2. Sexual Reproduction in Flowering Plants

Question 1. Name the parts of an angiosperm flower in which the development of male and female gametophyte take place.

Answer: The male gametophyte or the pollen grain develops inside the pollen chamber of the anther, whereas the female gametophyte (also known as the embryo sac) develops inside the nucellus of the ovule from the functional megaspore.

Question 2. Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events? Name the structures formed at the end of these two events.

Answer:

Character	Microsporogenesis	Megasporogenesis
1. Definition	This is the formation of microspores in sporogenous tissue (microspore mother cell) due to meiosis.	This is the formation of megaspores in megaspore mother cell due to meiosis.
2. Number of spore mother cells involved	Many.	One.
3. Fate of spore	Microspore leads to development of male gametophyte.	Leads to formation of female gametophyte (embryo sac).
4. Site of occurrence	Pollen sacs (microsporangia) in anther lobes.	In nucellus of ovule.

Type of cell division during microsporogenesis and megasporogenesis meiosis.
Structure formed — (a) Due to microsporogenesis. Microspores (pollen grains) are formed which lead to development of male gametophyte.(b) Due to megasporogenesis. Megaspores are formed. Out of them one megaspore leads to development of female gametophyte (embryo sac).

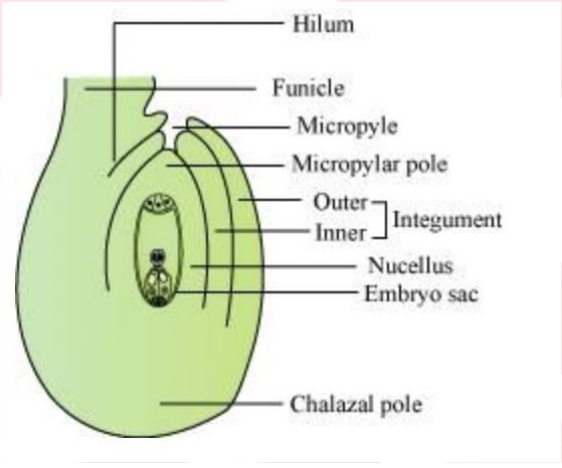
Question 3. Arrange the following terms in correct developmental sequence:Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes

Answer: The correct development sequence is as follows:
Sporogenous tissue – pollen mother cell – microspore tetrad – Pollen grain – male gamete

During the development of microsporangium, each cell of the sporogenous tissue acts as a pollen mother cell and gives rise to a microspore tetrad, containing four haploid microspores by the process of meiosis (microsporogenesis). As the anther matures, these microspores dissociate and develop into pollen grains. The pollen grains mature and give rise to male gametes.

Question 4. With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.

Answer: The diagram of a typical angiosperm ovule is as follows:



An ovule consists of funicle, micropyle, integuments, nucellus, embryo sac, hilum, chalaza etc.
Funicle - It is the stalk of ovule which connects ovule to the placenta. Funicle is short and multicellular.
Hilum - It is the point where funicle connects the main body of the ovule.
Integuments - These are the layers that surround the ovule. There can be outer integument and inner

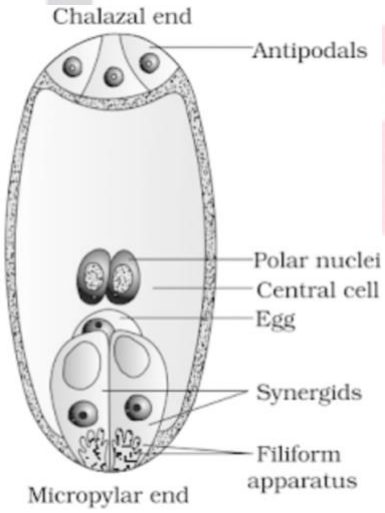
integument. The main function of integuments is to protect the inner tissues.
Micropyle - The opening which is present at the top of integuments is called micropyle. The main function of micropyle is to allow the entry of the pollen tube into the ovule.
Nucellus - Integuments surround parenchymatous tissue which constitutes the main body of the ovule and is called nucellus. The primary function of nucellus is to provide nutrition to the developing embryo.
Chalaza - The swollen part of ovule present opposite to micropyle is called chalaza.
Embryo sac- It is present in the nucellus and it contains female gamete called egg.

Question 5. What is meant by monosporic development of female gametophyte?

Answer: Megaspore is the first cell of the female gametophyte. Depending upon the number of megaspores the development of female gametophyte is termed as monosporic, bisporic or tetrasporic. Monosporic development starts with meiosis in megaspore mother cell to form a dyad and then tetrad of megaspores. Out of four, one is functional that undergoes the three simultaneous divisions to form 2-, 4- and finally 8-nucleate and 7-celled embryo sac.

Question 6. With a neat diagram, explain the 7-celled, 8 nucleate nature of female gametophyte.

Answer: The eight nucleate female gametophytes of flowering plants have an egg apparatus made of one egg cell and two flanking cells at the micropylar end. The flanking cells are known as synergids and have finger-like projections on the wall which forms filiform apparatus. Three cells present at the chalazal end of embryo sac are called as antipodals. The large central cell has two polar nuclei. This makes embryo sac 7 celled and 8 nucleate structure.



Question 7. What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.

Answer: There are two types of flowers present in plants namely Oxalis and Viola − chasmogamous and cleistogamous flowers.
Chasmogamous flowers have exposed anthers and stigmata similar to the flowers of other species.
Cross-pollination cannot occur in cleistogamous flowers. This is because cleistogamous flowers never open at all. Also, the anther and the stigma lie close to each other in these flowers. Hence, only self-pollination is possible in these flowers.

Question 8. Mention two strategies evolved to prevent self-pollination in flowers.

Answer: The strategies evolved to prevent self-pollination in flowers are:
1) Dichogamy- The maturation of anthers and stigma at different time in a bi-sexual flower which prevents self-pollination.
2) Self-incompatibility: The pollen grains of a flower are not capable of completing growth on the stigma of the same flower.

Question 9. What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?

Answer: Self incompatibility is also called self-sterility. It is the natural inability to prevent self-pollination in which pollen grains from the same flower is unable to fertilize ovules of same flower or plant.
It happens due to several complex mechanisms. These could be saprophytic or gametophytic incompatibility. Prevent of pollen germination, retardation of growth, reorientation of pollen tube, failure of nuclear fusion could be one of the reason.

Question 10. What is bagging technique? How is it helpful in a plant breeding programme?

Answer:
i)In the flowers with both anther and stigma, the anther is removed before maturation carefully using forceps.

ii)The flower is then covered with a bag made up of butter paper.

iii)The covering of emasculated flowers with a bag of suitable size, generally made up of butter paper, to prevent contamination of its stigma with unwanted pollens is called bagging technique.

iv) When the stigma matures, the pollens from desired flower are dusted on the stigma with the help of pre-sterilized brush and the flower is re-bagged until the fruit is developed.

v) This technique is called artificial hybridization. Plant breeders often use this method to prevent the contamination of stigma of flowers from unwanted pollens. This technique is also helpful is developing the plant of desired variety.

Question 11. What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.

Answer: Triple fusion is the fusion of the male gamete with two polar nuclei inside the embryo sac of the angiosperm.
This process of fusion takes place inside the embryo sac.
When pollen grains fall on the stigma, they germinate and give rise to the pollen tube that passes through the style and enters into the ovule. After this, the pollen tube enters one of synergids and releases two male gametes there. Out of the two male gametes, one gamete fuses with the nucleus of the egg cell and forms the zygote (syngamy). The other male gamete fuses with the two polar nuclei present in the central cell to form a triploid primary endosperm nucleus. Since this process involves the fusion of three haploid nuclei, it is known as triple fusion. It results in the formation of the endosperm. One male gamete nucleus and two polar nuclei are involved in this process.

Question 12. Why do you think zygote is dormant for sometime in a fertilized ovule?

Answer: Further development of zygote into embryo and subsequent development of embryo need food resources. The food is provided by endosperm. Hence, endosperm needs to develop to ensure development of embryo. Hence, zygote remains dormant for some time till endosperm develops.

Question 13. Differentiate between:

1. **Epicotyl and hypocotyl**
2. **Coleoptile and coleorrhiza**
3. **Integument and testa**
4. **Perisperm and pericarp**

Answer:

(a) Hypocotyl and epicotyl

Hypocotyl	Epicotyl
The portion of the embryonal axis which lies below the cotyledon in a dicot embryo is known as the hypocotyl.	The portion of the embryonal axis which lies above the cotyledon in a dicot embryo is known as the epicotyl.
It terminates with the radicle.	It terminates with the plumule.

(b) Coleoptile and coleorhiza

Coleoptile	Coleorhiza
It is a conical protective sheath that encloses the plumule in a monocot seed.	It is an undifferentiated sheath that encloses the radicle and the root cap in a monocot seed.
It comes out of the soil.	It remains inside the soil.
It breaks the seed coat and grows.	It breaks the seed coat and stops the growth.

(c) Integument and testa

Integument	Testa
It is the outermost covering of an ovule. It provides protection to it.	It is the outermost covering of a seed.
It is composed of living cells.	It is composed of dead cells.
Usually one or two layered.	It is single layered.

(d) Perisperm and pericarp

Perisperm	Pericarp
It is the residual nucellus which persists. It is present in some seeds such as beet and black pepper	It is the ripened wall of a fruit, which develops from the wall of an ovary.
It is usually dry.	It can be dry or fleshy.
It is non-functional in seeds.	It is functional.

Question 14. Why is apple called a false fruit? Which part of the flower forms the fruit?

Answer: Fruits derived from the ovary and other accessory floral parts are called false fruits. On the contrary, true fruits are those fruits which develop from the ovary, but do not consist of the thalamus or any other floral part. In an apple, the fleshy receptacle forms the main edible part. Hence, it is a false fruit.

Question 15. What is meant by emasculation? When and why does a plant breeder employ this technique?

Answer: Emasculation is the process of removal of stamens from a bisexual flower before they shed pollen in order to prevent self-pollination and permit cross-pollination of . stigma with unwanted pollen. During breeding, the breeder wants to make sure that the desired pollen grains are used for pollination and the stigma is protected from contamination (from unwanted pollen).
This technique is employed as the first step before pollination. A plant breeder employs this technique to select specific traits in order to get disease-resistant plants.

Question 16. If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?

Answer: Parthenocarpy is the system of developing fruits without involving the system of fertilization or seed formation. consequently, the seedless varieties of economically essential culmination such as orange, lemon, water melon and many others. are produced the usage of this technique. This technique entails inducing fruit formation by using the utility of plant boom hormones which includes auxins.

Question 17. Explain the role of tapetum in the formation of pollen grain wall.

Answer: The innermost wall layer of microsporangium is called tapetum. Cells of tapetum have dense cytoplasm and generally have more than one nucleus.

Functions of tapetum –
• It provides nourishment to the developing pollen grains.
• Helps in the formation of exine (the hard outer layer of pollen grain) which is composed of sporopollenin.
• It secretes hormones and enzymes

Question 18. What is apomixis and what is its importance?

Answer: Apomixis is the mechanism of seed production without fertilization. It is a kind of asexual reproduction which mimics sexual reproduction, where the female gametophyte or the ovule in the flower directly develops into an embryo skipping meiosis and syngamy. Thus apomixis produces a clonal progeny with a maternal genotype.

Apomixis is of high importance as;

- It produces seed progeny which are exactly the same as the mother plant. Thus apomixis helps in the preservation of good characters over generations for crop plants.
- It helps in the production of hybrid seeds with a combination of desirable characters. It also prevents the loss of specific characters from a hybrid.
- It helps in the cost-effective and time-efficient production of seeds.