophily is the mode of pollination which is accomplished through the agency of water. Pollination by water is quite rare in flowering plants and is limited to only about 30 genera, mostly monocotyledons e.g., *Vallisneria*, *Zostera, Ceratophyllum*, etc. In many aquatic plants with emergent flowers, pollination occurs by wind or insects, e.g., Lotus, Water Lily, Water Hyacinth, etc.

15. **(a)** Internal copulatory organs are absent in plants and thus the aid of an external agency is required for the transfer of pollen grains from the anther to the stigma.

16. **(c)** Pollen grain does not contain the stigma, style and ovary. It is female gametophyte (gynoecium) which contains stigma, style and ovary.

17. **(c)** Two types of pollination are recognised based on the destination of pollen grains. When pollen grains are transferred from an anther to the stigma of the same flower, the process is called self pollination or autogamy. Cross-pollination is further classified depending on whether the pollination has occurred between two flowers on the same plant (geitonogamy) or between two flowers on different plants (xenogamy).

18. **(a)** Wind pollinated or anemophilous plants produce a large amount of pollen to compensate for the loss of pollen grains during transfer.

19. **(a)** In *Tradescantia bracteata,* it has been shown that the plasmodial cytoplasm derived from the tapetum has callose activity. Shortly before callose degradation starts the cytoplasm of tapetal cells show certain vesicles which are probably associated with callose activity. This suggests that sporophytic tissue, presumably tapetum, is involved in the synthesis of callose enzyme for the release of microspores in a tetrad by degrading the callose wall.

20. **(a)** Megaspore mother cell is diploid and after meiosis four haploid megaspores are formed.

21. **(c)** Megaspore mother cell is diploid and megaspore is haploid.

22. **(c)** In meiotic cell division the resultant cell does not have the exact genetic make up due to the process of crossing over. Crossing over takes place in the meiotic cell division only.

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

24. **(d)** Tapetum is the innermost wall layer of a microsporangium. It nourishes the developing pollen grains. The tapetal cells enlarge radially and become filled with dense protoplasmic contents as well as nutrients. Tapetal cells are generally multinucleate or their nucleus becomes polyploid due to endoploidy. Microsporogenesis refers to the process of formation of haploid microspores (or pollen grains) from a microspore mother cell (MMC) or pollen mother cell (PMC_ through meiosis (and not mitosis).

25. **(b)** In most angiosperms, microspores (pollen grains) of a tetrad grow and separate from one another shortly after meiosis. However, in some plants the spores tend to remain together in tetrads for longer periods and develop into pollen grains (*e.g., Drimys, Drosera*). In many members of families Orchidaceae and Asclepiadaceae, all the microspores in a sporangium remain united to form a pollinium.

26. **(b)** Double fertilization is a characteristic feature of angiosperms. It involves two fusions in which one female gametes fuse with egg cell to form zygote and other male gamete fuses with the diploid secondary nucleus to produce triploid primary endosperm nucleus.

27. **(b)** After fertilization the ovary begins to grow and gradually matures into the fruit. In some cultivated varieties of oranges, banana, grapes, apples, pineapples and some other fruits the ovary may grow into the fruit without fertilization. Such a fruit is seedless or with immature seeds and is known as the parthenocarpic fruits.

28. **(b)** In angiosperms, cotyledons are embryonic leaves. Embryo also has radicle and plumule which gives rise to root and shoot respectively.

29. **(b)** The central cell is the largest cell of the embryo sac. It has a highly vacuolate cytoplasm which is rich in reserve food and golgi bodies. In the middle the cell contains two polar nuclei which have large nucleoli. The polar nuclei fuse to form a single diploid secondary or fusion nucleus.

30. **(a)** In angiosperm, triploid endosperm is formed by fusion of secondary nucleus and second male gamete. This tissue is used by developing embryo.

31. **(c)** The megaspore mother cell is diploid. This divides by meiotic division and produce four haploid megaspores.

32. **(c)** In nuclear type of endosperm the division of the primary endosperm nucleus and a few subsequent nuclear division are not accompanied by wall formation. So numerous nuclei are freely suspended in its sap. In coconut, the primary endosperm nucleus undergoes a number of free nuclear divisions. When the fruit is about 50 mm long before the embryo sac gets filled with a clear fluid in which float numerous nuclei of various sizes. At a later stage (about 100 mm long fruit) the suspension shows in addition to free nuclei, several cells each enclosing variable number of nuclei. Gradually these cells and free nuclei start setting at the periphery of the cavity and layers of cellular endosperm start appearing. In mature coconuts the liquid endosperm becomes milky and it does not contain free nuclei or cell.

33. **(c)** In monosporic (*Polygonum*) type of development of embryo sac, only one megaspore situated towards chalazal end remains functional. The remaining three megaspores gradually degenerate and finally disappear. The functional haploid megaspore enlarges in size and, by means of three successive mitotic divisions, gives rise to an eight-nucleate embryo sac. This type of embryo sac development occurs in a majority of flowering plants and the common example is *Polygonum*.

34. **(d)** During embryo development in dicots, the suspensor cell divides transversely a few times to produce a filamentous suspensor of 6-10 cells. The first cell of suspenor towards the micropylar end becomes swollen and functions as haustorium whereas the last cell of suspensor at the end adjacent to the embryo is known as hypophysis. The function of the suspensor is to anchor the embryo to the embryo sac and push it deep into the endoperm so that the embyo lies in a nutritionally favourable environment.

35. **(b)** Embryo generally possesses an embryonic root (radicle) a embryonic shoot (plumule) and one or two cotyledons irrespective of its mode of development a nature. Some groups of plants however, are characterised by the presence of reduced embryos, lacking the differentiation of these organs, for example, the plants of Balanophoraceae, Orchidaceae, Orobanchceae.

36. **(a)** From the 2-celled stage until the initiation of organs the embryo is commonly called proembryo. In the majority of angiosperms the zygote divides transversely, resulting in small apical cell towards the interior of the embryo sac and a large basal cell.

37. **(c)** The ovules where the micropyle comes to lie close to the funiculus due to unilateral growth of the ovule are called anatropous. This is the most common type of ovule in angiosperms. The curvature of the ovule also affects the nucellus in a way that the later becomes horse shoe-shaped the ovule is called amphitropous.

38. **(c)** One hypodermal nucellar cell of the micropylar region differentiates the sporogenous cell. It forms a diploid megaspore mother cell or megasporocyte. The megaspore mother cells undergo meiosis and forms a row of four haploid megaspores. Only the chalazal megaspore remains functional Megaspore enlarges and gives rise to female gametophyte, also called embryo sac.

39. **(b)** The three chalazal cells of the embryo sac are called antipodal cells. They are the vegetative cells of the embryo sac which may degenerate soon or take part in absorbing nourishment from the surrounding nucellar cells. Internally they are connected with the central cell by means of plasmodesmata.

40. **(b)** The central cell is the largest cell of the embryo sac. It consists of a highly vacuolate cytoplasm which is rich in reserve food and Golgi bodies. In the middle the cell contains two polar nuclei which have large nucleoli. The polar nuclei fuse to form a single diploid secondary or fusion nucleus.

41. **(a)** Synergids are special type of cells found in the embryo sac which direct the growth of the pollen tube towards the egg cell for fertilization by the sperm cell.

42. **(b)** Each pollen grain contains a vegetative cell, and a generative cell that divides to form two sperm cells. The vegetative cell then produces the pollen tube, a tubular protrusion from the pollen grain, which carries the sperm cells within its cytoplasm. The sperm cells are the male gametes that will join with the egg cell and the central cell in double fertilization. The two sperms in a pollen tube often change their shape.

43. **(c)** Apomixis is the type of asexual reproduction in which development of reproductive propagules takes place without meiosis and syngamy. There are two kinds of apomixis (asexual reproduction) in flowering plants: Agamospermy and vegetative propagation. Agamospermy is further divided into three types:

(i) Adventive Embryony: Formation of embryo directly from the diploid sporophytic cells (nucellus integument) of ovule (other than zygote) is called adventives embryony, e.g., Citrus.

(ii) Parthenogenesis: Formation of embryo from unfertilized egg.

(iii) Apospory and apogamy: Formation of embryo from any other cell of embryo sac (other than egg) without fertilization. During embryogenesis, an embryo develops from zygote inside the embryo sac and the embryo sac becomes an endosperm. Apomictic embryo, if develops, increases the number of embryos inside the seed. Occurrence of more than one embryo in a seed is called polyembryony.

44. **(a)** Apomixis is a mode of reproduction in some plants which results in the formation of seeds without gametic fusion. It is a form of asexual reproduction. In plants, apomixis commonly mimics sexual reproduction but produces seeds without fertilization, e.g., some species of Asteraceae and grasses. There are several methods of apomictic development in seeds.

45. **(a)** Tapetum acts as a nourishing tissue for the developing microspores. If degeneration of tapetum occurs earlier than usually the spores are deprived of nutrition and as a result the pollen grains released are sterile.

46. **(c)** Self-incompatibility is the inability of pollen from a flower to germinate on the stigma of the same flower (or other flower of same plant). Two categories of self-incompatibility

have been recognized depending on the origin of factors determining the mating types :

(i) Gametophytic self-incompatibility (GSI). The incompatibility process is determined by the genotype of male gametophyte (pollen) itself, e.g., Liliaceae, Poaceae, Solanaceae.

(ii) Sporophytic self-incompatibility (SSI). The incompatibility process is controlled by the genotype of the sporophytic tissue of the plant from which the pollen is derived, e.g., Asteraceae, Brassicaceae.

47. (a) During double fertilization occurs in angiosperms, one male gamete fuses with the egg to form the diploid zygote (syngamy or generative fertilization). the diploid zygote finally develops into embryo. The other male gamete fuses with the two polar nuclei (or secondary nucleus) to form the triploid primary endosperm nucleus, PEN (triple fusion or vegetative fertilization). Double fertilization ensures that the nutritive tissue is formed only when the formation of embryo has taken place by fertilization of the oosphere or egg so that the energy spent on the formation of endosperm does not go waste in case the fertilization fail.

48. (d) In *Cocos nucifera* (coconut), the coconut water is free-nuclear endosperm and the surrounding kernel represents the cellular endosperm. The primary endosperm nucleus (PEN) first undergoes a number of free nuclear divisions without wall formation to form a large number of free nuclei (free nuclear endosperm).

49. (c) In some seeds, the endosperm persists in the seed as food storage tissue. Such seeds are called endospermic or albuminous, e.g., Castor, Maize, Wheat, Barley, rubber, coconut. In others, the endosperm is completely eaten up by the growing embryo. The food for later development of embryo is then stored in cotyledons which become massive. Such seeds are non-endospermic or ex-albuminous, e.g., Pea, Gram, Bean, Groundnut.

50. (c) The division of the primary endosperm nucleus and a few subsequent nuclear division are not accompanied by wall formation in nucellar type of endosperm. So numerous nuclei freely suspended in its sap. In coconut, the primary endosperm nucleus undergoes a number of free nuclear divisions. When the fruit is about 50 *mm* long before the embryo sac gets filled with a clear fluid in which float numerous nuclei of various sizes. At a later stage the suspension shows in addition to free nuclei, several cells each enclosing variable number of nuclei.

51. (c) Cellular endosperm is characterized by the absence of free nuclear stage. The division of the primary endosperm nucleus and a few subsequent nuclear division are regularly followed by wall formation. The occurrence of haustoria is a common feature of this type of endosperm. The haustoria may be micropylar or chalazal. Occasionally, both types of haustoria are present in the same plant.

52. (a) In non-albuminous seeds the endosperm is fully consumed by the developing embryo and thus no residue is left.

53. (b) In false fruits the thalamus also contributes to fruit formation, e.g. apple, cashew nut, etc.

54. (a) parthenocarpic fruits are seedless because there is no fertilisation.

55. (c) Emasculation is done in hybridisation and female flower is bagged to prevent contamination.

56. (a) Endosperm is source of nutrition for the developing embryo, thus the nature ensures that endosperm is formed before starting the process of embryogenesis.